Shanta Gold West Kenya Feasibility Study: Ramula-Mwibona Open Pit Mining Project

Environmental Impact Assessment Report

Prepared for:

Shanta Gold Kenya Limited

Project Number:

SGL8045

October 2024

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR THE PROPOSED RAMULA-MWIBONA GOLD MINING PROJECT IN SIAYA AND VIHIGA COUNTIES, GEM AND LUANDA SUB-COUNTIES, EAST GEM AND MWIBONA WARDS, RAMULA AND MUNUNGO VILLAGES

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Name	**Responsibility**		**Signature**	**Date**
Jiten Divecha	General Manager and Sign-Off	Shanta Gold Kenya Limited		14 October 2024

Executive Summary

Introduction

Shanta Gold Kenya Limited (hereafter SGKL) is conducting a feasibility study for their West Kenya Gold Project to determine the viability of developing an open pit gold mine and processing centre for the Ramula-Mwibona gold resource in Siaya and Vihiga Counties respectively ("the Project"). The Project will be undertaken in the East Gem and Mwibona wards located within the above two counties. As part of the feasibility study, Shanta Gold Kenya commissioned an Environmental and Social Impact Assessment (ESIA) to determine the potential environmental and social impacts associated with the proposed Project. The ESIA report together with various specialist studies will form part of determining the viability of the Project.

To undertake this Project, Shanta Gold Kenya appointed Kurrent Technologies Limited (KTL) as an in-country partner, registered under Kenya's National Environmental Management Authority (NEMA) and Digby Wells Environmental (hereafter Digby Wells). KTL is also responsible for the submission of all legislative required documents as part of the Environmental Permitting process. These documents will include but not be limited to the ESIA report and associated specialists' studies as guided under the Environmental Management and Coordination Act, 1999 (Act No. 8 of 1999) (Kenya, Amended in 2015) (EMCA) and its subsequent regulations and guidelines).

The Environmental Permitting application process will be undertaken in accordance with the requirements of the EMCA and its subsequent regulations and guidelines. The ESIA Process will comply with the Good International Industry Practice (GIIP), such as the Equator Principles (EPs) of 2020 and the International Finance Corporation's Performance Standards on Environmental and Social Sustainability (IFC PSs).

Location of the Project

The Ramula-Mwibona gold resource, the subject of this report, is within PL/2019/0222. The resource is located along the border of Vihiga County and Siaya County, 50-kilometre (km) northwest of Shanta Gold Kenya's head office in Kisumu, Kenya. The primary Project footprint is situated Siaya and Vihiga Counties, Gem and Luanda Sub-Counties, East Gem and Mwibona Wards, Ramula and Munungo Villages.

Details of Project Applicant

The Project Applicant is Shanta Gold Kenya Ltd, a company incorporated in Kenya in 2010, and existing to conduct mineral exploration and mining in Kenya. Shanta Gold Kenya Ltd is a wholly owned subsidiary of Shanta Gold Limited ('SGL'). Further details are provided in Table 1 below.

Table 1: Details of the Project Applicant

Project Applicant:	Shanta Gold Kenya Ltd
Registration No.:	CPR/2010/23874
Contact Person/ Client Project Manager	Jiten Divecha
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Proposed Ramula- Mwibona Open Pit Mining Project

The Project entails the use of open pit mining technique for the potential development of a gold mine. Key infrastructure includes a processing plant and associated facilities, Tailings Storage Facility (TSF), Waste Rock Dumps (WRDs), water management infrastructure, power supply, administrative buildings, and ancillary infrastructure.

Open pit production plans have been conceptualized for a 340koz contained open pit scenario, as well as a 370koz contained open pit scenario. The 370koz is a "forecast" plan assuming additional conversion of inferred to indicated within the base case $1750 pit shell. Production planning demonstrates a ramp-up phase in Years 1 to 3, peak mine production phase in Year 3 to 5, and mine production ramp-down phase in Year 6 to 8.

An equivalent mill throughput of 1500tpd has been rationalized based on this production plan. It should be noted that production plans have been developed based on basic "top-down" mining assumption – optimization work is required to assess the potential for phased pit development including later-stage open pit pushbacks. Phased pit shell development should help reduce the high strip ratios seen in the initial few years.

Another critical path for the Proposed Project is Land acquisition which will primarily be the purchase from private landowners. Public land will be acquired through the procedures outline in Land Act, 2012 (Act No.6 of 2012) (Revised 2019). The land acquisition process will be a voluntary, transparent and a negotiated process.

Land acquisition, compensation and resettlement issues associated with the Project will be addressed under the guidance of the laws governing land in Kenya, The international standards, rules, and guidelines (IFC PS5 on Land Acquisition and Involuntary Resettlement). Land acquisition and involuntary resettlement will be avoided where possible, minimised and mitigated, and will be carried out in accordance with forementioned guidelines. A Resettlement Policy Framework (RPF) has been developed as a reference guide to be used in managing land acquisition issues and addressing the involuntary resettlement and displacement of people and loss of land, assets, and cultural properties.

Relevant Policies, Legislation and Institutional Framework

Reviews of relevant policies, legislation, standards and guidelines that are applicable to this Project have been undertaken and presented in chapter three of this report. This provides a summary of the national and sectoral Legal Frameworks, regional and international agreements, conventions and treaties that govern the environmental and social issues pertaining to the planning and implementation of this Project.

Like many industrial projects, production of minerals results in a number of environmental impacts that must be addressed during the project life to maintain integrity of the environment. Moreover, the project proprietor must also ensure compliance with various policies and/or legislation that govern management of the environment. Before the execution of proposed project to exploit gold resources commence, the project needed to comply with relevant policies and legislation including land, water, mining and other relevant agreements together with local by-laws. Chapter three provides a summary of the relevant legal frameworks that govern environmental and social issues pertaining to planning and implementation of the project

In addition to the policy and legislation, the review also looked at the various relevant standards and guidelines that govern the various aspects of the Project. At the International level, this ESIA was carried out in accordance with the requirements of the "International Finance Corporation (IFC) guidelines" which are the "financial industry benchmark for determining, assessing and managing social and environmental risk in project financing".

A review of the local key environmental regulatory institutions and county administration that in one way or another will be responsible for overseeing the implementation of the proposed environmental management strategies for the proposed Ramula-Mwibona Project is discussed outlining the institution's mandates, roles and responsibilities.

Summary of the Prevailing Baseline Biophysical Environment

Vegetation

The Project area encompasses two distinct vegetation types: Moist Combretum wooded grassland and Lake Victoria's drier peripheral semi-evergreen Guineo- Congolian modified rainforest. Moist Combretum wooded grassland, prevalent in East Africa (Kenya, Tanzania, and Uganda), features Combretum molle (Velvet bush willow) as a characteristic species. Additionally, the Project area includes portions overlapping with Lake Victoria's drier peripheral semi-evergreen Guineo- Congolian modified rainforest, characterized by semi-evergreen forests where canopy species may be briefly deciduous while most understorey members remain evergreen.

Wetlands

No Ramsar wetlands are located within the Project area. The closest Ramsar wetland in relation to the Project area is Lake Nakuru. This system is located approximately 200 km east of the Project area and outside of the Project Site's catchment. No threats due to the proposed activities are therefore expected towards any Ramsar wetland.

A wide variety of major drainage systems are located within the immediate vicinity of the Project Site. One system fringe on the northern boundary, which flows from east to west. The second is located approximately 50 m outside of the Project area boundary and flows from north-east to south-west. The latter system also includes a tributary joining from the north, which originates on the southern Project area boundary. These systems are likely to present wetland habitat, or similar freshwater resource and are expected to be impacted upon by the proposed activities.

Freshwater Ecoregion

The Project area is situated within the Lake Victoria Basin Freshwater Ecoregion (ID: 521) (Abell, 2008). This ecoregion extends across several countries including Burundi, Democratic Republic of Congo, Kenya, Rwanda, Tanzania, and Uganda. The Lake Victoria ecoregion encompasses several small satellite lakes, including Lakes Kanyaboli, Sare, Namboyo in Kenya; Lakes Nabugabo, Gigati, and Agu in Uganda; and Lakes Ikimba and Burigi in Tanzania. These lakes may act as valuable sources of biodiversity since many of them are still relatively undisturbed by human activities.

Geology

The Siaya District, and specifically the Project area, is underlain by rocks of mainly volcanic and volcano sedimentary origin. The rocks are intensively jointed, fractured and faulted and covered with a layer of weathered rock material. The Ramula-Mwibona site is situated in an area characterised by intermediate groundwater potential (DHV Consultants, 1988).

Groundwater

Currently groundwater in the area is mainly used by local communities, farmers (dominantly peasants), and artisanal miners. The current depth of the artisanal mine is approximately 30 mbgl with estimated pumping rates of approximately 5 l/s. Artisanal mining, though predominant in western Kenya, remains low in productivity but detrimental to groundwater quality due use of heavy metals such as mercury for extraction of gold from the ores. The water table within the Project area ranges within 40 m to 150 m. Measurement of field water chemistry did not expressly show major concerns about the water quality within the study area, at least in terms of pH and electrical conductivity. However, several water points visited had low pH values which can be attributed to geological formations in the Project area. The possibility that iron, manganese and other trace metals may be mobilized due to the relatively low pH should be borne in mind in future monitoring data analysis (Rural Focus Ltd, 2023).

Surface Water

The Project area is situated within the Yala Catchment which is one of the important tributaries of the Lake Victoria North Basin (LVNB) (MineScope Services Pty Ltd, 2018). The Yala catchment is divided into three sub-catchments, the upper, lower, and middle catchments, the division is based on the gauging station at each outlet (Sabuni, et al., 2015) and the Project area is found in the lower catchment. The Project area is found upstream of the Abururu stream that confluences the Dhene River in a north-easterly direction.

Overall, the water quality results indicates that NO_3 is a parameter of concern. NO_3 and TDS is being influenced by agricultural activities and anthropogenic activities such as artisanal mining. It is recommended that continuous monitoring be done on streams that confluence the Dhene and Yala rivers to get a better understanding of what are the exact causes of elevated NO_3 levels and from which areas it originates.

Soils

According to the Food and Agricultural Organization soil classification system (FAO (2014)), the Project area is dominated by Humic Nitosols. These soils are common in Eastern Africa and are characterised by a deep structure. These soils are fertile and is defined by a clay accumulation of more than 30%. The dominance of this soil form emphasises the likelihood of the area being classified as having a high agricultural potential and soil sensitivity.

Land Use

The Project area and its direct surroundings is dominated by various land uses, specifically “Built Areas“ and “Crops”. The dominance of these land uses emphasises the likelihood of significant soil degradation in the form of compaction and over utilising of soil resources for subsistence crops. The dominance of crops emphasises the likelihood of soils having a high agricultural potential. The “Trees” land uses indicate forested areas, that are likely continuously utilized for wood. The “Bare Ground” areas indicate severe disturbances in the form of clearances and excavations, likely for building material.

Traffic

Traffic surveys were conducted at the various intersections, as illustrated previously. It must be noted that traffic surveys were conducted during market days to account for the highest peak of event-based fluctuation of background traffic.

An increase in vehicles through an intersection as a result of the development will likely increase traffic delays. Increases in delays have an economic and social impact on the community through increased travel times, driver impatience (leading to possible crashes) and the associated economic cost of these delays to private and commercial / heavy vehicle trips

Heritage

The Project area is located in a region that is rich in cultural heritage resources ranging from paleontological, archaeological, historical, and sacred sites. Research in the region focussed mainly on the archaeological and paleontological components and several sites are on record in Kisumu, Bondo, Homa Bay, Migori and Siaya Counties. Some of these sites are gazetted and under the protection of the National Museums of Kenya but will not be directly affected by the Project. The types of heritage resources contextualising the cultural heritage landscape of the larger Project area is based on known heritage resources within the region.

Critical Habitats

The proposed Project is located in the Lake Victoria Forest-Savanna ecoregion (a type of biodiversity unit classification) - directly east of Lake Victoria, but there are no protected areas or Key Biodiversity Areas (KBAs) in the immediate vicinity. Specialists have noted that the area is modified with notable agriculture present.

Although threatened and migratory species were identified, these species did not trigger Criteria 1 and 3, while the threatened status of the terrestrial ecoregion did not meet the thresholds of Criterion 4. Specialists did not identify any possible triggers for Criterion 5. Therefore, *no critical habitat was identified in the Project AoI.*

<u>Ecosystem Services</u>

Ecosystem Services Assessment (ESA) has been undertaken to ensure alignment with the requirements of the International Finance Corporation (IFC) Performance Standard 6 (PS6) which requires projects to preserve the benefits from ecosystem services that communities depend on and that the project may adversely impact (Type I); and that the environmental and social risks and impact identification process considers a project's dependence on ecosystem services (Type II).

The following priority ecosystem services were identified for which significant impacts would adversely affect communities and/or Project operations: air quality regulation, building materials, cultural services, food supply, raw materials, soil erosion and flood controls, water supply; and water quality regulation

<u>Human Rights Assessment</u>

In conducting the Human Rights Impact Assessment (HRIA), the consultancy team used the UN Guiding Principles on Business and Human Rights (UNGPs) as both the approach to the work and the methodology for carrying out the due diligence. The instruments used to determine what constitutes human rights included the UN Declaration on Human Rights, the International Bill of Human Rights and the International Labour Organisation's Declaration on Fundamental Principles and Rights at Work.

Key human rights issues were identified in relation to the Project, and these include physical and/or economic displacement, water and ecosystems services, artisanal mining, employment, and gender.

<u>Blasting and Vibration</u>

The assessment based on mining 10 m benches using 140 mm diameter holes in waste and 5 m benches using 115 mm holes in ore. The larger 140 mm hole diameters will dominate the blasting impact and most of the impact study is therefore based on the use of 140 mm holes on 10 m benches. Presplitting will be needed in the pit, and this aspect of blasting will have the highest significance ratings on air blast and fly rock.

The aspects related to blasting that were investigated include ground vibration, air vibration (referred to as air blast in this report), and fly rock. Dust and fumes from blasting are referred to in this report, but not quantified.

There are permanent communities within the proposed mine fence line that will be affected by ground vibration, air blast, and fly rock aspects of blasting. It is assumed these people will be relocated but that houses and people beyond the proposed mine fence line will not be moved.

Blasting and associated aspects (including air blast, fly rock, and fumes) will result in a medium-high negative impact significance on the neighbouring communities, houses, roads, and infrastructure within 1000 m of blasting operations. There is a low impact significance for Ground Vibration for people and structures outside the mine fence line.

Summary of the Prevailing Socio-Economic Environment

Siaya County

The Siaya County covers approximately 2,530 km². The main economic activity is agriculture comprising of crop and livestock production as well as fishing. Crop and livestock production in the area is largely subsistence with a key focus on maize, beans, cassava, finger millet, sweet potatoes, bananas, tomatoes, sorghum, cattle, sheep, goats, and chicken. Other economic activities include micro, small and medium enterprises (SMEs) such as boda, jua kali, groceries, transport, and retail stores. The County also hosts two light industries that produce oxygen and construction materials (nails, chain link fence). The county has potential in irrigation agriculture, ranching, fish processing, apiculture, textile industry and tourism.

The latest Kenya National Bureau of Statistics (KNBS) Population and Housing Census (2019) outlined that most (53%) of the County's population is dominated by females and the least (47%) of the population are males. The predominant age group in Siaya County (57%) is the population is between 15-64, followed by (38%) of those between the ages of 0-14. The County's population is dominated by young people, this is essential for economic development in the area. Mining operations requires a young population for employment opportunities to carry out mining related activities.

The County is also characterised by poverty prevalence which manifests itself in other socio-economic outcomes such as poor nutrition, health, and access to education. The agricultural sector also contributes significantly to socio-economic growth and development through forward and backward linkages with other priority sectors of the economy. Ramula mining development can contribute to ease agricultural dependence and provide alternative economic opportunities, as well as reskilling the population to be employable in the mining sector.

Vihiga County

The Vihiga County consists of five Sub-Counties namely, Hamisi, Emuhaya, Luanda, Sabatia and Vihiga. The county is further subdivided into thirteen divisions, forty-one locations, and one-hundred and forty sub-locations. Hamisi Sub- County is the most expansive with an area of 188.9 km^2, Sabatia 110.9 km^2, Vihiga 90.2 km^2, Emuhaya 89.5 km^2, and Luanda with 84 km^2.

Vihiga CIDP (2023-2027) outlined that the county continues to experience urbanization attributed to increasing rural-urban migration and overall growth in population. Emerging urban centres include areas of Marengo, Mbale, Chavakali, Jeptulu, Luanda which is an Area of Influence (AoI), and Serem. The increasing population in the urban areas necessitate integrated planning for improved provision of requisite services such as housing, sewerage systems, solid waste management, health, education, and other social amenities. The project implications related to migration will not be different from that of the Siaya County. However, there is a likelihood that this can change the migrations patterns seeing people migrating from urban centres to the rural setting where the project is located.

According to Vihiga CIDP (2023-2027) agriculture is the backbone of the county's economy contributing over (34 %) of the Gross County Product (GCP), and accounting to (80%) of both direct and indirect employment. The sector continues to face challenges to do with productivity, land use, markets, and value addition. The county proposed the following strategic areas to mitigate these challenges:

- Provision of subsidized farm inputs;
- Increased market access and value addition;
- Transforming land use and enhanced soil testing; and
- Promotion of agribusiness with a focus on youth and women.

Stakeholder Engagement Activities

Stakeholder engagement has been undertaken in alignment with the EMCA, amended in 2015 and 2019, as well as Industry good practice guidelines for stakeholder engagement. Consultation with interested and affected stakeholders is a key aspect of the ESIA process and critical to the success of the Project.

Engagements have been held with Village elders, landowner/farmers, traditional leaders, representatives of the communities, potential vulnerable groups such as women and youth have been consulted to understand their specific issues and concerns. This enables meaningful participation with all levels in the communities. The findings and recommendations are discussed and disclosed in an open and transparent manner with the affected people to solicit their comments and suggestions in the studies. The specific issues raised by stakeholders through the ESIA process meetings are summarised in Table 2.

Table 2: Analysis of Stakeholder Issues

No.	Concern Category	Community Concern
1.	**Land Acquisition & Resettlement**	**Forceful Evictions**: Apprehension and fear of forceful evictions from ancestral lands
		Lack of Title Deeds & Land Ownership: Concern of lack of title deed as a challenge in negotiations and compensation.
2.		**Water Resources**: Concerns were voiced regarding the project's impact on local water resources. Stakeholders want assurances that water

	Environmental Management	abstraction will not lead to depletion or contamination of water sources. They expect adherence to water quality regulations and effective management practices to safeguard community water supply.
		Mine Rehabilitation: Stakeholders emphasized the need for comprehensive plans to rehabilitate mined areas post-operation. They sought assurances that environmental rehabilitation will be prioritized to mitigate long-term environmental impacts and ensure sustainable land use post-mining.
		Chemical Use and Water Management: Concerns were expressed over water pollution risks from mining chemicals and the need for detailed mitigation plans compliant with water quality regulations.
		Dust Management: Questions were raised about dust management strategies during mining activities to protect community health and safety.
		Mercury and Cyanide Usage: Environmental impacts associated with mining activities, particularly the historical use of mercury in ASM and plans to use cyanide in large-scale mining. Stakeholders are keen on understanding the mitigation measures to minimize environmental contamination and health risks.
		Noise and Air Quality: Concerns were raised about potential noise pollution and its impact on local communities, particularly during operational phases. Stakeholders expect mitigation strategies to address noise and air quality concerns, ensuring minimal disruption to community life.
3.	**Safety Concerns**	**Mining Safety**: Stakeholders expressed concerns about the high incidence of fatal accidents linked to artisanal small-scale mining (ASM) activities in Kakamega County. They sought assurances on how the project will ensure safety during large-scale mining operations.
4.	**Community Engagement and Transparency**	**Public Participation**: Stakeholders emphasized the importance of inclusive public participation throughout the project lifecycle. They expect transparent communication and opportunities for meaningful engagement to ensure their concerns are heard and addressed.
		Information Disclosure: Transparency in disclosing project details, including land requirements and specific mining plans, was highlighted as crucial. Stakeholders want clear and timely information to make informed decisions and provide feedback on project developments.
		Understanding of Exploration vs. Mining: There were misunderstandings regarding the distinction between exploration and full-scale mining, emphasizing the need for clear communication on project phases and impacts.
		Perceived Lack of Transparency: Concerns were raised about the transparency of project intentions and profitability, leading to fears of potential exploitation without clear community benefits.

		Grievance Mechanism: There were concerns about ack of redress mechanisms for existing grievances (in the exploration stage) between the community and the client. Grievances including lack of local employment for the project & lack of community involvement in the project.
5.	**Community Relations and Livelihoods**	**Co-existence with Artisanal Miners (ASMs):** Stakeholders highlighted the existing presence of artisanal miners in the project area and stressed the importance of co-existing harmoniously with them. They sought clarity on how the project will support and integrate ASM activities without displacing or negatively impacting these groups.
		Resettlement and Compensation: Questions were raised about potential displacement of landowners due to the project and how compensation will be determined and implemented. The community expects transparent processes, including Resettlement Action Plan (RAP) studies, to ensure fair compensation and livelihood restoration for affected persons.
6.	**Social Impacts**	**Employment and In-Migration**: There is anticipation of increased employment opportunities due to the project, potentially leading to in-migration. Stakeholders want to ensure that local community members are prioritized for employment and provided with necessary skills through capacity-building initiatives.
		Child Labor: Concerns were raised about the prevalence of child labor in mining activities. Stakeholders expect robust measures to be in place to prevent and mitigate child labor risks associated with the project.
		Vulnerability of Special Groups: Vulnerable groups such as the elderly, disabled, widows, children, and girls face heightened challenges, including poverty, poor health, lack of job opportunities, and social exclusion. Children are exposed to child labour in the mines, while girls are at risk of early pregnancies, sexual abuse, and school dropouts. Widows face marginalization and land disputes, exacerbating their vulnerability. Concerns were raised about how the project may further impact these groups, especially with potential displacement and land tenure issues.
		Heritage: Concerns about the potential erosion of cultural practices and community values due to the project were raised. Fears from the community include family disintegration, increased immorality, and a shift away from traditional norms.
		General Safety and Security: Security concerns were raised with expressed fear of increased drug abuse and crime with the influx of people due to the West Kenya Project.
7.		**Equitable Employment**: Ensuring equal employment opportunities for women in various roles within the mining project.

	Gender Issues and Considerations	**Capacity Building:** Providing training programs to enhance women's skills and employability in mining-related jobs.
		Representation: Promoting gender-balanced representation in community committees and stakeholder groups.
		Inclusive Consultation: Actively involving women in consultation processes and decision-making, recognizing their leadership roles and specific concerns.
		Gender-Based Violence (GBV): Addressing potential GBV risks through preventive measures and support systems.
		Inequitable Compensation: Concerns were raised about women being sidelined in the compensation process, with fears that they may not receive their fair share, particularly in land ownership and compensation negotiations.
8.	**Youth Issues**	**Employment Opportunities:** Ensuring priority in employment opportunities for local youths in various roles within the mining project.
		Capacity Building: Providing training programs to the youths without any form of education to enhance the skills and employability in mining-related jobs.
9.	**Corporate Social Responsibility**	**Local Community Benefits**: Stakeholders expressed expectations that the project will contribute positively to local communities through corporate social responsibility initiatives. They seek commitments from the project proponent to support community development projects that enhance livelihoods, programmes to sensitize youths and children on importance of education, priority on health facilities in the area and mine technologies for artisanal miners.

Project Alternatives

Project alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing a project, considering location or site alternatives, activity alternatives, temporal alternatives or the 'no-go' alternative. Alternatives also help identify the activity with the least environmental and social impact, as well as ensuring project feasibility. The following attributes were used for consideration of different alternatives options for the Project:

- Project design alternative;
- Location alternatives;
- Technology alternatives; and
- The no-go alternative

Through the impact assessment and considering engineering and economic viability, several preferred options for the placement of the waste rock dump, tailing storage facility, location of the mine camp, power and water sources were determined. Other alternatives assessed include location for proposed additional surface infrastructure, technology options for power supply and the “No-Go Alternative”. Ultimately, when all the potential Project impacts are taken into consideration, along with the proposed social and environmental management measures, the Project represents a net benefit to the area and Kenya as a whole.

Assessment of Project Impacts

The proposed project will be developed on a greenfield, however, based on the baseline environment, the area is populated with active livelihood activities including but not limited to the extensive artisanal small-scale miners. This has resulted to modification of the natural habitats. Notwithstanding the existing baseline environment, the proposed Project will result in environmental and socio-economic impacts (positive and negative) due to the nature of the proposed activities. The most significant potential impacts associated with the Project include:

- Groundwater drawdown as a result of abstraction of water;
- Potential groundwater and surface water contamination from interaction with the WRD and potential seepage;
- Alteration of the physical and chemical properties of soil resources and loss of topsoil due to increased erodibility, which in turn reduces the land’s agricultural potential;
- Alteration of the local natural hydrology;
- Loss of habitat in terms of plant and animal species, and consequently loss of general biodiversity;
- Benefits to the communities through job opportunities and the legislated Community Development Agreement (CDA) which translates to 1% of the value of gold produced;
- Business opportunities through procurement and multiplier effects through purchase of supplies by the mine from local and national businesses; and
- Economic and physical displacement for construction of the Project as well as disruption of movement patterns, potential influx into the area leading to increased social ills and increase pressure on available social infrastructure.

Environmental and Social Management Plan

To manage the abovementioned impacts and other less severe impacts that were identified during the ESIA process, an environmental and social management plan (ESMP) hereinafter referred to as Environmental Management Plan (EMP) has been developed that includes mitigation measures aimed at avoiding or limiting the consequence and probability of negative impacts. This includes the development and implementation of various measures and associated monitoring programme to ensure the effectiveness of implementation.

Environmental and Social Monitoring Plan

This section outlines the monitoring and reporting program to be implemented during the construction, operations, and post-closure phases of the Project. The monitoring and reporting program have been developed on the basis of the Project activities that will be carried out, as per the potential impacts identified in the ESIA. For accommodating the proposed Project, SGKL will ensure monitoring of all environmental and social aspects is progressive and sufficient resources and document controls are in place. Additional monitoring points will be added based on gap analysis as more information becomes available. The principal purpose of the monitoring and reporting program will be to provide information necessary to determine the Project's operational and environmental performance within and around the proposed Project areas.

The monitoring and reporting program has been designed to:

- Comply with applicable Kenyan legislation, standards, and guidelines; and
- Adhere to good international practice relating to environmental monitoring

Cost Benefit Analysis

The Cost-Benefit Analysis of the proposed Project can be directly linked to the impact assessment conducted, which covered the positive and negative impacts resulting from Project implementation based on the actual capital investments, expenditures as well as different Valued ecosystem Components and specialists' analysis of the different Project components.

The Resource Evaluation or Cost Benefit Analysis discusses the results of the cost benefit analysis of the proposed Project. It provides a brief economic overview of Kenya as a country as wells as the economics for the Vihiga and Siaya Counties, further the chapter discusses the various key project stakeholders and the associated accruing benefits and costs.

The development of the Project will incur financial costs to the proponent that will include capital costs of US$ 137 million, operating costs of US$ 45 million per annum and, royalties of US$ 2.6 million per annum and with all other government contributions of US$ 1 million per annum for the Mineral Development Levy. The payment of royalties and taxes by the proponent will be converted to benefits to the community as these funds are filtered into social schemes and infrastructure within Kenya. Furthermore, in compliance with the Mining (Community Development Agreement) Regulation, SGKL will be required to enter into formal agreement with Project affected communities and share an additional 1% of the value of gold produced. Similarly, capital and operating costs may benefit Kenyan businesses that supply goods and services required for the development and operation of the Project.

Although the Project will result in impacts (costs) of significance, these costs will be minimised through the implementation of mitigation measures and on-going management of issues over the life of the Project. Hence this indicates that the proposed Project is economically feasible, technically viable and socially desirable. Provided that all of the environmental safeguards outlined in this report are adhered to, the Project should continue to benefit both the local communities and the country.

Rehabilitation and Mine Closure Plan

The proposed Project components will be decommissioned based on Kenyan regulations and standards as well as international standards and protocols. A Conceptual Mine Closure Plan (MCP) has been prepared to adequately reclaim the disturbed site prior to Project interventions.

The closure measures set out in the mine closure plan are based on a screening level risk assessment undertaken for the Project, which was informed by relevant biophysical information and available specialist studies. The closure measures developed were costed in the Digby Wells closure costing model to determine the initial closure costs estimate for the Project.

Another component that was computed as part of this study is the Closure Cost Assessment (CCA) which was determined using third party/ contractor rates and rates from rehabilitation projects that Digby Wells previously undertook. Quantities used to determine the CCA were taken from available plans, maps and information provided by SGKL.

The CCA for the Project, as assessed in September 2024, amounts to **US $5,385,431**. The costs exclude Value Added Tax (VAT) but includes Preliminary and Generals (P&Gs) at 12% and contingencies at 10%.

Conclusion

Development of the Project will result in the modification of the baseline biophysical and socio-economic environment from agricultural and residential to operation mining. The Project will generate environmental and socio-economic impacts, the most significant of which is related to physical and economic displacement of surrounding communities where project infrastructure will be built. The Project footprint including the primary and secondary impacted communities will be affected by loss of ecosystems services derived from the use of land for agriculture, potential invasive plant species infestation as well as loss in livelihood options available including but not limited to the artisanal miners.

It is thus advised for SGKL to strictly adhere to ESMP, and all recommendation provided in each of the specialist studies and other relevant technical reports. This will include but not limited to development of an overarching Environmental and Social Management System (ESMS) which would include among other aspects Standard Operating Procedures (SOPs).

Furthermore, progressive monitoring of various environmental and social aspects must continue accordingly to detect new and/ or significant impacts that may result in long-term, irreversible impacts to the communities. Where such impacts are identified, corrective measures must be implemented timely.

Cognisant of the requirement set in the ESMP, SGKL will need to ensure compliance to other related legislative requirements including but not limited to health and safety, workers regulatory frameworks among others.

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This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Digby Wells Environmental prior written consent.

LIST OF ABBREVIATIONS

°C	Degrees Celsius
ABA	Acid Base Accounting
AERMOD	American Meteorological Society/United States Environmental Protection Agency Regulatory Model
AG	Acid Generating
AIPs	Alien and Invasive Plants
Ambient Noise	Ambient noise is the noise from all sources combined – mining noise, traffic noise, birdsong, running water, etc.
AMD/ML	Acid Mine Drainage and Metal Leaching
AoI	Area of Influence
AP	Acid Potential
AQIA	Air Quality Impact Assessment
AR6	IPCC 6th Assessment Report
ARD	Acid Rock Drainage
ASM	Artisanal and Small-scale Mining
ASPT	Average Score per Taxon
ASTM	American Society for Testing and Materials
Aw	Savanna Climate
AW3D30 DSM	ALOS World 3D - 30m Digital Surface Model
Barrick	Barrick Gold Corporation
BFS	Bankable Feasibility Study
BGGs	Burial Grounds and Graves
BGWQ	Background Groundwater Quality
BH	Borehole
BOQ	Bill of Quantities
Bt	Billion tonnes
CAD	Computer-aided design
CBD	Convention on Biological Diversity
CBO	Community-Based Organisations
CCA	Closure Cost Assessment

CCKP	Climate Change Knowledge Portal
CCME	Canadian Council of Ministers of the Environment
CCRVA	Climate Change Risk and Vulnerability Assessment
CH	Cultural Heritage
CH_4	Methane
CIDP	County Integrated Development Plan
CMIP6	Coupled Model Inter-Comparison Project Phase 6
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CoC	Constituents of Concern
Coeff. Var.	Coefficient of Variance
CONCAWE	Conservation of Clean Air and Water in Europe
COS	Crushed Ore Stockpile
CR	IUCN Red List Category: Critically Endangered
CRA	Closure Risk Assessment
CS	Cultural Sensitivity
CSI	Corporate Social Investment
CSWMP	Conceptual Stormwater Management
CVB	Channelled Valley Bottom
DD	Data Deficient
DD	IUCN Red List Category: Data Deficient
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
Digby Wells	Digby Wells Environmental
DO	Dissolved Oxygen
DSM	Digital Surface Model
DW test	Reagent (Distilled) Water test
E&S	Environmental and Social
EA	Environmental Authorisation
EC	Ecological Category

EC	Electrical Conductivity
ECT	International Energy Charter Treaty
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act, 1999 (Act No. 8 of 1999) (Kenya, Amended in 2015)
EMP	Environmental Management Plan
EN	IUCN Red List Category: Endangered
ENIA	Environmental Noise Impact Assessment
ENSO	El Niño Southern Oscillation
EOO	Extent of Occurrence
EPFIs	Equator Principles Financial Institutions
EPRP	Emergency Preparedness and Response Plan
EPs	Equator Principles
EPT	Ephemeroptera, Plecoptera and Trichoptera
ESA	Ecological Support Area
ESF	Environmental and Social Framework
ESG	Environmental and Social Governance
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESRI	Environmental Systems Research Institute
EWT	Endangered Wildlife Trust
FAO	Food and Agricultural Organisation
FFIA	Fauna and Flora Impact Assessment
FI	Functional Integrity
FS	Feasibility Study
GAI	Geochemical Abundance Index
GCM	Global Climate Models
GDP	Gross Domestic Profit
GHG	Green House Gas
GIIP	Good International Industry Practice

GIS	Geographic Information System
GLC	Ground Level Concentrations
GM	General Manager
GMWL	Global Meteoric Water Line
GN	Government Notice
GPS	Global Positioning System
ha	Hectare
HGM	Hydrogeomorphic
HIA	Heritage Impact Assessment
HIV/AIDS	Acquired Immunodeficiency Syndrome/Human Immunodeficiency Virus
HME	Heavy Mechanical/ Machinery Equipment
Hz	Hertz
I&APs	Interested and Affected Parties
IBA	Important Bird and Biodiversity Area
IBAT	Integrated Biodiversity Assessment Tool
ICB	Ionic Charge Balance
ICH	Intangible Cultural Heritage
ICMM	International Council on Mining and Metals
ICP	Inductively Coupled Plasma
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometer
IDF	Intensity Duration Frequency Curves
IFC PSs	International Finance Corporation’s Performance Standards on Environmental and Social Sustainability
IFRS	International Financial Reporting Standards
ILO	International Labour Organisation
IOD	Indian Ocean Dipole
IPCC	The Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
k	Hydraulic conductivity
KBA	Key Biodiversity Area

KEBS	Kenya Bureau of Standards
$kgCO_2e/L$	Kilograms Carbon Dioxide Equivalent per Litre
kh	Horizontal hydraulic conductivity
km	Kilometre
KNBS	Kenya National Bureau of Statistics
KNCHR	Kenya National Commission on Human Rights
KTL	Kurrent Technologies Limited
ktpm	kilotons per month
KV	Kilovolt
kv	Vertical hydraulic conductivity
KWS	Kenya Wildlife Service
L	Litres
L/h	Litre per hour
L/s	Litre per second
LC	Land Capability
LC	Least Concern
LCT	Leachable Concentration Threshold
LoM	Life of Mine
LP	Land Potential
LVB	Lake Victoria North Basin
m	Metre
m bgl	metres below ground level
m.a.m.s.l	Metres Above Mean Sea Level
m^3	cubic metre
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mbgl	Meters below ground level
MCP	Mine Closure Plan
MDGs	Millennium Development Goals
mg/ℓ	milligrams per litre

ML	Mining License
mm	Millimetre
mm/a	millimetre per annum
MM5	Mesoscale model - Fifth generation
Moz	Million Ounces
MRA	Mining Rights Area
ms	milli-seconds
mS/m	milli Siemens per metre
MSDS	Material Safety Data Sheets
Mt	million tonnes
Mtpa	Million ton per annum
MVA	Mega Volt-Amp
MW	Mega Watt
N_2O	Nitrous Oxide
NAF	Non-Acid Forming
NAG	Net Acid Generation
NAP	National Adaptation Plan
NASA	National Aeronautics and Space Administration
NBF	National Biodiversity Framework
NC	National Communications
NCCAP	National Climate Change Action Plan
NCCRS	National Climate Change Response Strategy
NDC	Nationally Determined Contributions
NE	IUCN Red List Category: Not Evaluated
NEMA	The National Environment Management Authority (NEMA) - Kenya
New POSA	New Plants of Southern Africa
NGOs	Non-Government Organisations
NLC	National Land Commission
NNP	Net Neutralising Potential
NO_2	Nitrogen Dioxide
NP	Neutralisation Potential

NPGD	National Policy on Gender and Development
NPO	Non-Profit Organisation
NPR	Neutralising Potential Ratio
NSRs	Noise-Sensitive Receivers
NT	IUCN Red List Category: Near Threatened
nT	nanoTesla
NT	Near Threatened
NTU	Nephelometric Turbidity Units
OEM	Original Equipment Manufacturer
OHS	Occupational, Health and Safety
ONA	Other Natural Area
OSHA	Occupational Safety and Health Administration
OSM	Open Street Map
PA	Protected Area
PAC	Project Affected Community
PAF	Potentially Acid Forming
PAG	Potentially Acid Generating
PAN	Potential Acid Neutralising
PAOI	Area of Influence
PAP	Project Affected Person
PCD	Pollution Control Dam
PDA	Project Development Area
PES	Present Ecological State
PL	Prospecting Licenses
PM_{10}	Particulate Matter less than 10 microns in diameter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
PPE	Personal Protective Equipment
PS	Performance Standards
PSC	Production Sharing Contracts
QA/QC	Quality Assurance/Quality Control
QDS	Quarter Degree Square

RCP	Rehabilitation and Closure Plan
RGS	River Gauging Stations
RMSE	Root Mean Square Error
ROM	Run-of-Mine
RR	Receptor Resilience
RWD	Return Water Dam
S	Storativity
S&EIA	Scoping and Environmental Impact Assessment
s.u	Standard Units
SACNASP	South African Council for Natural Scientific Professionals
SANAS	South African National Accreditation System
SANS	South African National Standard
SCC	Species of Conservation Concern
SCS	Soil Conservation Service
SDGs	Sustainable Development Goals
SDN	Sandstone
SEAG	Species Environmental Assessment Guideline
SEI	Site Ecological Importance
SEMS	Social and Environmental Management System
SEP	Stakeholder Engagement Plan
SFI	Soil Form Indicator
SGKL	Shanta Gold Kenya Limited
SIA	Social Impact Assessment
SIBOWASCO	Siaya-Bondo Water and Sanitation Company Limited
SMEs	Small and Medium Enterprises
SMHI	Swedish Meteorological and Hydrological Institute
SMP	Social Management Plan
SNNP	Sulfide Net neutralising potential
SNPR	Sulfide Netralisation Potential Ratio
SoW	Scope of Work
SOx (as SO_2)	Sulfur Dioxide

SPL	Sound Pressure Level
SPLP	Synthetic Precipitation Leaching Procedure
SS	Sulphide-Sulphur
SSP	Socio-economic Pathways
SST	Sea Surface Temperatures
SSV	Soil Screening Values
St. Dev.	Standard Deviation
SWI	Soil Wetness Indicator
SWL	Sound Power Level
SWMP	Stormwater Management Plan
Sy	Specific yield
T	Transmissivity
TB	Tuberculosis
TC	Total Concentration
TCFD	Taskforce on Climate-related Financial Disclosures
TCH	Tangible Cultural Heritage
TCH	Tangible Cultural Heritage
tCO_2e	Tonnes of carbon dioxide equivalents
TCT	Total Concentration Threshold
TDS	Total Dissolved Solids
The Project	Ramula- Mwibona Project
TOPS	Threatened or Protected Species
ToR	Terms of Reference
TSF	Tailings Storage Facility
TSP	Total Suspended Particulates
TUI	Terrain Unit Indicator
TVOC	Total Volatile Organic Carbon
UN	United Nations
UNFCCC	UN Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator

UVB	Unchanneled Valley Bottom
VAC	Visual Absorption Capacity
VAT	Value Added Tax
VIA	Visual Impact Assessment
VOC	Volatile Organic Carbon
VP	Vulnerable Persons
VU	IUCN Red List Category: Vulnerable
WBG	World Bank Group
WCMA	Wildlife Conservation and Management Authority
WET-EcoServices	Wetland Ecosystem Services
WET-Health	Wetland Ecological Health Assessment
WHO	World Health Organisation
WKFSP	West Kenya Feasibility Study Project
WMA	Water Management Area
WRA	Water Resources Authority
WRB	World Reference Base
WRC	Water Research Commission
WRD	Waste Rock Dump
wt. %	Weight percentage
WTP	Water Treatment Plant
WWF	World Wildlife Fund
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence
ZVI	Zone of Visual Influence

1. Introduction

Shanta Gold Kenya Limited (hereafter SGKL) is conducting a feasibility study as part of their West Kenya Gold Project to determine the viability of developing the proposed Ramula Mwibona; open pit gold mine and processing centre for the Ramula-Mwibona gold resources in Siaya and Vihiga Counties respectively ("the Project"). The Project will be undertaken in the East Gem and Mwibona wards located within the above two counties respectively. As part of the feasibility study, Shanta Gold Kenya commissioned an Environmental and Social Impact Assessment (ESIA) to determine the potential environmental and social impacts associated with the proposed Project. The ESIA report together with various specialist studies will form part of determining the viability of the Project.

To undertake this Project, SGKL appointed Digby Wells Environmental (hereafter Digby Wells) in collaboration with Kurrent Technologies Limited (KTL), an in-country partner, registered under Kenya's National Environmental Management Authority (NEMA), as the environmental practitioners. KTL is also responsible for the submission of all legislative required documents as part of the Environmental Permitting process. These documents will include but not limited to the scoping report and Term of Reference (ToR), ESIA report, and associated specialists' studies as guided under the Environmental Management and Coordination Act, 1999 (Act No. 8 of 1999) (Kenya, Amended in 2015) (EMCA) and its subsequent regulations and guidelines).

The Environmental Permitting application process will be undertaken in accordance with the requirements of the EMCA and its subsequent regulations and guidelines. The ESIA Process will comply with the Good International Industry Practice (GIIP), such as the Equator Principles (EPs) of 2020 and the International Finance Corporation's Performance Standards on Environmental and Social Sustainability (IFC PSs).

This report constitutes the **Environmental Impact Statement (EIS) Report** which accompanies the Environmental Impact Assessment (EIA) phase submission. The term ESIA has been used interchangeably with the term EIA. EIA is the legal term for the process as per Kenya's EMCA with ESIA being broadly utilised to emphasize the "social" component denoted by the letter "S").

1.1. Project Background

Shanta Gold Limited (SGL) acquired the West Kenya Project (see Section 1.2) from Barrick in August 2020. Previous operators including Aviva Mining Kenya Ltd and Acacia Exploration Kenya Ltd (owned by Barrick) had been exploring for gold over a number of years, with the combined exploration efforts culminating in the discovery of a gold resource, Ramula-Mwibona, located on the boundary of Siaya and Vihiga Counties in 2021.

As part of the Feasibility Studies aimed at assessing the potential for the development of a gold mine, Shanta has embarked on undertaking this ESIA. The Feasibility Studies are aimed at establishing whether the Ramula- Mwibona gold resources are economically and practically viable and whether a mine or mines can successfully be developed.

Note that the Ramula gold prospect has historically been named as such due to the proximity to Ramula village, which sits in Siaya County. However, part of the deposit lies in Vihiga County and at the recent request of Vihiga stakeholders, the gold resource will now be referred to as the Ramula- Mwibona deposit, or Ramula- Mwibona project, to indicate that is it shared between the two counties.

1.2. Project Applicant

The Project applicant is SGKL, a company incorporated in Kenya in 2010 and exists to conduct mineral exploration and mining in Kenya. Further details are provided in Table 1-1 below. The project was first named Goodison Sixty Limited Company (a shelf company purchased from lawyers) (2010), then Aviva Mining (Kenya) Ltd (2010-2013), African Barrick Gold Exploration Kenya Ltd (2013-2014), and Acacia Exploration (Kenya) Ltd (2012014-2020), finally becoming SGKL in 2020. The name changes resulted from changes in investors and/ or project and licence ownership, or company re-branding. Company registration and name change documentation are included in Appendix A.

SGKL is a wholly owned subsidiary of Shanta Gold Limited (SGL, an East Africa-focused gold producer, developer, and explorer (Shanta Gold - Home). SGL's primary assets are two operating gold mines in Tanzania, namely; New Luika Gold Mine, and Singida Gold Mine, whilst the West Kenya Project in Kenya is an exploration stage Project with defined gold resources and prospecting licences, yet to reach the stage of mining. SGL was incorporated in Guernsey on the 05 May 2005 and is a public company whose shares are traded on the Alternative Investment Market (AIM) section of the London Stock Exchange.

In December 2023, SGL announced that Saturn Resources intends to acquire SGL, including SGKL. This acquisition is subject to shareholder approval and Tanzania and Kenya regulatory approval and if approved by all parties, is expected to be completed by the end of 2024. Should the acquisition be concluded, the new owners do not intend to affect any material changes to the ongoing strategy and operations of SGKL, including the potential development of the Ramula-Mwibona resource.

Table 1-1: Details of the Project Applicant

Project Applicant:	Shanta Gold Kenya Ltd
Registration No.:	CPR/2010/23874
Contact Person/ Client Project Manager	Jiten Divecha
Email Address:	Jiten.Divecha@shantagoldltd.com
Postal Address:	P O Box 1461-40100 Kisumu, Kenya

1.3. Details of Mineral Rights and Project Location

SGKL's West Kenya Project comprises seven Prospecting Licences issued by the Government of Kenya and covers a current area of 580 km^2 across parts of the counties of Siaya, Vihiga, Kakamega, and Kisumu in Western Kenya (Figure 1-1). The licences are collectively termed the West Kenya Project.

Prospecting Licences PL/2019/0222, PL/2019/0223, PL/2019/0225, and PL/2019/0226 are wholly owned by SGKL and were formerly parts of Special Licences SL 123 and SL 213, re-granted with new names and configurations in 2019 pursuant to the enactment of the Mining Act 2016. The licences were granted with an effective date of 01 August 2019 and subsequently renewed with a 50% reduction of licence area on the 01 August 2022 for a further three years. The licences may be renewed for a further final term of three years from 01 August 2025, with a further 50% reduction in licence area.

Prospecting Licences PL/2018/0210, PL/2018/0211, and PL/2018/0212 are owned by Gold Rim Exploration Kenya Ltd (Gold Rim) but are operated, managed, and funded by Shanta under a Joint Venture Agreement with Gold Rim.

All seven Prospecting Licences have been explored concurrently as one integrated regional exploration programme termed the West Kenya Project. The exploration has so far resulted in the discovery of two gold resources, Ramula-Mwibona, and Isulu-Bushiangala.

The Ramula-Mwibona resource, the subject of this report, are within PL/2019/0222. The resource is located along the border of Vihiga County and Siaya County, 50-kilometre (km) northwest of SGKL's head office in Kisumu, Kenya. Ramula is located approximately 45 km via paved road from SGKL's other known resource, Isulu-Bushiangala, located in Kakamega County. The Ramula-Mwibona deposit is within proximity of other known targets of interest including Miruka, Dhene, and Ochiegue.

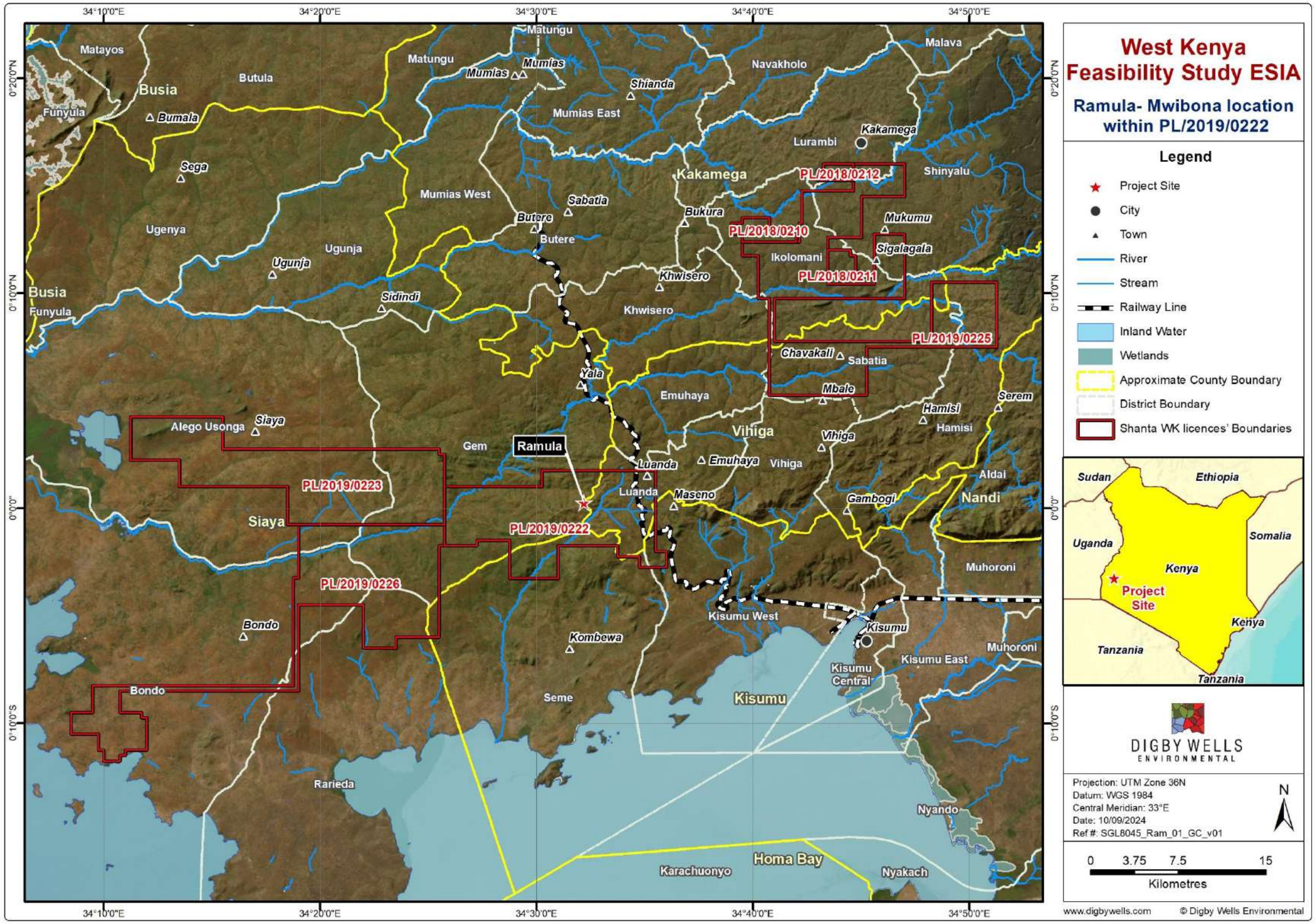


Figure 1-1: Shanta's West Kenya Project[1] showing the Location of Ramula- Mwibona within PL/2019/0222

[1] (Prospecting Licences PL/2019/0222, PL2019/0223, PL/2019/0225, PL/2019/0226, PL/2018/0210, PL/2018/0211 and PL/2018/0212),

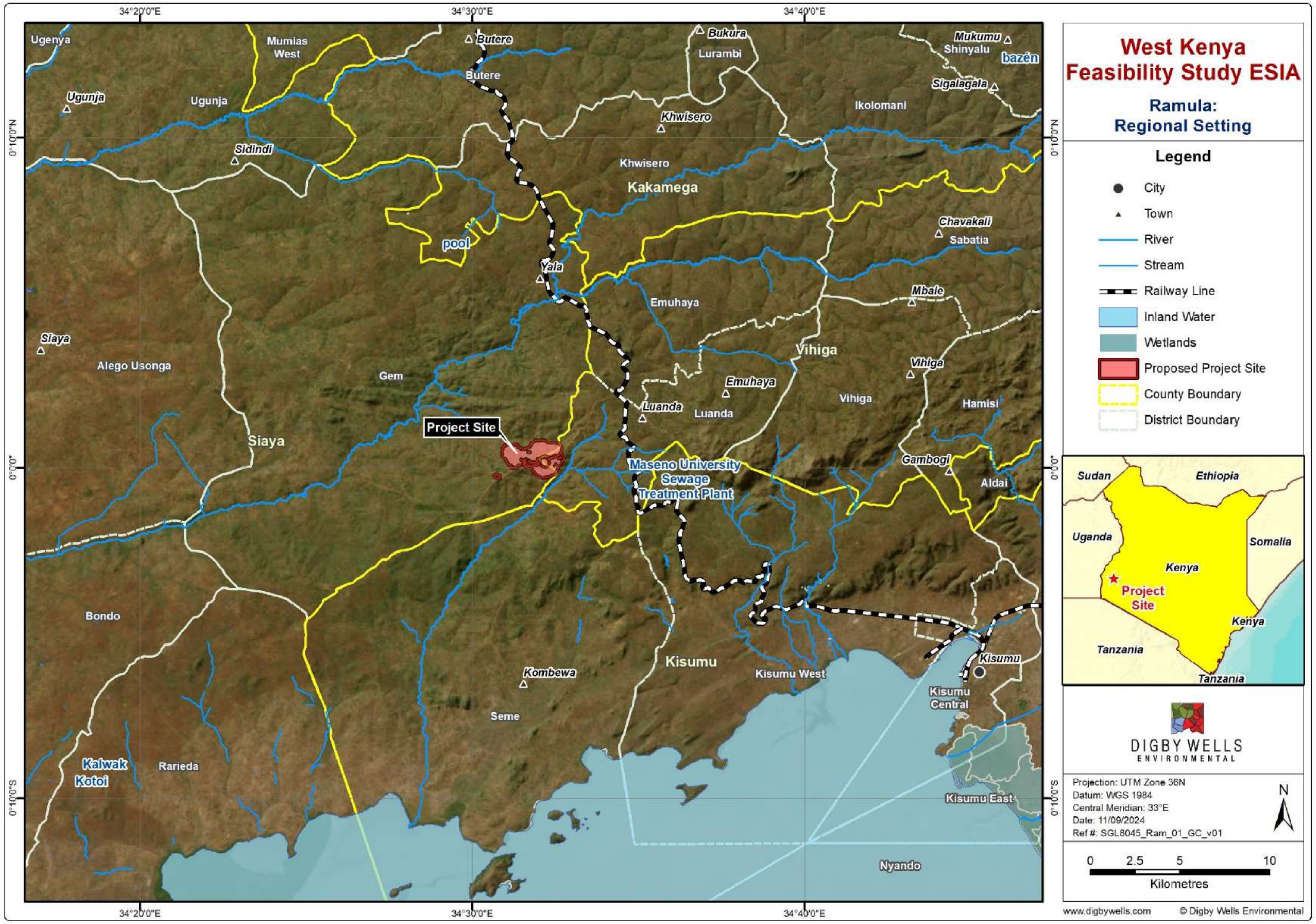


Figure 1-2: Ramula-Mwibona Regional Setting

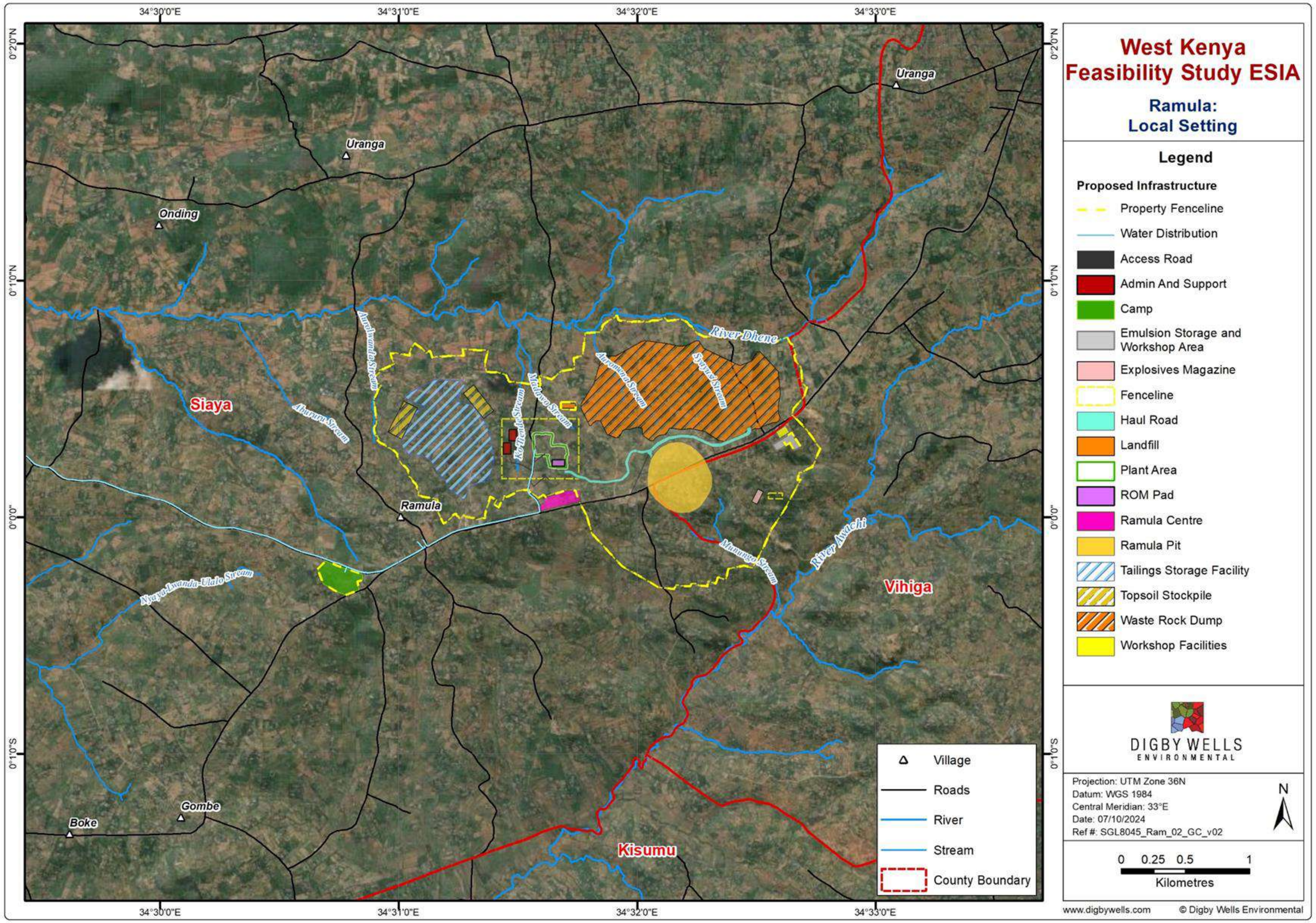


Figure 1-3: Ramula- Mwibona Local Setting

1.4. Motivation for the Application

The Ramula-Mwibona resource forms part of the three resource deposits that are in the process of being drilled to an Indicated resource level. Infill drilling within the footprint of the concession areas has been ongoing since 2021. Using the updated resource data, Shanta carried out internal Scoping Studies in 2022 and 2023. The Scoping Study updates were published in May 2023.

The main outcomes from the Scoping Studies suggest that the 0.5 Million ounces (Moz) of the Ramula- Mwibona resource is reasonably well developed and economically viable to carry forward into the Feasibility Study (FS) stage. The Ramula- Mwibona deposit is the main classified (inferred) deposit within the general Ramula region. Mineralization in the Ramula-Mwibona deposit is hosted within a series of stacked, shallow, thin, northwest-dipping quartz veins.

The Project is aimed at obtaining the required authorisation to mine the Ramula- Mwibona gold resources for economic purposes. This may lead to the enhancement of local economic development through job and business opportunities, and significant contributions to the Government of Kenya through taxes, royalties, and revenue contribution, which are likely to transfer into the local and regional economic growth. The host community also stands to benefit from the Community Development Agreement regulations whereby 1% of the value of gold produced will be allocated to community development projects.

1.5. Objectives and Scope of the EIA

This section provides the legislative objectives, and the EIA scope adhered to throughout the consolidation of the EIS for the proposed Project.

1.5.1. Principal Legislative Requirements for Undertaking an EIA

Undertaking an EIA is a legal requirement in Kenya, rooted in the Constitution of Kenya (2010). Chapter 69 of the Constitution of Kenya lists obligations in respect of the environment. The state must establish systems of environmental impact assessment, environmental auditing, and environmental monitoring. The state must also eliminate processes and activities likely to endanger the environment.

Section 58 of the EMCA, 1999, makes it a mandatory requirement for an EIA to be carried out by proponents intending to implement projects specified in the second schedule of the Act. Such projects have the potential to cause significant impacts on the environment. Similarly, section 68 of the same Act requires operators of existing projects or undertakings to carry out environmental audits to determine the level of conformance with statements made during the EIA. Regulation 18 of the Environmental (Impact Assessment and Audit) Regulations, 2003 for Study report (high risk).

Subsequently, the Environmental Impact Assessment and Audit Regulations, 2003 states in Regulation 3 that “the Regulations should apply to all policies, plans, programmes, projects, and activities specified in Part IV, Part V and the Second Schedule of the Act". Part III of the Regulations indicates the procedures to be taken during the preparation, submission and approval of the ESIA Report.

NEMA is ultimately responsible for issuing, varying, or cancelling environmental impact assessment licenses, and will coordinate the EIA process. NEMA is also responsible for coordinating powers over all public and private sectors.

To meet these requirements, SGKL appointed Digby Wells and KTL to undertake the EIA in compliance with the relevant legislative requirements. This required an initial phase of submitting the scoping report and Terms of Reference for NEMA's approval.

As pursuant to the EMCA, 1999, its EIA and EA regulations of 2003, and legal notices 21 and 32 of 2019, NEMA confirmed in a written letter with reference number **REF: NEMA/TOR/5/2/696** on **14 March 2024** that the ToRs and the scoping reports were approved. NEMA through the response letter further stated some regulatory requirements including:

- Submission of 12 copies of the study report upon payment of the applicable EIA processing and monitoring fees being 0.1% of the total project cost;
- A soft copy of the summarised executive summary in Word format for preparation of public notice; and
- One electronic copy of the report.

The NEMA advised that based on the scoping report and ToR submitted on 14 March 2024, that the Project would require a full EIA. The letter from NEMA has been included as Appendix B

1.5.2. ESIA Objectives

The ESIA for the Project aimed at ensuring that significant environmental and social impacts were identified and assessed, with appropriate mitigation measures proposed. The EIA programme was a participatory process, involving a broad range of directly and indirectly affected stakeholders of the Project. The specific objectives of the ESIA study are to:

- Describe the existing social, cultural, economic and environmental conditions within the Project area;
- Identify potential impacts on the existing environment, to ensure that social and environmental considerations are explicitly addressed and incorporated into the Project design and implementation process;
- Identify a range of appropriate mitigation measures to avoid or minimize the potential impacts of the Project, and to enhance the beneficial outcomes of the Project for the communities within the Project area;
- Identify a range of monitoring measures to ensure the mitigation measures are implemented effectively; and

- Assess other Project alternatives and the justification for implementing the proposed development.

The EIA has been prepared in accordance with the requirements of the EMCA and associated amendments the Environmental Impact Assessment and Audit Regulations, 2003, and its amendments of 2019. The main components of the EIA as per the Kenyan legislative requirement and further aligned with relevant international standards are detailed in Table 1-2.

Table 1-2: Components of the EIA Study Program

EIA Component	Description
Establishment of the baseline information	Collection of existing information, including physical, biological and socio-economic characteristics of the proposed Project area. Baseline information on terrestrial biodiversity (flora and fauna), wetlands, soil, surface water, groundwater, air quality, noise, vibration, traffic, visual aesthetics, heritage, climate change, greenhouse gas, geochemistry, socio-economic and aquatic biodiversity were incorporated into the EIA study phase.
Identification of and consultation with Project stakeholders	The identification of stakeholders, including those who will be directly affected by the Project. The stakeholders were identified at the national, regional, district, ward, and village level. Stakeholders were engaged during various stages of the study program, briefed with current Project information, and provided with the opportunity to express their concerns or desired outcomes from the Project.
Identification of the Project activities	Identification of the activities that will be undertaken during all stages of the Project was undertaken, including during construction, operations, closure, and post-closure phases.
Identification and assessment of the impacts	Identification and assessment of the potential impacts as a result of the Project activities on human health, the natural environment, socio-economic aspects, communities, and the landscape within the Project area was conducted, with the significance of the impacts determined.
Analysis of the Project alternatives	Various Project alternatives including mining, waste dump and tailings facility options, power and water supply, access and locations of various Project facilities were considered. The “no Project” option was also briefly analysed.
Development of Environmental and Social Management Plan	Based on the identified potential impacts of the Project and the significance of each impact, a range of feasible and cost-effective mitigation measures were identified to minimize the negative impacts. Management measures to enhance benefits associated with the Project were also identified.

EIA Component	Description
Development of Environmental and Social Monitoring Plan	A plan for monitoring the implementation of the proposed environmental and social management plan during the construction, operational, and decommissioning phases was compiled. This specifies which parameters are to be monitored, at what interval and frequency, and assigns responsibility for monitoring.
Analysis of the Project's costs and benefits	The viability of the Project and the economic, social, and environmental costs and benefits were analysed in relation to the national, regional, county, and local economic settings.
Project Closure	A conceptual decommissioning approach based on the proposed infrastructure layout and associated information available on the Project was prepared. The approach recognizes that there will be changes in the Project details, following construction and operation, which would need to be updated into the conceptual Mine Closure Plan (MCP). The closure plan will be a dynamic document to accommodate the Project changes during its implementation.

1.6. Project Boundaries

The sections below describe the boundaries of the Project in terms of the spatial, temporal, and institutional boundaries.

1.6.1. Spatial Boundaries

The Project core area will be demarcated by the boundaries of the proposed Mining License (ML), whose final outline is yet to be determined. It will include all sites where the main activities of the proposed Project will take place and is likely to be close to the property boundary indicated by a yellow line in Figure 1-3. This property boundary was selected out of three options after SGKL carried out an internal property footprint evaluation in 2023.

The environmental and social repercussions of the Project may extend beyond the Project boundary area. The impacts that could affect the wider area through noise and fumes generated due to movements of the heavy trucks and loaders around the mining site. Contamination of surface water in the Project area could also be carried downstream beyond the Project boundaries.

As such the Project study area has been mapped beyond the Mining License boundaries to capture any potential impacts associated with the Project activities. Modelling of the various potential impacts e.g., those associated with dust fumes, seepage, water contamination plumes, and others, will be used to determine the spatial boundaries for the overall environmental management and monitoring protocols.

1.6.1.1. Spatial Boundaries aligned to the Community Development Agreement Regulations under the Mining Act

The requirements as provided under the mining (Community Development Agreement) Regulations of 2017, under section 5(1) provide the legislative requirement for a proponent to enter into a Community Development Agreement. (CDA) with the Community. A 'Community' as defined under the Mining Act 2016 means (a) a group of people living around a mining operations area, or (b) a group of people who may be displaced from land intended for exploration and mining operations.

Section 5(1) further emphasizes that the basis for identification of one or more communities that will be impacted by the project needs to be defined as part of the ESIA process.

The administrative Wards of Mwibona and Gem East are host to the Ramula-Mwibona gold deposit itself, and to the proposed mining and processing infrastructure as shown in Figure 1-4. They are therefore the primary communities subjected to impact, and to displacement from land intended for mining operations. These two Wards will be the primary communities with which Shanta intends to enter a Community Development Agreement.

Cognisant of the CDA regulations, the project spatial boundaries were further delineated based on the Wards and Communities' impact boundaries based on the modelling results for three specialist studies and analysis from the Social Impact Assessment (SIA) study as illustrated in Figure 1-5 and Figure 1-6 respectively. The three modelled specialists' studies include the air quality, noise and Groundwater studies.

Figure 1-5 illustrates an impact map based on the potentially impacted Wards for the Project based on the modelling results. The identified wards to be potentially impacted by the Project includes the East Gem, Luanda South, Mwibona, North Seme and South Gem.

Figure 1-6 illustrates an impact map based on the potentially impacted community boundaries for the Project based on the modelling results. The identified communities to be potentially impacted by the Project includes Esitimi A, Munungo, Naya A, Naya B, Nyangulu, Nyangulu B, Obwanda, Obwanda B, Odundo A, Siandha 1, Siandha and Siandha B2.

It is important to note that the identified communities are based on the ESIA studies and as such as subject to change. The changes in the communities as beneficiaries into the CDA, is based on the confirmation of the preferred host sites and communities that may have not been identified giving a notice to the holder (as stipulated under section 5(3).

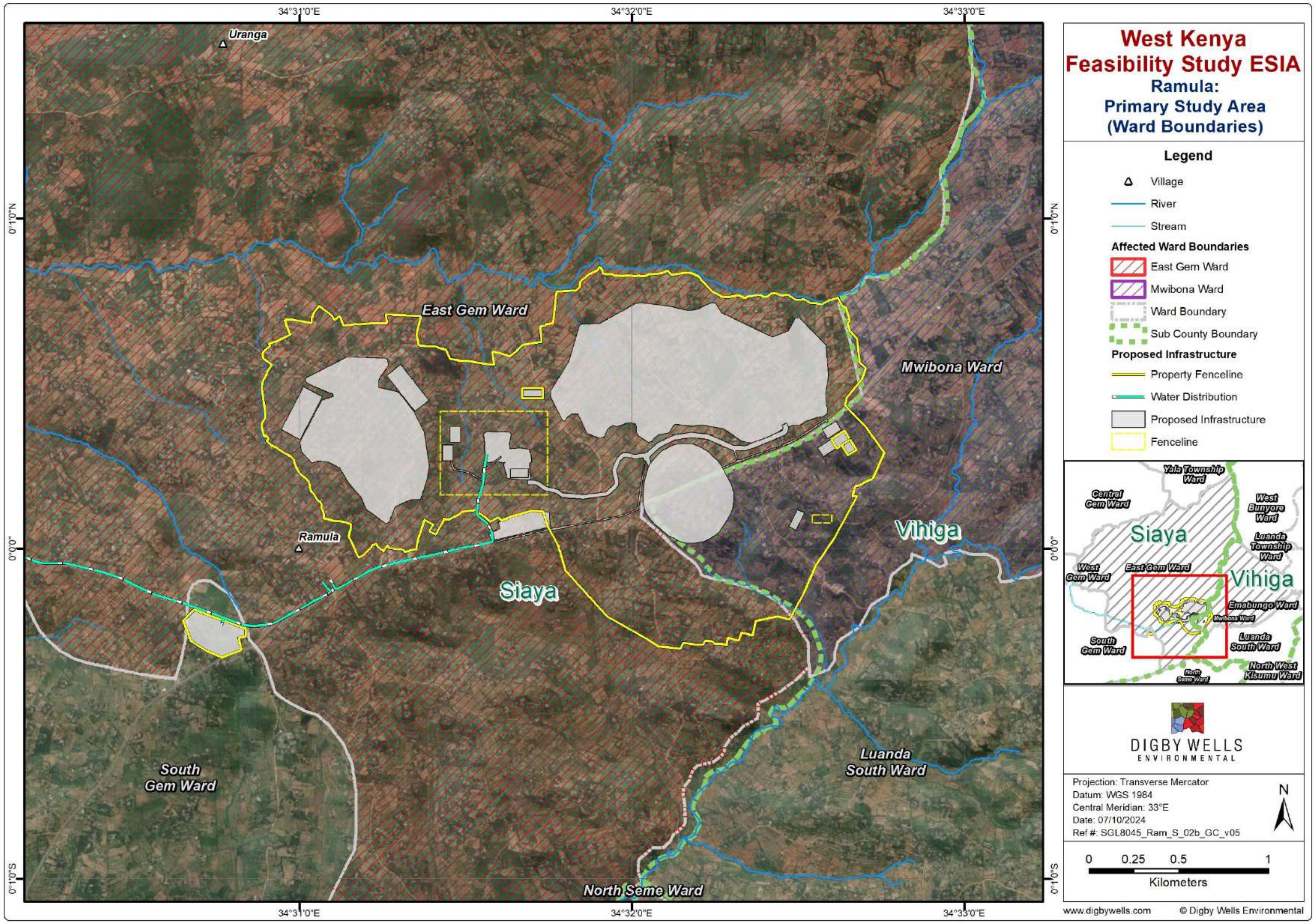


Figure 1-4: The Administrative Wards of Mwibona and Gem East are host to the Ramula-Mwibona Gold Deposit

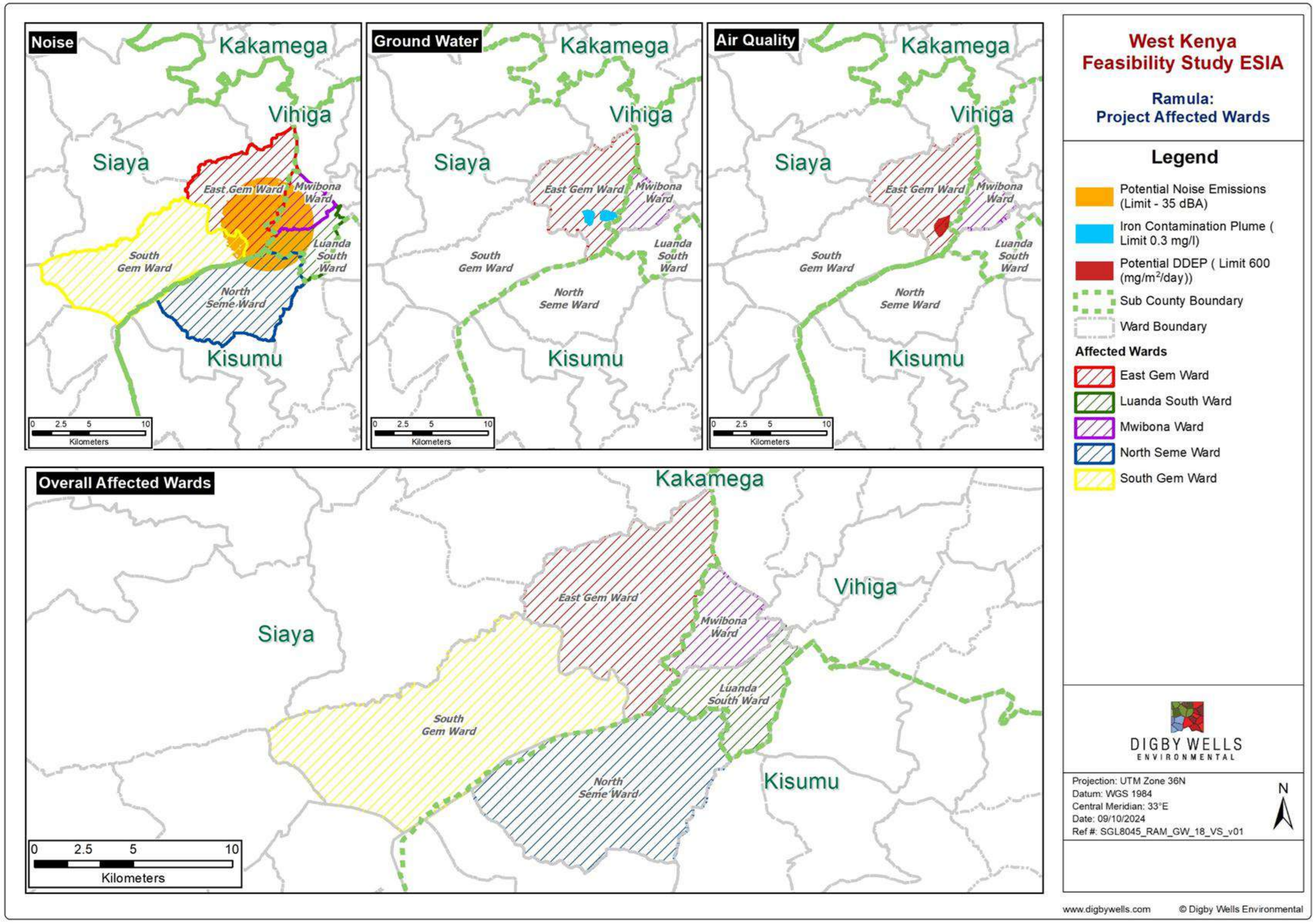


Figure 1-5: Spatial Impact Boundaries based on the Modelling results of the Air Quality, Noise and Groundwater studies

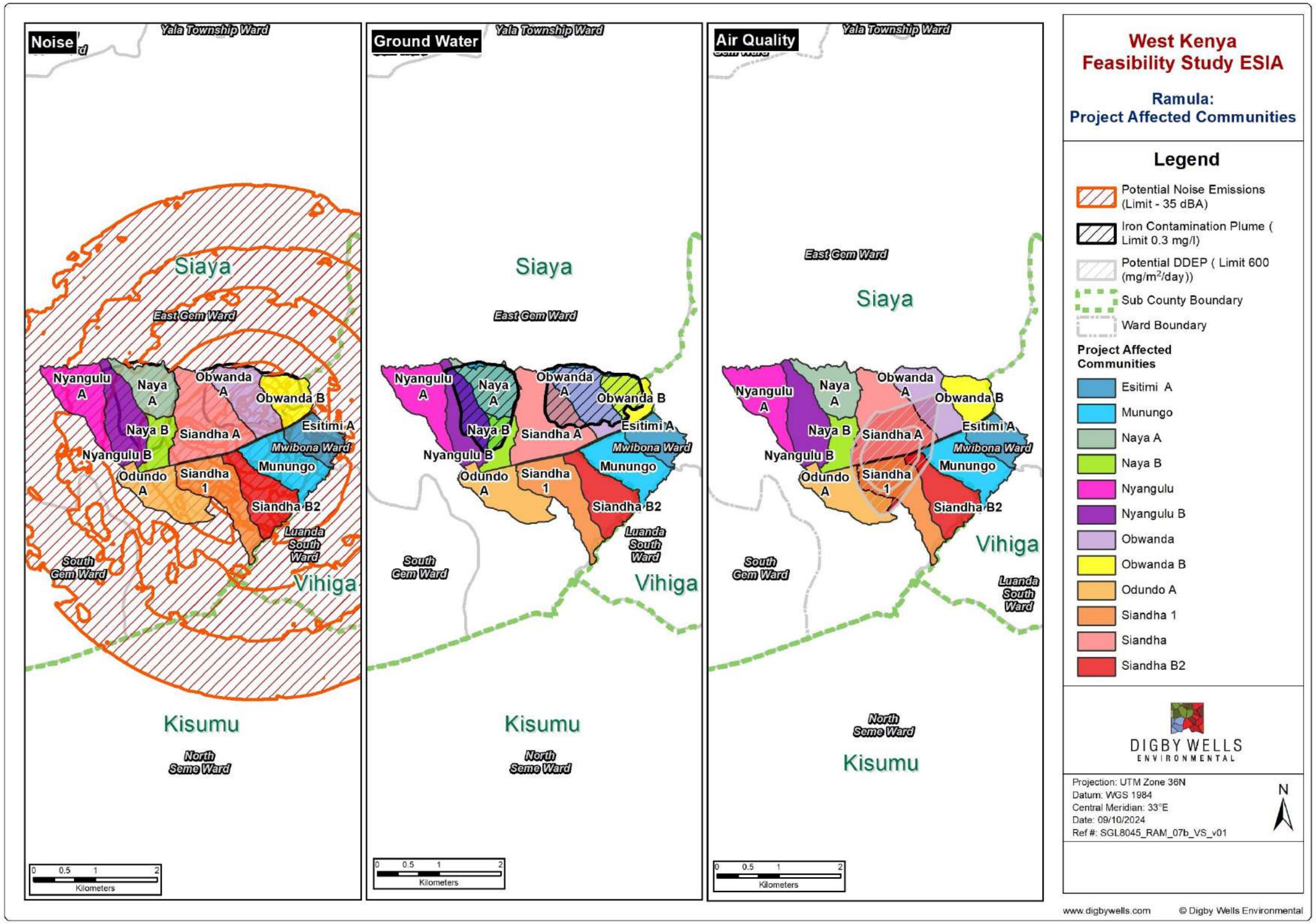


Figure 1-6: Spatial Impact Boundaries based on the analysis of the Social Impact Assessment Study

1.6.2. Temporal Boundaries

Temporal boundaries encompass the duration within which the Project is expected to have a potential effect on the prevailing biophysical and socio-economic environment. Temporal boundaries for Project-related impacts are defined in terms of the Project phases and summarised in the Table 1-3 below. Temporal boundaries are also defined for the potential cumulative impact, spanning baseline to a point in the future, within which Project effects on the biophysical and socio-economic environment are predicted to overlap with the effects of other projects or activities. The temporal boundaries of the Project consist of the durations for mobilisation, construction, and demobilisation phases.

Table 1-3: A High-level Summary of the Activities per Project Phase

Phase	Expected Duration	Activity
Construction	±1.5 years	Site/vegetation clearance for the placement of the main infrastructure including (low-grade ore stockpile, Heavy Mining Equipment (HME) workshop and camp).
		Demolition and relocation of housing infrastructure.
		Establishment of surface infrastructure and facilities including workshops, camp, magazine, and linear infrastructure (security fence, power lines, internal haul and access roads).
		Establishment of the Processing Plant and associated facilities.
		General construction activities including the use of vehicles and machinery as well as the storage and handling of waste and hazardous material.
Operational	8 years including time for processing ore stockpiles	Open pit mining (incl. blasting).
		Ore and mineral waste handling (low-grade ore stockpiles, Waste Rock Dumps (WRDs) and tailings (TSF)).
		Operation and management of water management infrastructure (dams, trenches, silt traps, etc.)
		General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material.
		Potential for discharge of treated effluent
Decommission-ing, Closure and Post-closure	± 5 years (incl. post-closure monitoring and	The Ramula pit to be retained as an open pit. Construction of a safety/security berm around the pit perimeter as a barrier to limit access

Phase	Expected Duration	Activity
	corrective measures)	Dismantling, demolition and removal of some of the infrastructure.
		Rehabilitation of WRD
		Rehabilitation of TSF and adjoining infrastructure
		Post-closure monitoring and rehabilitation.

1.6.3. Institutional Boundaries/Framework

To carry out the ESIA study, different institutions, and their roles in environmental management of mining Projects were identified. Table 1-4 summarises the identified institutions and their roles with regard to the proposed Project.

It is important to note that the Ramula- Mwibona gold deposit straddles the boundary between two counties: Siaya lies to the North, and Vihiga to the South, bringing in two sets of county administrative frameworks for the Project.

Table 1-4: The Institutional Framework for the Proposed Mining Project

Level	Institution	Role and Responsibility
National level	Ministry of Mining, Blue Economy and Maritime Affairs	• Issuing Licenses (prospecting, mining/quarrying, etc.); • Oversee implementation of the Mining Policy; • Enforcement of laws and regulations for mining/quarrying and protection of the environment; • Mining projects EIA and EMP approvals (through a multi-sectoral committee); and • Mining/quarrying conflict resolutions.
	NEMA	• Oversee policy, planning, and environmental matters; • Advise the Government on all environmental issues; • Environmental monitoring and auditing; • Coordinate lead ministries in environmental management; • Coordinate broad-based environmental projects; • Facilitate civil society involvement. • Monitor and assess activities being carried out by relevant agencies in order to ensure that the environment is not degraded. • Prepare and issue a report on the state of the environment; and

Level	Institution	Role and Responsibility
		• Coordinate issues relating to the articulation and implementation of environmental management aspects of other sector policies.
	Ministry of Water	• Enforce laws and regulations for water quality and utilisation; • Issuance and regulation of water rights; and • Effluent standards (monitoring and regulation).
	Ministry of Lands, Housing and Human Settlements Development	• Issuing of Right of Occupancy; • Land use planning; and • Valuation and compensation.
Non-Government Organisations (NGOs)	NGOs	• National Environmental watchdog; and • Initiating dialogue on national environmental concerns among stakeholders.
County Level	County office	• Administration aspects for Vihiga and Siaya.
Sub-county Level	Sub-county office	• General administration of the sub-county; and • Security matters.
	functional Departments	• Expertise in other sectors, e.g., Planning, Water, Health, Community Development, Natural Resources, etc.; • Socio-economic development; and • Extension services.
	Council	• Oversee performance and development plans; and • Oversee resources and environmental management.
Local Level	Councillors	• To oversee the overall performance of the development plans of the Ward.
	Ward/Village Executive Office	• General administration issues; • Socio-economic development of the ward/ village; and • Extension Services.
	Ward/Village Environmental Committees	• Coordinating and advising on environmental policy implementation obstacles; • Promoting environmental awareness; and • Information generation, assembly, and dissemination.

Level	Institution	Role and Responsibility
	Councils (Ward and Village)	• Oversee the performance of the administrative organs of the Ward/village; and • Oversee the performance of the Environmental Committees (within their jurisdictions).

1.7. EIA Phase Methodology

The sections below describe the activities that were executed to develop this EIS Report.

1.7.1. Desktop Assessment

As a first step, a desktop assessment was conducted to gain an understanding of the historical and planned activities for the Project. The following main documents were reviewed:

- Detailed Project Description for the Proposed Ramula- Mwibona Project (including engineering designs for the Project);
- Aerial imagery of the study area;
- Previous environmental and social data and reports; and
- Environmental monitoring data.

1.7.2. Baseline Assessment

A comprehensive baseline assessment was conducted as part of the EIA Phase. The purpose of this was to identify and assess the potential environmental and socio-economic impacts. To establish the prevailing biophysical and socio-economic environments, both desktop and infield investigations were carried out. The main aspects focused on were:

- Regional climatic conditions;
- Regional and local geological setting;
- Air quality characteristics;
- Ambient noise conditions;
- Soils and land use characteristics;
- Hydrological setting (both ground - and surface water);
- Aquatic biodiversity;
- Regional and local terrestrial biodiversity;
- Geochemical characterisation of the rock materials;
- Presence of wetland habitat; and
- Local socio-economic context.

Representative sampling techniques were employed across the Project area. It should be noted that the detailed baseline methodology and findings have been referenced as part of the appendices in this report, for each of the specialist studies.

1.7.3. Environmental Impact Assessment

A comprehensive quantification of pre- and post-mitigation scenarios of potential impacts was determined against the proposed Project activities and prevailing biophysical and socio-economic environments. The methodology for the impact assessment, including parameter ratings and probability consequence matrix is further detailed in Chapter 8.

1.8. EIA Experts

Table 1-5 and Table 1-6 provide details of the registered and non-registered experts facilitating and involved in the Project.

Table 1-5: Registered EIA Experts

S/N	Name of Expert	Profession	Corresponding Responsibility	NEMA EIA Registration	Experience	Signature
1	Sanjay Gandhi	Principal environmental and social lead	In-country Team Lead	Registered Lead Expert with NEMA (Reg No. 0119)	Sanjay Gandhi is an energy sector expert in all aspects associated with ESIA, Environment Auditing, Safety and Health (S&H) training, Root Cause Analysis (RCA) training and facilitation of incidents and S&H auditing in East Africa. He has over 30 years' experience working and consulting for the Oil, Gas and Power sectors, respectively. For 14 years, he worked for Chevron in East Africa and the United States of America initially as a Construction Engineer and later as the Regional Health, Environment and Safety (HES) Manager for East Africa and the Indian Ocean Islands. His core activities include leading multi-disciplinary teams for undertaking ESIA Studies of energy sector projects in Kenya. Sanjay has and continues to lead ESIA and Environmental Auditing teams for public and private sector projects. He is competent with the ESIA and public/stakeholder consultation requirements of international financing institutions such as the IFC, World Bank Group (WBG) and the Equator Principles.	

S/N	Name of Expert	Profession	Corresponding Responsibility	NEMA EIA Registration	Experience	Signature
2	Esther Ngoiri	Environmental and Social Expert	In-country Environmental and Social Lead	Registered Lead Expert with NEMA (Reg No. 6848)	Esther is an Environmental Specialist & Development Expert with over 7 years expertise spanning in environment and social impact assessment (ESIA), environmental auditing (EA), environmental training and project management. She has been instrumental in formulating environmental policies, and executing complex environmental and development programs. She demonstrates a unique ability to address environmental challenges, enhance sustainability, and contribute to Sustainable Development Goals.	
3	Anthony Mwangi Wachira	Environmental Lead	In-Country Environmental Lead	Registered Lead Expert with NEMA (Reg No. 6721)	Anthony Wachira has 14 years' experience in EI) and Environmental Audits, management and implementation of environmental and social safeguards / performance standards on projects. In particular, he has spent 11 years undertaking E&S work under Kurrent Technologies Ltd and 3 years in community-based projects and manufacturing setup.	
4	Sidney Mage	Health, Safety and Environment Expert	In-country Health, Safety and Environment Expert	Registered Expert with NEMA	Sidney Mage is a multi-faceted health, safety, and environment (HSE) professional with 10 years' work experience in various industries such as electric utility, oil and gas; manufacturing, mining and renewable energy. He holds a	

S/N	Name of Expert	Profession	Corresponding Responsibility	NEMA EIA Registration	Experience	Signature
					Bachelor of Science Degree in Environmental Health from Kenyatta University. During this time, while under the auspices of an approved subject matter expert, Sidney has undertaken environmental audits and safety and health audits for facilities. Sidney has in-depth understanding of applicable legislations as well as good international industry practices such as ISO 14001:2015-Environmental management systems, ISO 45001: 2018-Safety and Health Management Systems, ISO 31000: Risk Management-Guidelines and the IFC Environment and Social Performance Standards.	

Table 1-6: Non-Registered Key Experts

S/N	Name of Expert	Profession	Corresponding Responsibility
1	Barbara Wessels	Environmental Assessment Practitioner	Project sponsor and Technical Advisory
2	Deogratius Lorri	Biodiversity Specialist	Project Manager and Report Reviewer
3	Tshegofatso Msomi	Environmental Compliance Consultant	Project Administration and Report Compiler
4	Matthew Damhuis	Hydrogeologist	Hydrogeology study

S/N	Name of Expert	Profession	Corresponding Responsibility
5	Arjan van ‘t Zelfde	Hydrogeologist	Hydrogeology study
6	Megan Taylor	Hydrogeologist	Hydrogeology study
7	Xolani Masina	Hydrogeologist	Hydrogeology study
8	Aviwe Sentwa	Hydrogeologist	Hydrogeology study
9	Nompumelelo Dube	Hydrologist	Hydrology Study
10	Daniel Fundisi	Hydrologist	Hydrology Study
11	Byron Bester	Divisional Manager: Ecology	Overseeing Biodiversity, Aquatic & Wetland Ecologist
12	Lisa Hester	Ecologist	Terrestrial Ecologist
13	Dale Kindler	Ecologist	Terrestrial Ecologist
14	Jonathan Plaistowe	Biodiversity Scientist	Critical Habitat Assessment
15	Nina Hees	Biodiversity Scientist	Ecosystem Services Assessment
16	Taboka Mabudi	Social Scientists	Social Studies and Human Rights Assessment
17	Teddy Kanjongo	Environmental and Social Scientist	Social Studies
18	Alicia Kaijage	Environmental and Social Scientist	Social Studies

S/N	Name of Expert	Profession	Corresponding Responsibility
19	Jan Anton Hough	Social Scientist	Social Studies
20	Jessica Pryor	Social Scientist	Social Studies
21	Dr Matthew Ojelede	Energy and GHGs Management and Climate Risk Specialist	Overseeing Air Quality and Noise Assessments
22	Kathryn Terblanche	Environmental scientist	Climate change Assessment and Greenhouse Estimate
23	Matthias Rommelspacher	Environmental scientist	Climate change Assessment and Greenhouse Estimate
24	Becky Woythal	Environmental scientist	Climate change Assessment and Greenhouse Estimate
25	Orapeleng Mosito	Mine Closure specialist	Mine Closure and Rehabilitation Plan
26	Ivan Bake	Soil, Wetland and Lad use/capability Scientist	Soils and Wetland Reports
27	Varaidzo Sabeta	Geographic Information System (GIS) & Remote Sensing	GIS & Remote Sensing Specialist
28	Keenan Terry	Environmental Scientist	Environmental Noise
29	Dr Levi Ochieng	Geochemist	Geochemistry Study
30	Kgaugelo Thobejane	Geochemist	Geochemistry Study
31	Lucy Stevens	Director: Legal Services	Technical Reviewer and Legal advisor

S/N	Name of Expert	Profession	Corresponding Responsibility
32	Jaco Van Der Walt	Heritage specialist	Cultural Heritage and Archaeology Studies
33	Danny Viljoen	Heritage specialist	Cultural Heritage and Archaeology Studies

1.9. Structure of this Report

Table 1-7 below outlines the structure of this ESIA Report.

Table 1-7: Structure of this ESIA Report

Report Chapter	Description of Chapter Content
Chapter 1	Project Background: Introduction, overview of the Project, objectives of the EIA Study, and summary of methods adopted in carrying out the study.
Chapter 2	Project Description: Provides a description of the Project including the proponent, location of the Project, proposed infrastructure and Project activities.
Chapter 3	Policy, Legislative and Administrative Framework: Provides a summary of the applicable national legislative requirements as well as international best practice standards applied to the EIA phase.
Chapter 4	Prevailing Biophysical Baseline Environment: Provides a description of the biophysical environment based on various specialist studies including collection and primary data from the Project area and subsequent analysis of the findings.
Chapter 5	Prevailing Socio-Economic Environment: Provides a description of the socio-economic environment based on the stakeholder engagement and secondary information
Chapter 6	Stakeholder Engagement Activities: Provides a description of the stakeholder engagement process, a summary of the main queries and comments raised by stakeholders and the responses provided by the Project proponent
Chapter 7	Project Alternatives: Describes Project development alternatives that were considered
Chapter 8	Impact Assessment: Provides the analysis of impacts per specialist study for the construction, operational and decommissioning and closure phases of the Project and includes recommended mitigation and management measures
Chapter 9	Environmental Management Plan: Provides the environmental and social management plan for the Project which includes the proposed management measures to mitigate the negative impacts and enhance the positive impacts expected from the Project.
Chapter 10	Environmental Monitoring Plan: Describes the environmental and social monitoring plan to be implemented during the LoM
Chapter 11	Cost Benefit Analysis: Provides details on the costs and benefits of the Project

Report Chapter	Description of Chapter Content
Chapter 12	Rehabilitation and Decommissioning Plan: This includes closure costing and rehabilitation activities for the various infrastructures on the Project site.
Chapter 13	Conclusion: Provides the conclusion and main recommendations.
Chapter 14	Reference List: Provides a list of all the literature referenced throughout the report

2. Project Description

This Chapter describes the proposed activities which are subject to EIA application. An overview of the Ramula-Mwibona Mineral resource is given in context. The Project constitutes establishment and operation of an open cast gold mine and its associated infrastructure.

2.1. Declaration on Project Proximity to Sensitive Areas

The Project triggers the list of activities contained in the Second Schedule of EMCA, which provides guidance on whether a proposed Project requires a full EIA or not. Projects considered to have a serious effect on the environment require a full EIA.

Although, the proposed Ramula-Mwibona mine area is considered “rural”, social, and environmental factors are a key area of importance for the Project due to the relatively high numbers of potentially impacted persons. The following sensitive receptors have been identified;

- Land holdings;
- Households;
- Watercourses;
- Receiving Environment;
- Water sources including streams, rivers and springs;
- Commercial and community structures; and
- Artisanal mine workings.

2.2. Overview of the Proposed Project

The Project entails the use of open pit mining technique for the potential development of a gold mine. Key infrastructure include a processing plant, Tailings Storage Facility (TSF), Waste Rock Dumps (WRDs), water management infrastructure, power supply, administrative buildings, and ancillary infrastructure To examine the likely positive or negative environmental, social and economic effects of a Project several specialist studies and stakeholder engagements are required as part of the ESIA process. The specialist studies are listed below:

- Terrestrial Biodiversity (Flora and Fauna) Impact Assessment Report;

- Aquatic Biodiversity Impact Assessment Report;
- Critical Habitat Assessment inclusive of the Wetland Impact Assessment Report;
- Soils, Land Use and Land Capability Impact Assessment Report;
- Air Quality Impact Assessment Report;
- Noise and Vibration Impact Assessment Report;
- Climate Vulnerability Assessment Report;
- Hydrogeology Impact Assessment Report;
- Hydrology Impact Assessment Report;
- Geochemistry Assessment Report;
- Socio-economic Baseline and Social Impact Assessment (SIA) Report;
- Archaeology and Cultural Heritage Impact Assessment Report;
- Vehicular Traffic Assessment Report;
- Greenhouse Gas (GHG) Assessment Report;
- Ecosystem Services Assessment Report; and
- Visual Amenity/Aesthetic Assessment Report.

2.3. Mining and Processing

Whittle pit shells were generated using the Ramula indicated resource block model for varying gold prices and economic factors. Using the pit shells, conceptual open pit mine production plans were developed.

The Whittle pit shells are shown illustratively in Figure 2-1, and pit shell outputs are summarised in Table 2-1**.** The pit shell geometries do not change significantly by gold price, and instead is mainly driven by the flat dipping ore body geometry. Another takeaway is the relatively high average strip ratio of 14.8, which is anticipated to decrease with additional infill drilling as well as future definition of “low grade” ore contained in between the mineralized domain wireframes.

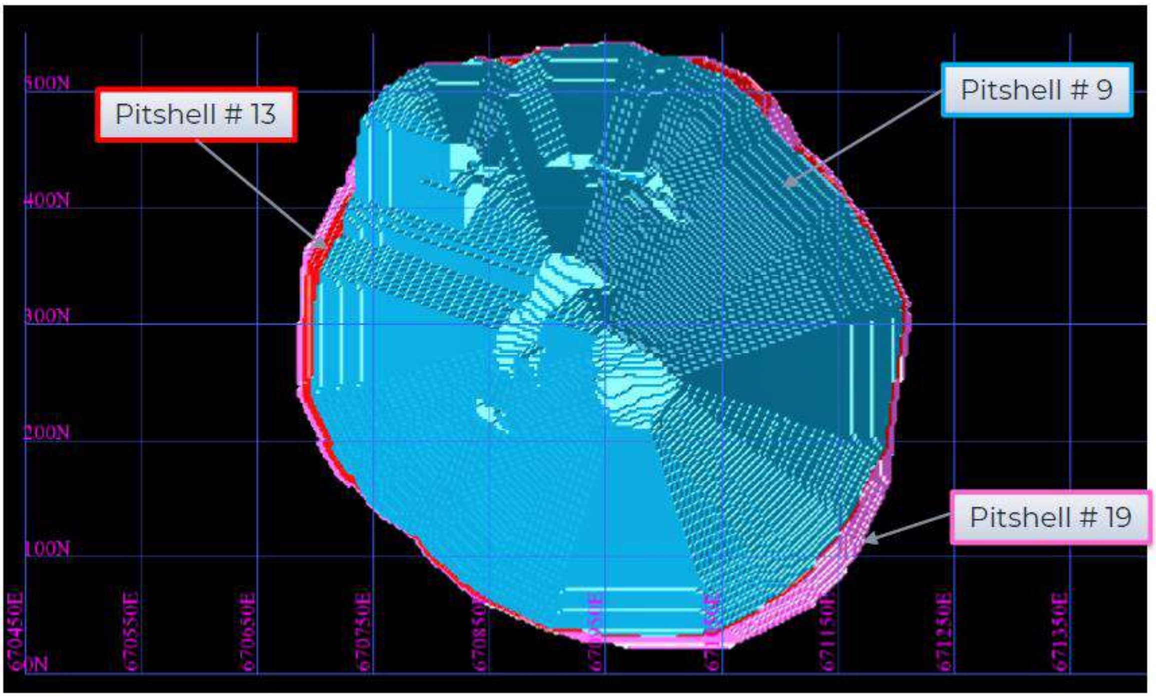


Figure 2-1: Ramula Whittle Pit Shells

Table 2-1:Ramula Pit Shell Summary

Block Model 2.5x2.5x2.5		RM_Shell#9 ~ $1550/Oz	RM_Shell#13 ~ $1750/Oz	RM_Shell#19 ~ $2000/Oz
Material Type	**UOM**	*Feb 2023 Block Model Depth ~ 220m*	*Feb 2023 Block Model Depth ~ 220m*	*Feb 2023 Block Model Depth ~ 225m*
ROM Ore (>=COG Au_g/t)	Au_g/t	1.20	1.10	0.94
Volume	BCM	1,166,435	1,011,908	1,164,241
Tonnes (Diluted)	t	3,173,154	2,755,185	3,171,513
Gold Grade (Diluted)	Au_g/t	3.11	3.50	3.22
Contained Ounces	oz	317,531	309,877	328,350
Recovered Ounces @ 90%	oz	285,778	278,889	295,515
Total Waste				
Volume	BCM	13,957,429	14,881,033	15,858,622
Tonnes	t	38,194,743	40,722,298	43,405,581
Strip Ratio	Vol:Vol	12.0	14.7	13.6
Total Rock			**29,158**	
Volume	**BCM**	**15,123,864**	**15,892,941**	**17,022,863**
Tonnes	**t**	**41,367,897**	**43,477,483**	**46,577,094**

Open pit production plans have been conceptualized for a 340koz contained open pit scenario, as well as a 370koz contained open pit scenario, presented in Table 2-2 and

Table 2-3 respectively. The 370koz is a “forecast” plan assuming additional conversion of inferred to indicated within the base case $1750 pit shell. Production planning demonstrates a ramp-up phase in Years 1 to 3, peak mine production phase in Year 3 to 5, and mine production ramp-down phase in Year 6 to 8. An equivalent mill throughput of 1500tpd has been rationalized based on this production plan. It should be noted that production plans have been developed based on basic “top-down” mining assumption – optimization work is required to assess the potential for phased pit development including later-stage open pit pushbacks. Phased pit shell development should help reduce the high strip ratios seen in the initial few years.

The open pit mining costs have assumed an equivalent Contractor fleet and cost structure sourced from Shanta Tanzania benchmarks (average $3.50/tonne). Trade-off assessments will also be undertaken to assess Owner operated mining fleets, and/or hybrid Contractor-Owner operated mining fleet models.

Table 2-2: Ramula Open Pit Production Plan – 340koz Contained.

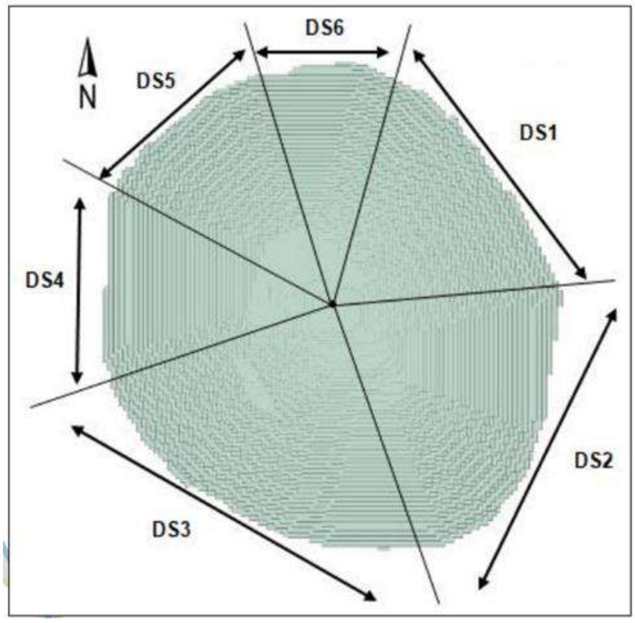
RAMULA - OP			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
ROM Ore (>=0.80Au_g/t)	Volume	BCM	16,963	39,415	143,284	195,700	199,753	218,199	198,594	-	1,011,908
	Tonnes	t	46,186	107,318	390,127	532,845	543,880	594,104	540,724	-	2,755,185
	Gold Grade	Au_g/t	1.68	2.63	2.64	2.97	3.83	4.06	4.02	-	3.50
	Cont. Ounces	oz	2,492	9,080	33,108	50,955	66,916	77,475	69,851	-	309,877
Waste (<0.8Au_g/t)	Volume	BCM	1,291,356	1,933,598	3,390,086	3,330,964	2,916,963	1,320,992	697,074	-	14,881,033
	Tonnes	t	3,533,825	5,291,337	9,277,052	9,115,262	7,982,337	3,614,926	1,907,560	-	40,722,298
Total	**Volume**	**BCM**	1,308,652	1,973,447	3,533,781	3,526,810	3,116,709	1,538,586	894,956	-	15,892,941
	Tonnes	**t**	3,580,011	5,398,655	9,667,179	9,648,107	8,526,217	4,209,030	2,448,284	-	43,477,483
Daily Target	**BCM/Day**	**BCM/d**	3,585	5,407	9,655	9,662	8,539	4,215	2,445	-	43,509
	Tonnes/Day	**t/d**	9,808	14,791	26,413	26,433	23,359	11,532	6,689	-	119,026
Strip Ratio	**Wst:Ore**	**Vol:Vol**	77	49	24	17	15	6	4	-	14.8
Stockpile level											
Tons on stockpile	Tonnes	t	46,186	153,504	122,131	125,477	139,856	204,461	214,185	-	
Gold on stockpile	Grams Au	g	77,516	359,929	404,585	325,434	566,524	748,482	978,568	-	
Grade on Stockpile	Gold Grade	Au_g/t	1.68	2.34	3.31	2.59	4.05	3.66	4.57	-	
Plant/Mill	**1,500**	**tpd**									
Tons Milled / Treated	Tonnes	t	-	-	421,500	529,500	529,500	529,500	531,000	214,185	2,755,185
Gold Milled / Treated	Grams Au	g	-	-	985,124	1,664,030	1,840,221	2,227,778	1,942,528	978,568	9,638,249
Grade Milled / Treated	Gold Grade	Au_g/t	-	-	2.34	3.14	3.48	4.21	3.66	4.57	3.50
Plant recovery	Recovered Gold	%	0%	0%	90%	90%	90%	90%	90%	90%	90%
Gold produced	Recov. Ounces	oz	-	-	28,505	48,150	53,248	64,462	56,208	28,315	278,889

Table 2-3: Ramula Open Pit Production Plan – 370koz Contained.

RAMULA - OP			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
ROM Ore (>=0.80Au_g/t)	Volume	BCM	-	24,312	69,897	122,247	191,903	201,810	208,592	229,383	115,190	1,163,334
	Tonnes	t	-	65,430	188,110	328,994	516,456	543,117	561,370	617,323	310,003	3,130,803
	Gold Grade	Au_g/t	-	1.50	2.28	2.29	3.64	2.90	5.29	3.75	4.79	3.67
	Cont. Ounces	oz	-	3,147	13,765	24,203	60,503	50,704	95,457	74,444	47,691	369,914
Waste (<0.8Au_g/t)	Volume	BCM	-	1,280,250	1,890,125	3,166,475	3,156,370	2,948,809	1,520,491	1,015,899	411,239	15,389,656
	Tonnes	t	-	3,507,018	5,177,663	8,673,999	8,646,317	8,077,741	4,165,117	2,782,877	1,126,516	42,157,248
Total	Volume	BCM	-	1,305,746	1,961,215	3,290,635	3,349,036	3,150,963	1,727,553	1,242,788	525,054	16,552,990
	Tonnes	t	-	3,572,448	5,365,773	9,002,993	9,162,774	8,620,858	4,726,487	3,400,199	1,436,519	45,288,051
Daily Target	BCM/Day	BCM/d	-	3,577	5,373	8,991	9,175	8,633	4,733	3,396	1,439	45,317
	Tonnes/Day	t/d	-	9,788	14,701	24,598	25,103	23,619	12,949	9,290	3,936	123,984
Strip Ratio	Wst:Ore	Vol:Vol	-	54	28	26	17	15	7	5	4	13.5
Stockpile level												
Tons on stockpile	Tonnes	t	-	65,430	253,540	161,034	147,990	161,607	193,477	279,800	60,303	
Gold on stockpile	Grams Au	g	-	97,867	526,006	398,391	585,061	561,266	1,187,469	1,213,554	287,659	
Grade on Stockpile	Gold Grade	Au_g/t	-	1.50	2.07	2.47	3.95	3.47	6.14	4.34	4.77	
Plant/Mill	1,500	tpd										
Tons Milled / Treated	Tonnes	t	-	-	-	421,500	529,500	529,500	529,500	531,000	529,500	3,130,803
Gold Milled / Treated	Grams Au	g	-	-	-	880,423	1,695,188	1,600,863	2,342,834	2,289,394	2,409,266	11,505,627
Grade Milled / Treated	Gold Grade	Au_g/t	-	-	-	2.09	3.20	3.02	4.42	4.31	4.55	3.67
Plant recovery	Recovered Gold	%	0%	0%	0%	90%	90%	90%	90%	90%	90%	90%
Gold produced	Recov. Ounces	oz	-	-	-	25,476	49,051	46,322	67,791	66,245	69,714	332,923

2.3.1. Geotechnical Information

Geotechnical analysis was based on the conceptual geotechnical information that was provided by the Geotechnical Consultants (Middindi Consulting (Pty) limited). Based on the conceptual geotechnical assessment, Ramula- Mwibona deposit was categorised into six major geotechnical sectors (Figure 2-2). Further technical details are provided in the technical report attached as Appendix C



Design Sector	Wall Dip Direction	Azimuth (°)
1	230	016 to 086
2	310	086 to 160
3	30	160 to 252
4	90	252 to 299
5	135	299 to 342
6	180	342 to 016

Figure 2-2: Ramula - Mwibona Deposit Conceptual Geotechnical Design Sectors (Consulting (Pty) Ltd, 2023)

Apart from the above conceptual geotechnical design sectors shown in Figure 2-2, two based on function of height were introduced, namely as Weathered and Fresh; with their classification as detailed below.

- Geotechnical zone 1 – Surface with 1457mRL as the highest/maximum to 1400mRL and categorized as Weat:
  - Assumed from 1400mRL going down;
  - Assumed overall slope of 40 degree; and
  - Assumed competent ground based on the visual observations of the drilling samples.
- Geotechnical zone 2 – Fresh or competent ground:
  - Assumed from 1400mRL going down;
  - Assumed overall slope of 43 degree; and
  - Assumed competent ground based on the visual observations of the drilling samples.

2.3.2. Mineral Resource Estimate

The published 2023 indicated resource is summarised in Table 2-4. The 417koz reported resource has been constrained within the $1750/oz pit shell, and also constrained by mineral wireframes. There is an additional 50koz of inferred material within this pit shell, as well as lateral extension targets immediately around the pit. There is known resource below the bottom of the pit, and the deposit continues to be open at depth (Figure 2-3).

The next stages of infill and exploration drilling will target some known gaps within the pit as well as the lateral extensions around the pit shell, for the purpose of growing the open pit mine's inventory.

Table 2-4: Ramula Indicated Resource (March 2023)

			March 2023 Mineral Resource Estimate*		
Target	**Material**	**Cut-off grade (g/t)**	**Tonnes (t)**	**Grade (g/t)**	**Indicated Ounces (Oz)**
Ramula	Oxide	0.7	241,400	1.52	11,800
	Fresh	0.7	5,089,500	2.47	404,900

*Resource estimates constrained by $1750/oz pit shell and mineral domain wireframes.

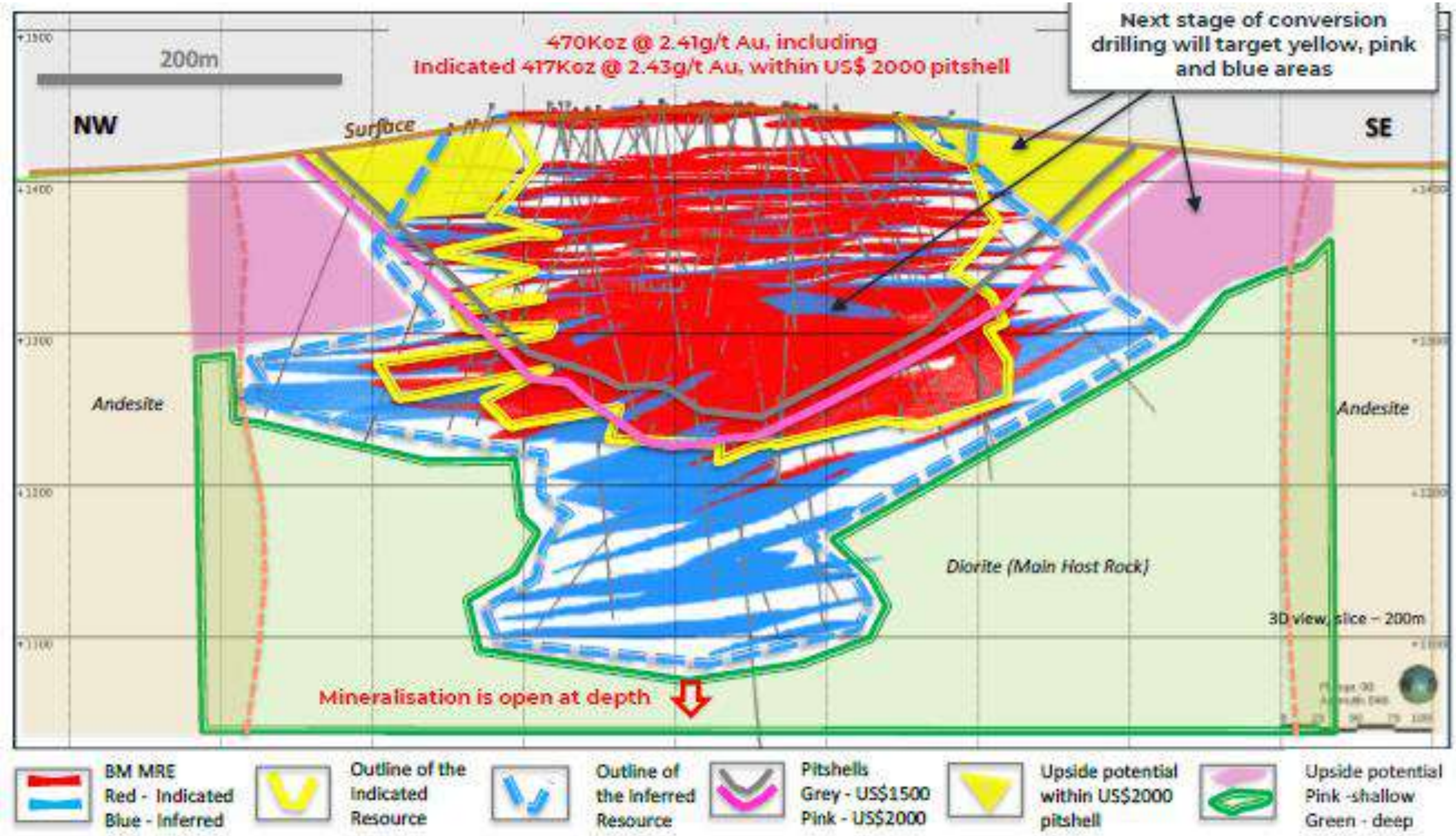


Figure 2-3: Ramula Long-section Showing Indicated, Inferred, and Future Conversion Potential

2.3.3. Mine Life and Production Schedule

The purpose of the Phase 1 sterilization drilling is to ensure that proposed mine infrastructure arrangements will not negatively impact potential gold resources. Various tradeoffs and design works will be required through early 2024 in order to drive towards a design freeze by 2024.

A design freeze is required so that work associated with the ESIA can proceed with a known situation related to location of infrastructure and key mining generational parameters. However, contributing to the design freeze, the ESIA team will be required to contribute to social and environmental design criteria and tradeoff assessments associated with environmental-social impacts.

2.4. Ramula Process Design

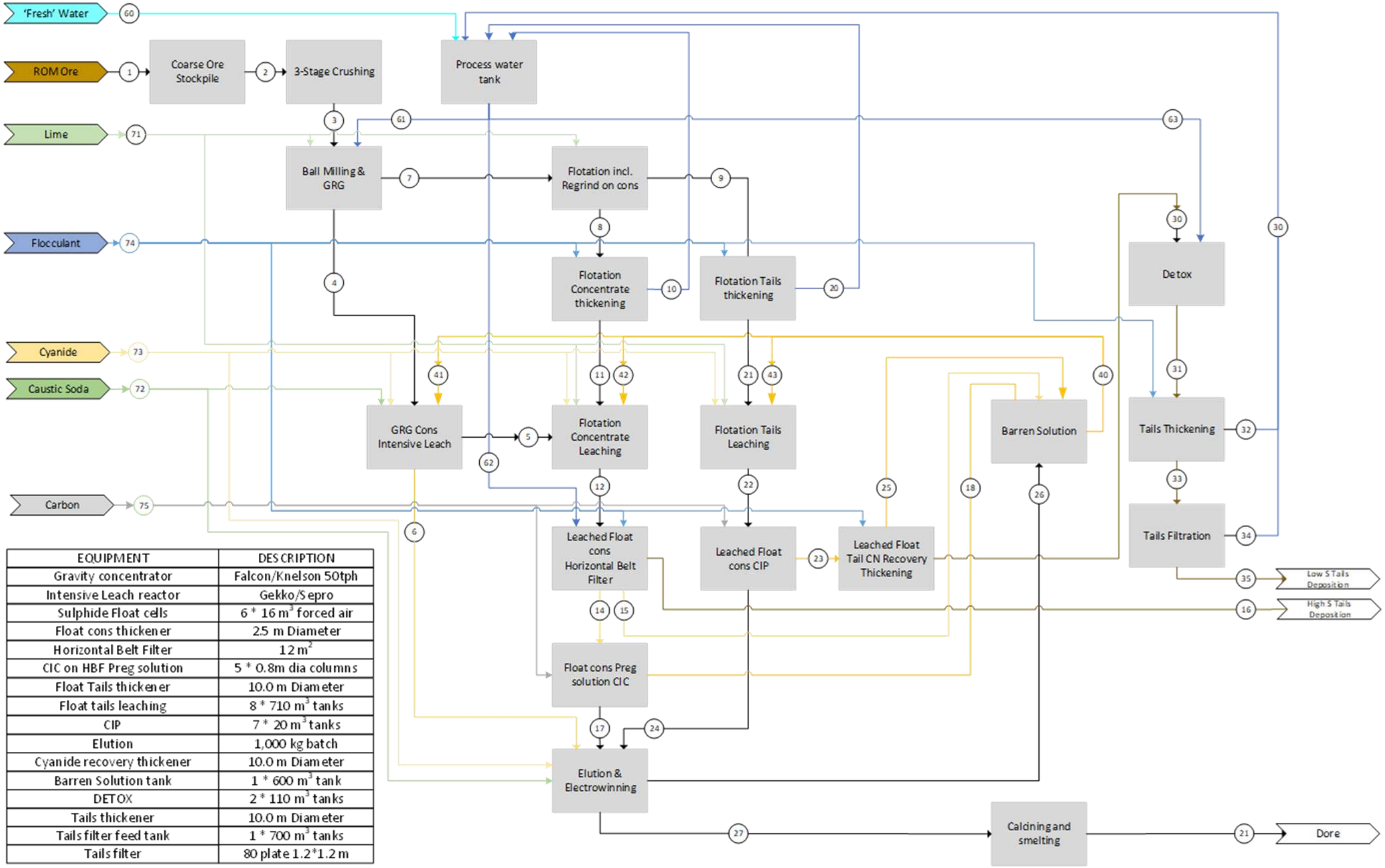
Preliminary metallurgical test work was conducted using Ramula drill core with ore zone samples selected from several drillholes. A total of 40 samples (86kg) of core was sent to Nesch Mintech Tanzania Ltd. Testing included mineralogical analysis, geochemical analysis, grind testing, gravity separation, direct leach, and CIL leach. The met test results are presented in the report dated June 2022 (Reference Nesch June 2022). General conclusions from the preliminary met test work demonstrated:

- No notable issues of deleterious mineralogy negatively impacting recovery;
- Good gravity recovery potential;
- Beneficial for fine grind of 53um P80 to improve recovery;
- Overall gold recovery expected at +90% including gravity with CIL; and
- Optimization of grind size and residence time would be focus of future test work.

A conceptual process flowsheet was developed to support the conceptual capex/opex estimates for this scoping study. A 2000tpd mill throughput (Figure 2-4) was assumed for this flowsheet which might be high compared to assessed open pit throughput rates of 1500tpd, however there are future considerations for increasing the Ramula pit reserves as well as additions from nearby regional deposits. Overall met recovery assumptions are provided in Table 2-5. General design configurations and met recovery assumptions are also based on current design and operational experience for both New Luika (NLGM) and Singida (SGM) mine sites. The Ramula 2000tpd flowsheet configuration assumes the following major components:

- 3-Stage crusher circuit (Primary Jaw, Secondary-Tertiary Cone);
- Single ball mill, 4.6mD x 8.2mL, 2.8MW;
- Gravity concentrator;
- Pre-leach thickener;
- 4 x 1000m3 CIL tanks;

- Detox tanks;
- Oxygen plant;
- Elution and Smelting circuit; and
- Tailings facility (with or without tails thickener)



EQUIPMENT	DESCRIPTION
Gravity concentrator	Falcon/Knelson 50tph
Intensive Leach reactor	Gekko/Sepro
Sulphide Float cells	6 * 16 m³ forced air
Float cons thickener	2.5 m Diameter
Horizontal Belt Filter	12 m²
CIC on HBF Preg solution	5 * 0.8m dia columns
Float Tails thickener	10.0 m Diameter
Float tails leaching	8 * 710 m³ tanks
CIP	7 * 20 m³ tanks
Elution	1,000 kg batch
Cyanide recovery thickener	10.0 m Diameter
Barren Solution tank	1 * 600 m³ tank
DETOX	2 * 110 m³ tanks
Tails thickener	10.0 m Diameter
Tails filter feed tank	1 * 700 m³ tanks
Tails filter	80 plate 1.2*1.2 m

Figure 2-4: Ramula Process Flowsheet 2000tpd.

Table 2-5: Ramula (WK) Met Recovery Assumptions

Description	Units	WK Project	NLGM	SGM
Crusher feed size	mm	600	400	400
Ore Milled	tpd	2,000	2,500	1,000
Ore Milled	tpa	706	883	353
Feed grade	g/t	3.00	2.78	3.00
Ball work index	kWh/t	17.5	17.5	17.5
Mill feed size - P80	mm	8.0	6.5	8.0
Mill product size - P80	microns	53.0	75.0	106.0
Gravity Recoverable Gold (GRG)	%	45%	-	40%
Leach Residence time	hours	30	30	24
Leach and Ardsorption tanks	No	4	11	6
CIL Gold Recovery	%	85%	89%	85%
Overall, Gold Recovery	%	90%	89%	91%
Elution plant capacity	t	2	2	2
Annual Gold production	oz/annum	57,881	70,083	28,941

It is noted that a second flowsheet was developed assuming potential future expansion of the Ramula plant from 2000tpd to 3000tpd assuming potential regional “Blue sky” additions such as Dhene, Miruka, and Ochiegue to the Ramula mine plans.

Next steps of process design for the WK FS will include:

- Second phase of metallurgical and mineralogical test work;
- Refinement of grind, residence time, and leach recovery parameters;
- Ore blending strategies to maximize recovery;
- Trade-offs of alternative flowsheet configurations, capex-opex cost benefits;
- Detailed mass balance, equipment, and power load lists; and
- Associated PFD’s, P&ID’s to support plant engineering and costing

2.5. Key Infrastructure

A conceptual site arrangement was developed for the Ramula mine and surface infrastructure footprint as illustrated Figure 2-5. The general purpose of the site arrangement was to highlight the land acquisition needs to support future investigation and environmental and resettlement planning, as well as to support the conceptual capex cost estimates. Plant and infrastructure arrangements are very conceptual at this time and sourced mainly through design arrangement experience from the recently constructed Singida gold mine (1000tpd).

The general site arrangement (Figure 2-5) components include:

- Overall, 467 Hectares (Ha) footprint;
- 500m buffer limit between open pit and fixed infrastructure;
- A provision of a buffer zone between mine infrastructure and private/public property;
- 1 open pit with 1 waste rock dump and associated sediment controls;
- Plant, and TSFareas positioned in the north-west quadrant;
- Camp and service facility areas positioned in the south-west quadrant, outside the mine footprint;
- Regional road relocation is required for the diversion of traffic around the mine;
- 7.5 kilometres water intake pipeline from Yala River to the mine; and
- 4 Mega Watt (MW) Diesel Genset Power System.

Note the conceptual site configurations do not include the following:

- Host resettlement site not yet identified; and
- Potential tie-ins to existing utilities not yet identified.

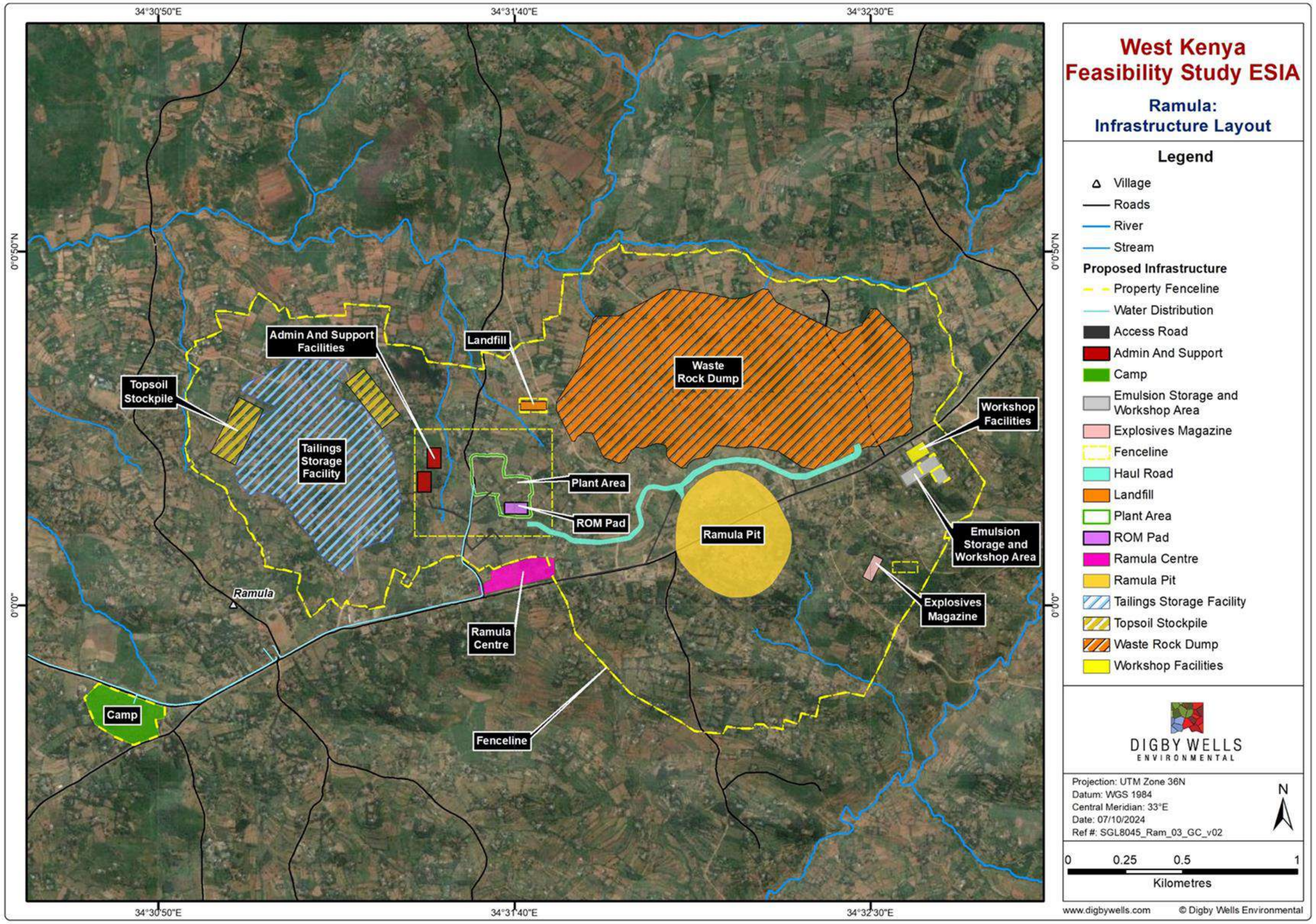


Figure 2-5: Ramula-Mwibona Infrastructure Layout

Next steps of surface infrastructure design for the Ramula- Mwibona Project will include:

- Detailed topographical survey to support arrangements;
- Sterilization drilling around known soil/geophysics anomalies to establish footprints;
- Property evaluations and land acquisition assessments;
- Environmental controls assessments;
- Regional road diversion assessments;
- Sizing of plant, power, and supporting services;
- Basic engineering for plant and service areas; and
- Detailed site arrangements including cut-fill mass balances, costing and scheduling.

2.5.1. Tailing Storage Facility

Tailings material which is generated as part of the gold recovery process needs to be deposited to tailings storage facility (TSF). The SGKL's Processing Plant would treat ore from the deposits to recover gold using a gravity circuit and a conventional carbon-in-leach (CIL) process. From this process, gold doré is produced for shipment.

Epoch was appointed to undertake a comprehensive Multi-Criteria Alternative Assessment (MAA) and provide preferred site option for the construction of the TSF with the support from Digby Wells. A total of nine (11) TSF options based on location, alternatives as TSF options based on the tailings technology and disposal technique have been illustrated in Figure 7-1. These options were evaluated against a pre-determined MAA.

The MAA utilises a structured scoring and weighting system to rank each site and technology option, ultimately identifying Option 7B as the preferred location and employing a dewatered deposition technology. The TSF will comprise of two storage basins:

- A dry-stack tailings facility, and
- A stormwater dam.

The general arrangement of the TSF is shown in Figure 2-6. Further technical details are provided in the technical report attached as Appendix D.

2.5.1.1. TSF Seepage Barrier Requirements

Kenya does not have legislation that prescribes the seepage barrier requirements for mine-residue. SGKL prescribed the basin of the TSF should be lined. ProMet 101, the company that is designing the process plant, performed a waste classification study on Sulphide and Oxide tailings specimens from Ramula-Mwibona Gold Mine and showed that 5 percent of the tailings are potentially AMD forming with the leachable concentrations for the oxide tailings for arsenic, which exceeds the IFC guideline value of 0.1 mg/L (IFC, 2007).

As part of the feasibility study process, ProMet 101 has introduced an arsenic treatment process at the process plant to ensure that the tailings slurry stream reporting to the TSF is within IFC arsenic compliance concentrations.

In addition to the arsenic, cyanide in the 5 percent filtered tailings shall be treated prior to being discharged onto the TSF to comply with the ICMC (International Cyanide Management Institute, 2024) and IFC threshold limits.

2.5.1.2. TSF Site preparation

The average topsoil depth is approximately 300 mm thick and the TSF area shall be stripped from its vegetative cover and topsoil and stockpiled on designated topsoil stockpiles along the perimeter of the TSF. The maximum height the stockpiles shall reach is 2 m and shall be re-used during reclamation and closure to rehabilitate the TSF side slopes and basins.

2.5.1.3. Dry-stack Facility Design

Filtered tailings generated from the mining process shall be disposed of in the dry-stack facility. It is located within a valley confined between higher-lying areas to the south, east and west of its flanks. It occupies an area of 27.3 ha and reaches a final height of 61 m. Further details of the measurable attributes of the dry-stack facility are included the TSF technical report included as Appendix D.

2.5.1.3.1. Dry-stack facility development

The Dry stack facility will be comprised of the flowing zones; namely the compacted zone; nominally compacted zone; and high-sulphite tailings zone.The compacted zone is indicated by layers 1 to 15 in Figure 4-2 and shall be constructed using filtered tailings to a target moisture (14.4% by mass) and compaction effort (98% of Mod. Proctor effort) specified in the design. This zone forms the competent structural zone and the outer slope.

Filtered tailings shall be placed within the nominally compacted zone during times that is less favourable to construct the compacted zone. The zone has less stringent moisture and compaction requirements.

The High-sulphite tailings zone is reserved for 5 % of the total tailings feed which is stored separately to be accessible to be remined at a later stage. An overall external side slope profile of 1V:5H has been adopted for the dry-stack facility. This overall side slope profile lends itself to producing acceptable overall slope stability factors of safety and facilitates easy rehabilitation by topsoiling and grassing and to be integrated into the surrounding topography after closure.

2.5.1.4. Dry-Stack Facility Water Management System

General water management concepts specific to the SF, including surface run-off, sedimentation control, drains and evaporation, require careful consideration. The water management systems required for the DSTSF include Above liner drainage system, Below Liner Drainage System, Groundwater drainage system, Stormwater Diversion Trench

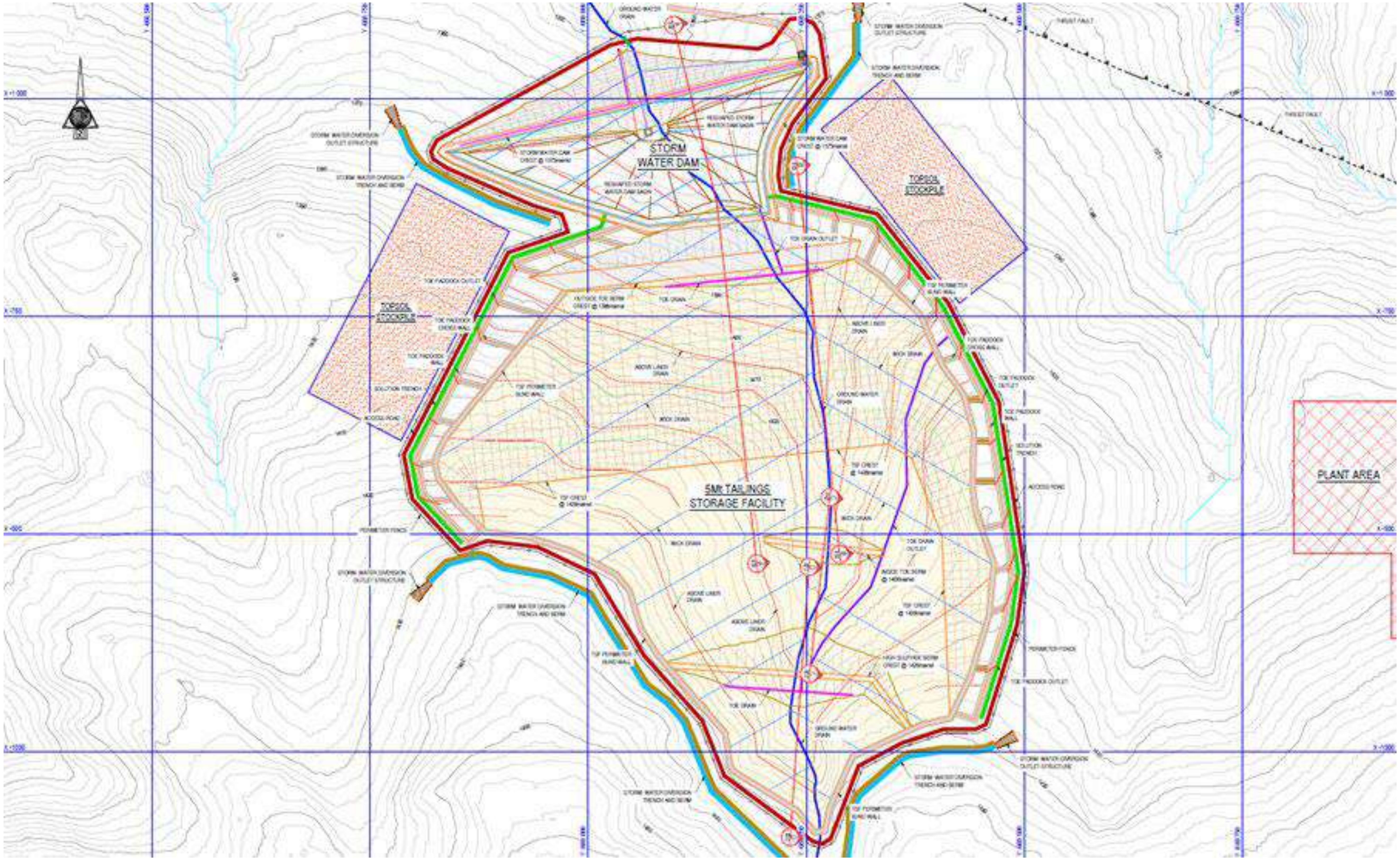


Figure 2-6: Dry Stack TSF General Site Arrangements

2.5.2. Waste Rock Dumps

Based on the provisional mine plan, a total of 41.8Mt (circa 14.8M bcm or 19.4M LCM) of waste rock will be generated over the LoM, hence a requirement for Waste Rock Dump (WRD) for the purpose of dumping additional waste not required for construction activities.

Selection of the waste rock area were based on several factors, amongst it has also not limited to construction location, design parameters criteria, capacity or requirements, rock characterisation and regulatory requirements.

The WRD has been designed to make optimal use of the space available downstream of the open pit while also minimising haulage distances as illustrated in Figure 2-7.

2.5.2.1. Waste Rock Dump Design

Waste rock generated from the mining process shall be disposed of on the unlined WRD footprint. The WRD is located over multiple valleys confined between higher-lying areas to the South, and a low-lying river valley to its North. The WRD occupies an area of 100 ha and reaches a final height of 105 m. Further technical details are provided in the technical report attached as Appendix E.

2.5.2.2. Stage capacity relationship

The WRD will be developed in successive lifts to provide a maximum waste rock storage capacity of 42.5 Mt. This will provide storage of approximately 8 years.

2.5.2.3. Side slope design

An overall external side slope profile of 1V:4H has been adopted for the WRD. This overall side slope profile lends itself to producing acceptable overall slope stability factors of safety, facilitates easy rehabilitation by topsoiling and grassing and supports the facility's integration into the natural landscape as part of the closure objectives.

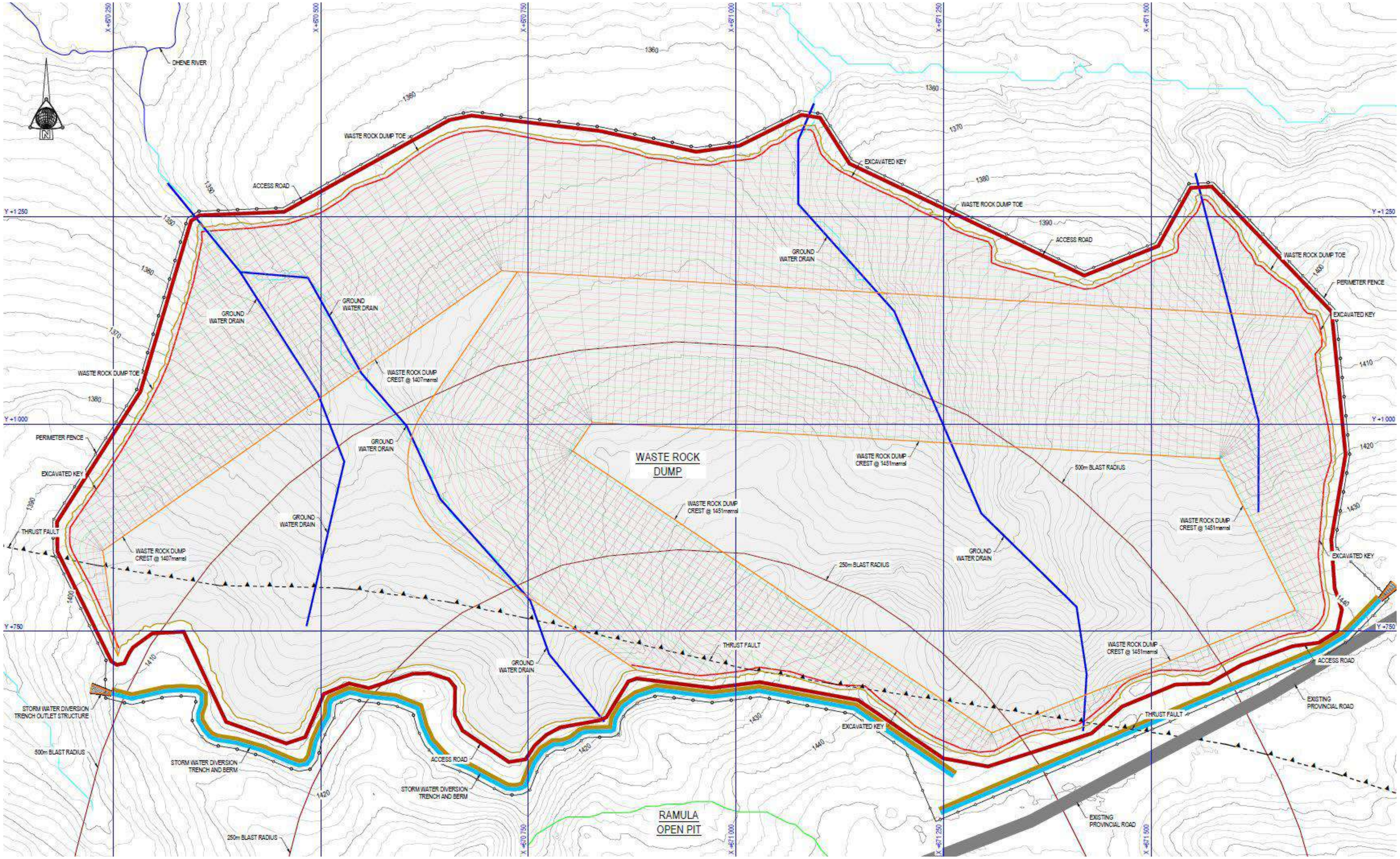


Figure 2-7: Final Waste Rock Dump Arrangement

2.5.3. Site Water Management

Water requirements for mining activities and general services will undergo treatment to meet potable water standards. The water treatment plant will be designed to handle a raw water flow of 4,800 m^3/day. Typically, approximately 5-10% of the water is lost during treatment while 20% is stored as reserve capacity to be utilised as a reserve capacity based on other demand needs that may emerge. This results in 3,360 m^3/day progressing to the offsite main storage tank. Out of this treated water, 40% is utilised for potable purposes, while the remainder is employed in mining operations.

The total amount of water used in the mining process is approximately 2,016m^3/day (done using the Singida Mine (Tanzania) as the base case), 40% of the water used in processing operations will be taken as the amount of water recycled in the Ramula-Mwibona Site (approximately 806.4m^3/day).

2.5.3.1. Site- Wide Water Balance

The requirement for conducting the Site Wide Water Balance (SWWB) has been provided as part of the integrated approach to managing the proposed Project water resources and establish if the mine has excess water (that must be discharged to the environment) or a water deficit.

As part of generating the SWWB, the models considered climate, runoff conditions, and any other factors that affect the availability of water. The outcome includes a comprehensive depiction/illustration of water flows around the site for each month of the year and each year of mining operations. The final objective is to resolve the water supply and/or the water discharge conditions so that the operation can adequately operate and so that environmental regulations can be met. Detailed SWWB and its description is provided in the Surface Water Impact Assessment Report included as Appendix F.

2.5.4. Raw Water Storage

Regarding potable water, 30% (approximately 403.2m^3/day) is assumed to go to the local community, leaving 70% (approximately 940.8m^3/day) to be used on the site. Within this 70%, water is assumed to be distributed among the Camp Area Tank, Service Water Tank, Fire Water Tank and Gland Water Tank.

Of this, 20% (188.16m^3/day) of the water goes into the Camp Area Water Tank and 30% (282.64m^3/day) of it goes into the Service Water Tank. The Practice Manual for Water Supply Services in Kenya (October 2005) recommends that the capacity for firefighting should not be less than 10l/s for 2hours.

This implies that each fire occasion will demand 36m^3/hour (72m^3/day) of water. As a result, the firefighting reserve has been allocated as 72m^3/day. The remaining potable water (398m^3/day) has been allocated to the Gland Service Tank. Of this, 40% (159.2m^3/day) is also assumed to be recycled back into the Tailings Storage Facility (TSF) and used for the mining processes. Water balance of the site can be seen in

Figure 2-8 below.

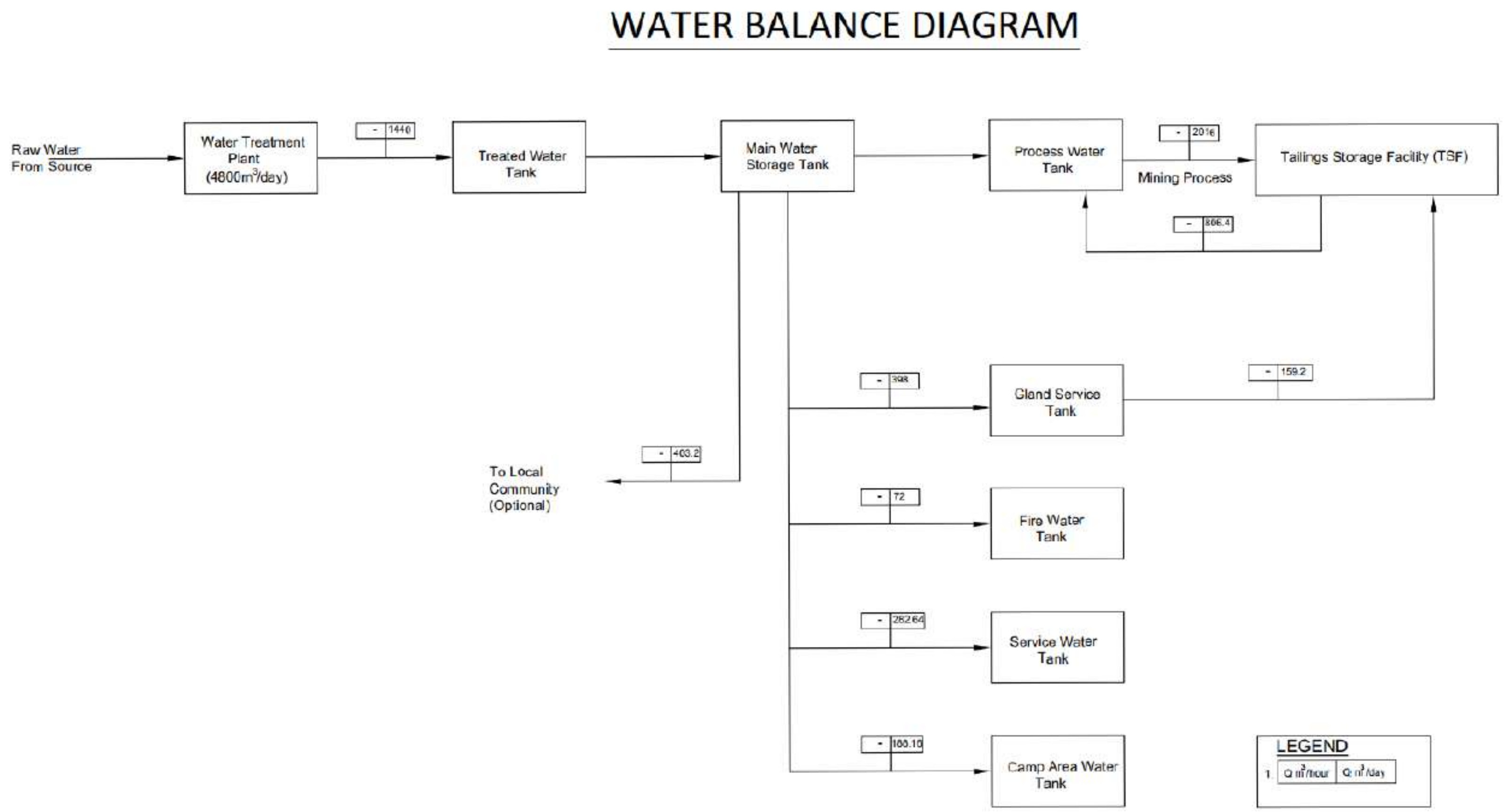


Figure 3: Ramula Water Balance Diagram

Figure 2-8: Water Balance (Howard Humphreys Consulting Engineers, 2024)

2.5.5. Access and Haul Roads

A consideration of the new haul roads was evaluated as part of the detailed ESIA to allow access to the proposed tailings facilities, camp, administration area, proposed waste rock dumps and support infrastructure.

A chosen location aimed at ensuring that the distance for haulage of the waste rocks and ores from the mining pit is minimized. In addition, other considerations for the selected site aim to minimize the environmental impacts, cost and risk of the implementation whilst ensuring that there is enough area to cater for the haul road footprint.

2.5.6. Non-Mineralised Waste Management

Non-mineralised waste management for all categories of the waste types that will be generated by the proposed Project will remain as per the current operation. General and hazardous waste will be managed in line with the Shanta's Integrated waste management and Standard Operating Procedures (SOP's).

2.5.7. Power Supply

The Project will require reliable, secure and constant sources of power. Therefore, four substations as power supply sources were considered and discussed in Chapter 7 of this report. Power supply requirements for the Project includes:

- Mine processing capacity of 1,500 tons per day(tpd);
- Total mining electrical load of 12 Mega Watts (MW);
- Incoming supply to the mine's substation of 33KV;
- Distribution within the mine loads of 6.6 KV; and
- 24 operating hours.

2.5.8. Telecommunications

SGKL will make use of a two-way radio system on a dedicated channel. Mining fleets are monitored by a control/ dispatch centre using this modular system. Telecommunications masts will be located at a number of sites around the mine, including the camp area, administration offices and the mining area.

2.6. Project Financing and Costing

The costing is based on 2022/2023 cost figures for reference. The total initial (pre-production) capital cost is estimated at $137M. This includes significant costs associated with pre-production open pit stripping and mining ($36M) and resettlement and regional road relocation ($27M). The mining, plant, and infrastructure costs were benchmarked from recent experience from the Singida mine build, which had an initial capital cost less than $60M including mining.

A small contingency of 5% is carried out in this current initial capital cost estimate. Recognized potential initial capex reductions including:

- Phased open pit mining to reduce waste stripping in the initial capital period;
- Reducing land acquisition and resettlement costs by reducing footprint, and incorporating land leasing rather than purchase for "undisturbed" areas;
- Staging TSF and WRD facilities to reduce earthworks in initial capital period; and
- Leasing of equipment where practical such as "power systems."
- In anticipation of potential initial capital cost reduction measures, a "low capex" scenario of $100M was also referenced in the financial models.
- Total life of mine sustaining capital costs of $19M - $24M were also estimated for the 6-year production period. This includes predominantly mining costs with additional sustaining capex allowances for plant and infrastructure (Table 2-6)

Table 2-6: Ramula Initial Capital Cost Estimate

West Kenya Concept – Ramula Open Pit &Process Plant Infrastructure					
Initial Capital Cost Estimate					
	Wk – Capex Mining & Processing Plant	**Qty**	**Units**	**Rate**	**Ramula Op**
	Item Description				
1000	Mining, Geology & Open Pit Operations				50, 499, 475
1100	Mining Equipment Hire	1	Sum	503,000	503,000
1200	Geology	1	Sum	447,706	447,706
1300	Open Pit	1	Sum	36,062,315	36,062,315
1400	Wrd, Rom Pad & Prestripping	1	Sum	3,325,880	3,325,880
1500	Haul Rds/Access Rds/Patrol Rds	1	Sum	1,250,000	1,250,000
1600	Tsf, Swm & Rwd	1	Sum	6,932,273	6,932,273
1700	Contractor Establishment And Magazine	1	Sum	197,542	197,542
1800	General Bulk Earthworks	1	Sum	1,780,759	1,780,759
2000	Mine Infrastructures				3,935,000
2100	General Infrastructure & Facilities	1	Sum	1,855,000	1,855,000
2200	Mine Buildings	1	Sum	620,000	620,000
2300	Bulk Water	1	Sum	1,460,000	1,460,000

West Kenya Concept – Ramula Open Pit &Process Plant Infrastructure					
Initial Capital Cost Estimate					
	Wk – Capex Mining & Processing Plant	**Qty**	**Units**	**Rate**	**Ramula Op**
	Item Description				
3000	Processing Plant				32,500,697
3100	Feed Preparation (Rom Feed, Crushing, Conveyor & Screening Circuit)	1	Sum	4, 257,542	4, 257,542
3200	Grinding, Screen, Gravity Concentrator & Preleach Thickener	1	Sum	7,983,856	7,983,856
3300	Leaching, Adsorption & Reagent Mixing Facility	1	Sum	6,764,409	6,764,409
3400	Desorption, Regn Kiln & Smelting 4	1	Sum	4,214,800	,214,800
3500	Plant Services	1	Sum	1,751,689	1,751,689
3600	Plant Building & Infrastructure	1	Sum	780,000	780,000
3700	Plant E, C & I	1	Sum	2,844,000	2,844,000
3800	Plant Start Up Consumables	1	Sum	2,584,401	2,584,401
3900	Pre-Production Operating Costs	1	Sum	450,000	1,320,000
4000	**Electrical And Power Generation**				**3,365,037**
4100	Bulk Power Infrastructure	1	Sum	240,000	90,000
4200	Bulk Power Equipment	1	Sum	3,563,037	3,563,037
5000	Resettlement & Road Relocation				27,266,000
5100	Road Relocation	1	Sum	6,450,000	6,450,000
5200	Resettlement & Property Acquisition	1	Sum	20,816,000	20,816,000
6000	**Environment, Health, Safety and ERT**				**502,500**
6100	Solid Waste Management	1	Sum	60,000	60,000
6200	Oil Separator and Incinerator	1	Sum	280,500	280,500
6300	ERT Equipment	1	Sum	162,000	162,000
7000	**IT and Security**				**1,180,000**
7100	IT & Communication	1	Sum	200,000	200,000
7200	Radio Communication System	1	Sum	250,000	250,000

West Kenya Concept – Ramula Open Pit &Process Plant Infrastructure					
Initial Capital Cost Estimate					
	Wk – Capex Mining & Processing Plant	**Qty**	**Units**	**Rate**	**Ramula Op**
	Item Description				
7300	Security And Access Control	1	Sum	730,000	730,000
8000	**Admin, Equipment &Support Service**				**10,688,00**
8100	Construction Equipment	1	Sum	3,005,000	3,005,000
8200	Consultancy Services and Labor	1	Sum	7,683,000	7,683,000
9000	**Contingency**				**6,511,235**
9100	Contingency	5%	Sum		6,511,235
	Total Capex_ Mining & Processing Plant				**136, 735,944**

Next steps for the Ramula- Mwibona capital cost estimate include:

- Developing the capital cost model to AACE Level 2 or 3 classification including labour, equipment, and commodity details;
- Updating costing with PFS/FS engineering work deliverables including various cost-benefit trade-offs;
- Receiving various Vendor Quotations for major equipment purchases; and
- Updating Kenya rate assumptions including power, labour, and import.

2.6.1. Ramula Operating Cost Estimate

The life of mine average operating costs are summarised in Table 2-7. The average operating cost of $87/t ($48M/year) includes $37/t mining, $20/t processing, $14/t mine admin and support services, and $15/t selling and royalty.

Table 2-7: Ramula Operating Cost Estimate

Item	Ramula
Production Rate	1500 tpd
Initial Capital Period	3 years
Production Period	5.5 - 6 years
Gold Sold	305 – 330koz
Initial Capex (Pre-Production)	$100M - $137M
Sustaining Capex	$19M - $24M (~$4M/yr)

Average Total Opex ($/t)	$87/t (~$48M/yr)
- Mining	$38/t
- Processing	$20/t
- Admin	$14/t
- Selling & Royalties	$15/t

The general operating cost assumptions include:

- Mining: Average $3.60/t Contractor mining rate sourced from Singida Contractor rates;
- Processing: Benchmarked to New Luika 2500tpd @ $19/t and Singida 1000tpd @ $25/t;
- Admin: Benchmarked to New Luika $11M/year ($12/t) and Singida $3.5M/year ($10/t) with additional assumption of higher marginal cost profile in Kenya vs Tanzania; and
- Selling and Royalty: Selling Expenses 0.5%, Kenya Government Royalties 3%, WK NSR 2%, Community Development Agreement 1%.

Next steps for the Ramula-Mwibona Project capital cost estimate include:

- Developing the mining and processing operating cost models with detailed cost drivers based on physicals, power, labour and other rates;
- Developing the admin operating cost model with detailed headcounts and budget summaries by support area;
- Confirming selling and royalty rates; and
- Updating cost metrics with Kenya specific rates including labour, power, and commodities.

2.7. Land Acquisition Requirements

In Kenya, various legal and established methods for acquiring land exist. Recognized approaches to land ownership include gifting, nomination, purchase, succession-inheritance, adverse possession, surrender, compulsory acquisition (by the government only), land allocation, land allotment, and land adjudication. Almost all the land parcels that will be acquired by Shanta will be Private Land under Freehold Tenure. Leasehold land parcels may be encountered at markets or trading centres that are within the Project footprint. It is also expected that Public Land will also be encountered (Public Institutions like Schools, Hospitals, and other Government Agencies).

Land acquisition for the Project will primarily be the purchase from private landowners. Public land will be acquired through the procedures outlined in Land Act, 2012 (Act No.6 of 2012) (Revised 2019). The land acquisition process will be a voluntary, transparent and a negotiated process.

Land acquisition, compensation and resettlement issues associated with the Project will be addressed under the guidance of the laws governing land in Kenya, The international standards, rules, and guidelines (IFC PS5 on Land Acquisition and Involuntary Resettlement). Land acquisition and involuntary resettlement will be avoided where possible, minimised and mitigated, and will be carried out in accordance with forementioned guidelines. An RPF has been developed as a reference guide the development of the Resettlement Action Plan (RAP) which will used in managing land acquisition issues and addressing the involuntary resettlement and displacement of people and loss of land, assets, and cultural properties. The Resettlement Process as guided under the Kenyan legislation is as follows:

- Inception/Preparation;
- Field Activities/Survey/Preparation of RAP;
- Implementation of RAP; and
- Post Implementation

Based on the initial phase as part of the resettlement planning, field Survey were undertaken this included:

- Survey of the affected land parcels and subdivisions;
- Census Survey of property owners and administration of socioeconomic questionnaires;
- Asset Inventory of the properties (structures, trees, perennial crops and cultural properties);
- Assessment of business (Income losses);
- Assessment of Artisanal and Small-Scale Miners (ASMs) turnover and income;
- Data Evaluation and Preparation of RAP report;
- Disclosure of Proposed Compensation Packages Project Affected Persons (PAP) at the Household/Individual Level;
- Validation of Land Assets Ownership by SGKL;
- Constitution of the Implementation Committees; and
- Issuance of Notification for Acquisition of Land.

2.7.1. Summary of the RAP progress

The field surveys started in May 2024 and, approximately 60% of the scope has been completed. The Project Affected Households (PAHs) were consulted individually at their household level during the census and asset valuations. Survey questionnaires were administered to collect personal and livelihood information including their perceptions, hopes, fears, and concerns about the proposed project. The census survey was conducted between May and September 2024 alongside the Asset Inventory.

2.7.1.1. Census and Socio-Economic Survey

The census and socio-economic surveys were conducted by a multidisciplinary team comprising sociologists, surveyors, valuers, and enumerators under the direction of the Team Leader. The survey team employed the following methods as part of the census and socio-economic survey:

- Semi-structured questionnaires;
- Focus Group Discussions;
- Key Informant Interviews, and
- Field observation

Since the RAP process is currently ongoing and relevant land acquisition processes are yet to completed, the summary provided gives context. Once the RAP document is finalised it will be circulated to all relevant stakeholders.

2.7.1.2. Host Sites Analysis

An evaluation of the availability and proximity of land that could be used to resettle any displaced persons during the implementation of Gold Mining activities in Ramula-Mwibona area of Siaya and Vihiga Counties has been carried out.

The proposed Project will lead to the displacement of PAPs who will lose their ancestral agricultural land. Although it is expected that many of the households will opt for cash compensation and will elect to self-resettle, there must be allowance made for those who choose to be resettled in one or more host sites located near the project site. The following aspects were observed:

- A total of 18 Host Sites were evaluated and found to have land parcels that could be acquired for the resettlement of displaced persons from the project footprint.. The majority of the land parcels are privately owned. Land adjudication has been done, however, there are land parcels still in the names of deceased persons meaning that succession will need to be carried out.
- The estimated size of land in Ramula that is going to be acquired for the project is approximately 969.01 acres (Assessed – 635.34 acres and Unassessed – 333.67 acres) Mwibona covers 185.46 acres. This gives a total of approximately. 1,154.47 acres for the Ramula-Mwibona project footprint.
- The estimated land availability for each Host Site varies between approx.40% to 70%. The total estimated land availability for the 18 Host Sites is 3,147.9 acres. Due to the possibility that some of the landowners may not be willing to sell their land parcels and Some of the land parcels may have unresolved issues, the Land Uptake has been estimated at approx. 60%, This results in approximately. 1,888.7 acres of land are available for resettlement against a demand of 1,154.47 acres. This suggests that there is approx. 61% more land available for the exercise.

3. Policy and Legislative Framework

The activities associated with planning, pre-construction preparations, construction, and operation and decommissioning of the Project are governed by a range of Acts and regulations, with the aim of protecting the environment and communities' proximity to the Project.

SGKL is committed to undertake all Project activities in full compliance with Kenya's legislation and any obligations under local compliance and adherence to relevant international standards and best practices.

This Chapter highlights the relevant policy and legislative frameworks including environmental specific guidelines relevant to the Project and directly/indirectly relevant to the Project.

3.1.1. Relevant Policies

The EIA studies need to take cognisance of the requirements of all relevant policies pertaining to the mining sector. Whilst the list below is not exhaustive, it provides policies that are pertinent to the environmental management of mining related projects. The listed below policies will be reviewed during the detailed EIA to observe their relevance to the Project.

Apart from the national environmental policy, there are several sectoral policies that consider EIA as one of the planning tools for facilitating and promoting sustainable development. They provide directives on the management of the Project to ensure minimum impacts on the natural resources and sensitive ecosystems. Some of the key policies relevant to this Project have been briefly described in Table 3-1.

3.2. Principal Legislation and Regulations

The Constitution of Kenya of 2010 has taken onboard various issues that are related to environmental management. Article 42 of the Bill of Rights contained in the Constitution provides that 'every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures.

Chapter 5 of the Constitution is dedicated to land and the environment. The constitution requires that land be used and managed in a manner that is equitable, efficient, productive, and sustainable. Part 2 of Chapter 5 of the constitution is dedicated to Environment and Natural Resources. Article 69 in Part 2 provides that the state shall provide encourages efforts towards sustainable of natural resources, increasing of the national forest cover public participation in the management, protection and conservation of the environment, protection of genetic resources and biodiversity, environmental impact assessment, environmental audit, and monitoring of the environment, etc. The proposed Project should ensure compliance with the constitutional requirements in as far as equitable.

Environmental Management and Coordination Act, 1999 (Act No. 8 of 1999) (Kenya, amended in 2015) (EMCA) and its subsequent regulations and guidelines) provide the legal and institutional framework for sustainable management of the environment in implementation of the National Environment Policy. The Act outlines principles for environmental management such as the precautionary principle; the polluter pays principle; and the principle of public participation in development policies, plans and processes for the management of the environment.

The Act also provides for impact and risk assessments, prevention and control of pollution, waste management, environmental quality standards, public participation, as well as compliance and enforcement.

Mining Act, 2016: is the principal legislation governing all mining projects. Whilst guidelines are set through the Act itself and the associated regulations, it also recognises the role played by other bodies that are affected by mining activities, in one way or another.

The Mining Act applies to minerals that are specified in the Act and these have been classified into various groups including construction and industrial minerals, precious stones, precious metals, semi-precious stones, bases and rare metals, fuel minerals and gaseous minerals.

3.2.1. Relevant Legislation and Regulations

Furthermore, in accordance with the Mining Act, 2016 and its associated environmental regulations, EIA studies are mandatory to all projects applying for mining or special mining licenses. The EMCA, also requires all mining projects to conduct an EIA prior to commencement of any operations. There are other legislative instruments that are relevant to a mining project and which this Project will have to adhere to, including but not limited to those provided in International Guidelines and Standards.

3.2.2. Relevant International Standards

Kenya is also a signatory to various multilateral agreements and international conventions in terms of environmental assessment and management which have been described in Table 3-3.

Table 3-1: Relevant Policies and National Strategies for the Ramula- Mwibona Project

Policy Framework	Description
The Land Policy (2007)	The Land Policy in Kenya is guided by the environmental management principles which are aimed at restoring the environmental integrity through introduction of incentives and encouragement of use of technology and scientific methods for soil conservation, among others. The policy further requires fragile ecosystems to be managed and protected by developing a comprehensive land use policy bearing in mind the needs of the surrounding communities. The policy also requires zoning of catchment areas to protect them from degradation and establishment of participatory mechanisms for sustainable management of fragile ecosystems. The policy also called for development of procedures for co-management and rehabilitation of forest resources while recognizing traditional management systems and sharing of benefits with contiguous communities and individuals. Lastly, all national parks, game reserves, islands, front row beaches and all areas hosting fragile biodiversity are declared as fragile ecosystems under the policy.
The National Biodiversity Strategy of 2000	The National Biodiversity Strategy and Action Plan (NBSAP) was formulated in order to enable Kenya address national and international commitments defined in Article 6 of the Convention on Biological Diversity (CBD). The strategy is a national framework of action for ensuring that the present rate of biodiversity loss is reversed, and present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya's biodiversity; to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation. The proposed Project will need to comply with the requirements of this strategy since the Project may lead to loss of biodiversity in some sections along the proposed route.

Policy Framework	Description
Wildlife Policy of 2011	The wildlife policy is aimed at promoting protection and conservation of wildlife in Kenya, both in protected and non-protected areas. The policy is implemented by the Kenya Wildlife Service (KWS). The proposed Project will need to be consistent with this policy. Where wild animals will be disturbed during the construction and operation of the highway, appropriate mitigation measures must be implemented to minimize disturbance to wildlife.
Environment and Development (Sessional Paper No. 6 of 1999)	The Kenya's policy paper on the Environment and Development was formulated in 1999. The policy defined approaches that will be pursued by the Government in mainstreaming environment into development. The policy harmonized environmental and developmental objectives with the broad goal of achieving sustainable development. The policy paper also provided guidelines and strategies for government action regarding environment and development. With regard to wildlife, the policy reemphasized government's commitment towards involving local communities and other stakeholders in wildlife conservation and management, as well as developing mechanisms that allow them to benefit from the natural resources occurring in their areas.
National Environmental Action Plan (NEAP) of 1994	The National Environment Action Plan (NEAP) for Kenya was formulated in 1994 through a consultative process involving various stakeholders. The action plan was aimed at integrating environmental considerations into the country's socio- economic development. The integration process was to be realized through development of a comprehensive framework that ensures linkage of environmental management of natural resources to decision-making processes. The NEAP also established the process of identifying environmental problems and issues, awareness raising, building national consensus, defining policies, legislation and institutional needs, and planning environmental projects. An Environmental Action Plan for Arid and Semi-arid Lands (ASAL) and County-specific Environmental Action Plans for 24 ASAL districts were also formulated thus forming part of the building block to the NEAP.

Policy Framework	Description
Physical planning Policy	The current policy governs the development and approval of all building plans as provided for in the Physical Planning Act (Cap 286). The proposed Project will be subjected to the provisions of this policy and legislation.
Public Health Policy of 2014	The public health policy calls upon the Project proponents to ensure that buildings are adequately provided with utilities so that they are fit for human habitation. The workers camps must be provided with all amenities/utilities that are essential for safeguarding public health for all people using the facilities.
HIV/AIDS Policy of 2009	The policy identifies HIV/AIDS as a global crisis that constitutes one of the most formidable challenges to development and social progress. The Pandemic heavily affects the Kenyan economy through loss of skilled and experienced manpower due to deaths, loss of man hours due to prolonged illnesses, absenteeism, reduced performance, increased stress, stigma, discrimination and loss of institutional memories, among others. Due to the large of number of workers who will be involved in the Project and the associated social issues with a project of such as scale, HIV/AIDS has been considered as one of the possible impacts, but adequate mitigation measures have also been proposed to that effect.
Gender Policy of 2011	The purpose of the Gender Policy is to institutionalize the Kenya National Policy on Gender and Development (NPGD), within Gender, Children and Social Development. It articulates the policy approach of gender mainstreaming and empowerment of women at the ministry level. The policy seeks to have a society where women, men, children and persons with disabilities enjoy equal rights, opportunities and a high quality of life.

Table 3-2: Relevant Legislative and Regulatory Framework

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
1.	EMCA, 1999 and the Amendment Act of 2015, Legal Notice No. 31 of April 2019 on the EMCA.	The Act focuses on key environmental aspects, for effective management. ESIA/EA regulations ensures that decision-makers are provided the opportunity to consider any environmental impacts of a project early in the project development process, and assess whether environmental impacts can be avoided, minimized, or mitigated to acceptable levels. Act states that every person in Kenya is entitled to a clean and healthy environment. Part VI Section 58 of the Act guides that any new project, activity, or operation should undergo Environmental Impact Assessment (EIA) and a report prepared for submission to the National Environment Management Authority (NEMA) for review, who shall issue licenses as appropriate with specific conditions of approval to be adhered to during project implementation. It is required that an EIA/EA study in Kenya is undertaken by a firm duly licensed by NEMA.	The Proposed project is expected to: Ensure all activities are carried out in an environmentally friendly manner throughout the design, construction, and operation phases of projects. Comply with EIA requirements during implementation of infrastructure investments and subsequently undertake environmental and social audit(s) and monitoring to safeguard and enhance the environment and to ensure a clean and healthy environment for all. The proposed project has contracted KTL a licensed firm of experts to conduct the ESIA study.
2	EMCA (Impact Assessment and Audit, 2003) and the Amendment Regulations, 2019	The Regulations provide guidelines for conducting EIA and audits and provide guidelines to the proponent undertaking a project specified in the Second Schedule of the EMCA. For a low-risk project, a Summary Project Report is to be prepared and submitted to NEMA. A Comprehensive Project Report is to be prepared for a Medium Risk Project,	The Proposed project is categorized as High-Risk Project (6) category of Mining Activities. Therefore, it will require a full Environmental Impact Assessments (EIA) before commencement.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		Full Environmental Impact Assessment Study culminating in a Study Report is to be prepared for High-Risk projects with significant adverse environmental impacts.	
3.	EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006	The Regulations make provision for conservation of biological diversity including conservation of threatened species, record keeping of biological diversity and access procedures to genetic resources.	The project activities shall promote the conservation of biological diversity and cause no harm to ecosystems. An EIA license shall also be sought for any Project activity that could potentially impact on ecosystems.
4.	EMCA, 1999 and the Amendment Act of 2015, (Waste Management) Regulations,2006	The regulations cover the management of all categories of waste including Solid waste, Industrial waste, hazardous waste, toxic substances and waste, biomedical waste, and radio-active substances. The Regulations vest responsibilities of waste management to the generator who shall use cleaner production methods to minimize the waste generated segregate and dispose the waste generated in an approved manner. The Regulations also provide that the waste transporter shall be licensed.	The project proponent shall ensure that the waste generated during the construction phase shall be disposed of in accordance with the regulations. NEMA licensed waste handlers will be engaged to manage waste generated from all project sites.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		The regulation contains definition of hazardous wastes in the fourth schedule, it requires that prior to generating hazardous waste, a developer shall undertake an EIA study and seek approval from NEMA.	
5.	EMCA (Water Quality) Regulations, 2006.	The regulations prohibit the discharge of any pollutants into the aquatic environment unless the discharge meets the standards specified in the Regulations. The regulations provide that anyone who discharges effluent into the environment or public sewer shall be required to apply for Effluent Discharge License.	During the construction and operation phase, the project proponent shall ensure that there are no discharges to the environment to avoid any form of pollution, including water pollution.
6.	EMCA (Noise and Excessive Vibrations Pollution) (Control) Regulations, 2009.	Part II Section 3 of the Regulations prohibit making of any loud, unreasonable, unnecessary, or unusual noise which annoys, disturbs, injures, or endangers the comfort, health or safety of others and the environment. The regulations require a permit/license to be obtained from NEMA for any activities that emit noise or excessive vibrations beyond the permissible levels. Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub-regulation 2 of this regulation, no person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident. Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to	The Contractors associated with the proposed Ramula-Mwibona Gold Mine will be required to ensure compliance with these regulations to promote a healthy and safe working environment throughout the construction and operation phase. This shall include regular inspection and maintenance of equipment to reduce noise and vibration, prohibition of unnecessary noise emitted from construction equipment and project heavy and light vehicles, and adherence to the noise levels stipulated for day and night in these Regulations.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations.	
7.	EMCA (Air Quality) Regulations, 2014.	The Regulations provide for prevention, control, and abatement of air pollution to ensure clean and healthy ambient air to protect human health. The regulations apply to specific priority air pollutants, mobile and stationary sources as well as stipulated emission standards. Allows NEMA to consider the use of other internationally recognized emission standards in relation to air pollutant/source where there are no local emission standards, targets or guidelines set out in the Regulations.	The emissions likely to result from mining activities (such as dust and exhaust emissions from running vehicles and equipment engines) and particulate matter have the potential of polluting the immediate environment. Bush clearing, earthworks and bulk delivery of construction material, if unmanaged may result in generation of dust. Thus, the need for strict adherence to these Regulations and standards therein in preventing and monitoring possible pollutants and managing sources.
8.	EMCA (Controlled Substances) Regulation,2007	The regulations aim at regulating the production, trade and use of controlled substances and products. It requires compliance with the relevant reporting requirements under the Montreal protocol on substances that deplete the ozone layer and promote use of ozone friendly substances, products, equipment and technology. Any importer of Ozone Depleting Substances is required under these regulations to obtain an import license.	The project proponent shall comply with the provisions of these regulations.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
9.	EMCA (Wetlands, Riverbanks, Lake Shores and Sea Shores Management) Regulations 2009	The regulation makes provision for the sustainable use of wetlands to be included in the national and local land use plans to ensure sustainable use and management of the resources. EIA is mandatory for all activities likely to have adverse impact on the management of wetlands.	If water will be drawn from local sources like River Yala, it must be used in a sustainable manner, aligning with the regulations' emphasis on responsible resource utilization.
10.	Forest Conservation and Management Act, 2016	The Act makes provision for the conservation and management of public, community and private forests and areas of forest land that require special protection, defines the rights in forests and prescribes rules for the use of forest land. It makes provision for community participation of forest lands by community forest association, the trade in forest products, the protection of indigenous forests and the protection of water resources.	All proposed Project activities that will potentially have impacts on forests shall be carried out in line with the requirements of this Act. There will be need to clearly state mitigate measures where project activities will result in clearance of tree covers during construction of the plant and mining.
11.	The Wildlife Conservation and Management Act, 2013	This is the main law that governs the management of wildlife including their habitats such as national parks, national reserves and local sanctuaries. Part XI of this Act lists the offenses in national parks which includes among others pollution of wildlife habitats and ecosystems; and damage of any object of geological, prehistoric, archaeological, historic, and marine or other scientific interest within a National Park.	The project proponent will need to clearly state their adherence to the provisions of the law.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
12.	Wildlife Conservation and Management (Activities in Protected Areas) Regulations, 2015 (DRAFT)	These regulations provide guidance on the conduct of any activities within a protected area. Regulation 5(d) of these regulations indicate that in management of the activities in protected areas, the Service or the owner in the case of a conservancy or sanctuary, shall regulate the acceptable mode of transport in each protected area and post any restriction at all entry points. Regulation 7(1)(s) indicates that, except with the special permission of the Kenya Wildlife Service (KWS), no person shall, in the case of a state-protected area, clear any bushes, make road works, paths in the protected area.	The project proponent will need to clearly state their adherence to the provisions of the law
13.	Wildlife Conservation and Management (Protection of Endangered and Threatened Ecosystems, Habitats and Species) Regulations, 2016 (DRAFT)	The overall objective of these regulations is to ensure protection of endangered and threatened ecosystems, habitats and species which are published in the national Gazette in accordance with section 46 of the Wildlife Act. Regulation 9(1) outlines restricted activities regarding the listed species, which include among others conveying, moving or otherwise trans locating any specimen of a listed species. Any regulated activities can only be carried out pursuant to permit issued in accordance with the Wildlife Act and these regulations.	A comprehensive biodiversity study of the proposed project will be undertaken, and if any endangered or threatened species are identified, then suitable management measures will need to be put in place. These measures will need to be in accordance with the requirements of these Regulations.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
14.	Wildlife Conservation and Management (Protected Wetlands) Regulations, 2016 (DRAFT)	The aim of these regulations is to ensure appropriate management of protected wetlands in Kenya whether in public, community or private land. Regulation 6(2) states that "Neither the national government, county governments or communities shall lease or otherwise alienate any protected wetland." Regulation 6(3) further states that "The Polluter Pays Principle shall be strictly applied in regard to payment of compensation for pollution of protected wetland areas." Regulation 9 lists the activities restricted in wetlands, which include among others any form of alteration, interference or modification of wetlands. The conduct of such activities requires a permit. Regulation 10 lists prohibited activities in protected wetlands which include among others dredging, unless the wetland is only impacted by siltation.	These regulations are applicable to any protected wetlands that shall be identified in the project area.
15.	Public Health Act, Chapter 242	The Act provides for protection of public health through prevention and guarding against introduction of infectious diseases; the promotion of public health; the prevention, limitation, or suppression of infectious, communicable, or preventable diseases; and engaging local authorities.	During the Construction and Operation phase the project shall require establishment of camps and facilities that would require to comply with the Act. Construction activities shall be undertaken in a manner that promotes public health, safety, and hygiene. In addition, all generated waste will be managed in a manner that they do not cause nuisance to the public.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
16.	Occupational Safety and Health Act (OSHA), 2007	The Act promotes Safety, Health, and Welfare of all workers at the workplace, preventing work related injuries and sickness, protecting third party individuals from being pre-disposed to higher risk of injury and sickness associated with activities of people at workplaces. The Act establishes codes of practices to be approved and issued by the Directorate of Occupational Safety and Health Services (DOSHS) for practical guidance of the various provisions of the Act. PART V of the Act requires all workplaces to be registered with DOSHS. PART X of the Act contains provisions for the General welfare conditions that must be present during the construction phase of the project. Which include first aid facilities, supply of drinking water, accommodation for clothing and ergonomics at the project offices and campsites. PART XI of the Act contains special provisions on the management of health, safety and welfare, which include work permit systems, PPE requirements and medical surveillance.	The contractor during the construction and operation phase of the proposed project shall adhere to the Act provisions as related to project sites and safeguarding the safety, health, and welfare of all workers. These include provision of personal protective clothing, clean water, registration of workplaces, and insurance cover, to protect all workers from work related injuries and/or other health hazards. The project contractor will be required to comply with the requirements of this Act through obtaining relevant work site permits and licenses, train workers on OHS, inspect equipment to ensure they are in good working conditions, among other measures. During the construction phase the contractor will be required to fully comply with the requirements of Legal No. 40: Building Operations and Works of Engineering Construction Rules,1984 (BOWEC).

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
			The contract will incorporate minimum OHS requirements in Bid Documents to be met by all the contractors. Regular supervision and inspection of infrastructure shall be carried out during construction and operation phases to ensure safety.
17.	The Factories and Other Places of Work (Noise Prevention and Control) Rules L.N.24, 2005	The rules give provisions for the permissible noise level, guidelines to develop and implement an effective noise control and hearing conservation program, noise control measures, related information sharing and training of workers, maintenance of the noise measuring equipment, recommended provisions for installation and maintenance of machinery or plant, provision and maintenance of hearing protection to the affected workers, medical examinations and hearing tests for workers, selection and use of hearing protection.	Construction and operation activities are likely to generate noise. As a subsidiary legislation under the OSHA, 2007, the rules shall be referred to in the project to ensure noise prevention and control measures are adhered to. The safety, health and welfare of all the workers associated with the proposed Expressway will need to be assured in line with all the provisions of this Act throughout the Project lifecycle (construction and operational phases).
18.	The Factories and Other Places of Work (Hazardous	The rules provide guidance on exposure limits to hazardous substances, provision of personal protective equipment for air bone and other hazardous substances exposure and recommended working in hazardous conditions.	Project activities may include handling of hazardous substance as a subsidiary legislation under the OSHA, 2007, the rules shall be referred to in the project to

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
	substances) Rules, 2007		ensure hazardous substances exposure guidelines are adhered to.
19.	The Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007	The rules promote adherence to fire safety measures at every workplace, process, and operations. The rules provide guidance with reference to the location of large installations for highly flammable substances, use of fire-resistant construction material, the storage, marking and labelling of highly flammable substances, waste disposal, installation, and handling of electrical equipment, evacuation procedures, fire safety, fire detection systems, firefighting appliances and fire safety audits.	As a subsidiary legislation under the OSHA, 2007, the proposed project shall observe adherence to the rules by facilitating the reduction of potential fire risks.
20.	The Factories and Other Places of Work (Safety and Health Committees) Rules, 2007	These Rules shall apply to all factories and other workplaces, which regularly employ twenty or more employees. The occupier of every factory or other workplace to which these Rules apply shall establish a Safety and Health Committee in the manner provided in the Rules.	The proposed project activities may require establishing of work teams with more than 20 workers therefore as a subsidiary legislation under the OSHA, 2007, the proposed projects shall observe adherence to the rules by facilitating the formation of Safety and Health Committees, as applicable.
21.	The Work Injury Benefits Act (2007)	The Act applies to all employees including those employed by the Government, other than the armed forces, in the same way, and to the same extent as if it was a private employer.	The contractors and sub-contractors will require to obtain and maintain work injury benefit insurances for all their employees. Further, appliances and services must be availed and maintained for rendering first

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		An employee who is involved in an accident resulting in the employee's disablement or death is subject to the provisions of this Act and entitled to the benefits provided under this Act.	aid in the event of occurrence of accidents during implementation of the project.
22.	The County Government Act (No 17), 2012	The Act is established to give effect to the objects and principles of devolution as set out in Articles 174 and 175 of the Constitution. Part XI of the Act empowers County Governments to oversee planning of development projects by coordinating and ensuring integrated planning including coordinating the public participation and environmental protection. The Counties are required to facilitate the development of a well-balanced system of settlements and ensure productive use of scarce land, water and other resources for economic, social, ecological and other functions across a county.	The county governments will be responsible for the issuance of the relevant trade licenses, temporary facilities construction approvals, monitoring environment protection within the county and general development.
23.	National Museums and Heritage Act No. 6 of 2006, (Revised 2012)	The Chance Finds Procedures define requirements for the management of archaeological, paleontological, and other cultural deposits, finds and features, encountered during construction and development activities within Kenya.	Vegetation clearing and civil work might uncover cultural sites which can only be removed by the appropriate governmental structures and consultation with the traditional authorities. The Proposed project shall apply the Chance Finds Procedures where finds and features are encountered during construction.
24.	Protection of Traditional	The Act of parliament provides a guideline for the protection and promotion of traditional knowledge and cultural expressions.	The proposed project is likely to be implemented in areas of cultural

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
	Knowledge and Cultural Expressions Act, 2016	Section 3 requires every person dealing with matters relating to traditional knowledge or cultural expressions to be guided by the national values and principles of governance set out in Article 10 of the Constitution.	importance, and it will observe the requirements of this Act to protect and promote traditional knowledge and cultural expressions.
25.	National Land Use Policy, 2017	The policy identifies the critical land areas for reform in Kenya, presents a set of proposals for administrative reforms and legislative action for desired land reforms. The policy addresses critical issues including land tenure and decentralization of administrative structures and public engagement in decision making.	The Policy aligns well with the ESF requirements for environmental and social sustainability and climate change adaptation. The proposed project shall be carried out within the provisions of the physical planning and environmental management laws that operationalize the National Land Use Policy.
26.	Land Act, 2012 (Revised 2019)	The Act prescribes the statutory processes for acquiring land and creation of public rights of way. **Land Tenure:** The Act applies to all land declared as (a) public land under Article 62 of the Constitution; (b) private land under Article 64 of the Constitution; and (c) community land under Article 63 of the Constitution and any other written law relating to community land. **Compensation:** The Act provides for the payment of full, prompt and just compensation to all persons whose interests in the land have been determined.	It is anticipated that there will be the acquisition of land and the subsequent destruction of crops, trees, and other assets. Therefore, the provisions of the Land Act will be applied together with the Land Acquisition Act, 2010 on compensation for land. The Land Act further recognizes and compensates occupants in good faith and establishes measures to determine their eligibility and assess compensation payable to them.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		Right of Way (ROW): Section 143 and 146 provides for the creation of a public rights of way (ROW) or wayleave by the National Land Commission (NLC). Section 148(6) mandates NLC to make Regulations prescribing the criteria to be applied in the payment of compensation relating to acquisition of land for wayleave or communal right of way. **Occupants in Good Faith:** The Constitution, the Land Act and the Land value. The Amendment Act require compensation to be made to occupants in good faith of land compulsorily acquired who may not hold title to the land. **Unlawful occupiers of land:** Squatters are not considered occupants in good faith and are thus not entitled to any form of compensation under the national law when acquiring land compulsorily. The Act establishes the legal process to be followed in evicting unlawful occupiers. Encroachers/squatters are one of the beneficiaries of settlement programs. Dispute Resolution: The Act outlines procedures for consultations with affected population by NLC and grievance management procedures. Section 128 also provides for referral of any dispute arising out of any matter provided for under the Land Act may be referred to the Land and Environment Court for determination	
27.	Land Value Amendment Act 2019	The Act amended various sections of the Land Act, the Land Registration Act as well as the Prevention, Protection and Assistance to Internally Displaced Persons and Affected Communities Act. The Act aims at standardizing the	Compensation for affected land/rights of way and other assets will be in accordance with this Act, especially in assessing compensation using the criteria prescribed under the Act, and

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		value of land in Kenya for the primary purpose of enhancing efficiency and expediting the compulsory land acquisition process. The Act: Provides for assessing land value index regarding the compulsory acquisition of land; Highlights “just' compensation” in relation to compulsorily acquired land or creation of wayleaves, easements and public rights, to mean a form of fair compensation that is assessed and determined through criteria set out under the Act; Outlines various forms of compensation for land that is acquired compulsorily. They include monetary payment, alternative land, government bonds, equity shares in a government-owned entity, grant or transfer of development rights, and any other lawful compensation. Stipulates that compensation to be made to occupants in good faith of land compulsorily acquired who may not hold title to the land.	diverse modes of compensation available to affected persons.
28.	Land Assessment of Just Compensation Rules, 2017	Outlines the rules of National Land Commission to implement provisions of the Land Registration Act in respect of the amount of compensation to be awarded for land acquired under the Act. The Rules further set out factors to be considered when assessing compensation and provides that National Land Commission shall determine an award based on the market value of the land to be acquired.	The assessment of compensation for land and other assets affected by the proposed project shall be based on the provisions of these Rules.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
29.	Community Land Act, 2016	The Act provides guidance for the ownership and tenure system; the protection of community land rights; the role of county governments; the procedure for registration of communities, recognition, and adjudication of community land; registration of community land; functions and powers of the community land management committee; and use and development planning of community land. The Act also provides guidance on transaction over community land and how unregistered community land may be acquired, which is mainly through either compulsory acquisition or through conversion. The Act mandates county governments to hold community land in trust for the concerned communities, until such a time that the community has been registered. It however prohibits the county government from transacting on, or otherwise disposing of community land. The Act further provides for compensation of compulsorily acquired community land to be deposited in an interest-bearing account held by the county government until such a time that the community has been registered, after which the compensation amount, together with interest earned, is transferred to the community account.	The Act will be applicable to the proposed project if it is being implemented in areas with unregistered community lands. The provisions of this Act shall be considered together with the provisions of the Land Act 2012 (as amended in 2019), and other relevant legislation, if some of the proposed Project activities requiring land will be implemented in the areas of Kenya in which this Act applies. All affected community land (registered or un-registered) will be compensated in accordance with the provisions of the Community Land Act 2016.
30.	The Land Laws (amendment) Act, 2016	An Act of Parliament to amend the laws relating to land to align them with the Constitution, to give effect to Articles 68(c)(i) and 67(2)(e) of the Constitution, to provide for procedures on evictions from land, and for connected purposes.	The Proposed project will align to the amendments in the Act, as applicable.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
31.	Land Registration Act, 2012	The Act gives provisions to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. The Act applies to, a) registration of interests in all public land as declared by Article 62 of the Constitution; (b) registration of interests in all private land as declared by Article 64 of the Constitution; and (c) registration and recording of community interests in land.	The Proposed project might traverse private land and community land (registered and unregistered). In this case all people whose land is traversed by the project will need to be verified, compensated, and an easement registered in their title deeds.
32.	Valuers Act 2010	This Act provides for the registration of valuers and the regulation of the valuation profession and practice in Kenya. Section 21 of Cap 532 prohibits any person who is not a registered Valuer and whose name does not appear in the register to prepare and submit a valuation report.	The Proposed project shall engage registered valuation experts for the Resettlement Action Plan preparation.
33.	Public Roads and Roads of Access Act (Cap. 399)	Sections 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road. Section 10 and 11 allows for notices to be served on the adjacent landowners seeking permission to construct the respective roads.	During the construction phase of the proposed project, access to the site areas will be required for the construction vehicles. Where existing roads do not exist, the Proponent shall seek permission from the appropriate authorities to create such access during the construction phase.
34.	Kenya Roads Act No. 2 of 2007 (Revised 2012)	Part II provides for the establishment of the Roads Authorities to provide powers and functions of the authorities and for connected purposes.	In engagement with the likely project affected persons and other stakeholders the project Proponent will: i) clearly identify the parcels to be affected by the

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		Section 4 of this Act specifies the function of KeNHA, specifically; Section 4(1) states that "The Highways Authority shall be responsible for the management, development, rehabilitation and maintenance of national roads." Section 29 of this Act further indicates that in exercising the powers, an Authority shall do as little damage as possible, and, where any person suffers damage, no action or suit shall lie against the Authority, but he shall be entitled to such compensation thereof as may be agreed between him and the concerned Authority, or, in default of agreement, as may be determined by an arbitrator appointed by the Chief Justice.	construction of access roads; ii) have notices in accordance with the provisions of the law and iii) seek approval from relevant authorities.
35.	Occupiers Liability Act (Cap. 34)	The rules of Common Law regulate the duty which an occupier of premises owes to his visitors in respect of danger and risk due to the state of the premises or to things omitted or attributes an affliction on his/her health to a toxic material in the premises.	The Proponent shall endeavor to ensure that the management of health and safety issues is of high priority during the construction and operation phase of the Project.
36.	Environment and Land Court Act, 2011	The Act gives effect to Article 162(2)(b) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes. The principal objective of the Act is to enable the Court to facilitate the just, expeditious, proportionate, and accessible resolution of disputes.	The Environment and Land Court, in applicable cases, shall be engaged on disputes relating to the environment, use and occupation. In line with the provisions of the Land Act 2012, where a party is aggrieved by the determination of the Tribunal on the issue of compensation payable or as to the person entitled to receive compensation, the aggrieved party within thirty (30) days of the date of

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
			the notification of such decision, may appeal to the Environment and Land Court to render a decision which will be final and binding.
37.	National Policy for Prevention and Response to Gender Based Violence, 2014	The Policy acknowledges that GBV is a serious global health, human rights, and development issue, and although affecting women, girls, men and boys. Women and girls have however been found to be disproportionately affected. Forms of recognized GBV issues include sexual violence, physical violence, emotional/psychological violence, harmful traditional practices, and socio-economic violence (through discrimination and/or denial of opportunities and services, social exclusion etc).	The proposed project will require the proponent, consultants and contractor to prepare Sexual Exploitation/Sexual Harassment prevention and response management plans for all activities that may involve the influx of labour into the project areas. The proposed project will also support the establishment and/or enhancement of the client's internal GBV (especially SEA/SH) policies and strategies and support their entrenchment at all levels including within project contractors and suppliers, in alignment with this National Policy.
38.	National Policy on Gender and Development, 2019	Aims of the policy include achieving equality of opportunity and outcomes with respect to access to and control of national and county resources and services, and equality of treatment that meets the specific and distinct needs of different categories of women and men. Special focus is however given on the empowerment of women who are currently the marginalized gender.	Compliance with the Policy aims and objectives of ensuring gender equality will be necessary in the proposed project. The contractors, suppliers will require to demonstrate commitment and adherence to the provisions of this policy instrument

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		Policy applies specifically and directly to all Government Ministries, Independent Bodies, Quasi-autonomous entities, and Departments and Agencies both at the national and county levels of government. The principles, strategies and approaches in the policy also apply to the private sector and civil society. The proposed policy actions include inter alia: developing and implementing national guidelines for mainstreaming gender, and standards for measuring compliance to gender mainstreaming in all sectors at all levels; Strengthening capacity of institutions with the responsibility of implementing and monitoring gender-related interventions. Enacting legislation to enhance women participation in economic, social and political spaces in both public and private spheres.	in their operational policies and in employment opportunities.
39.	Labour Relations Act 2012	The Act in Part II Section 6 provides for freedom of employees to associate; Section 7 provides for protection of rights of employees. Part VIII Sections 62-72 provide the mechanisms for trade dispute resolution and empowers an appointed conciliator to resolve the dispute. Where the dispute cannot be resolved Part IX provides for escalation to an Industrial Court. Part X Section 76 provides for protection of the employees' rights to hold strikes and lock outs if the dispute concerns terms and conditions of employment or the recognition of a trade union.	The proposed project shall facilitate the provision of enabling environments for workers to exercise their rights such as joining unions and associations. The contractor shall be sensitized on the provisions of this Act and required to have contracts in place that provides for non-violation of workers labour rights

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
40.	The Employment Act, 2007	The Act prohibits forced labour, direct or indirect discrimination and harassment of employees and potential employees and requires employer to promote equal opportunity in employment and strive to eliminate discrimination in any employment policy or practice.	The contractor shall advocate for equal pay for equal work. Child labour/forced labour will be prohibited in all activities of the project and the project contractor will be required to prepare labour management plans (LMPs) and entrench such requirements in all its operations regardless of source of financing for client infrastructure projects.
41.	Labour Institutions Act, 2007	The Act establishes the Wage Council whose functions include, inter alia, investigating the remuneration and conditions of employment in any sector, and recommending minimum wage remuneration and conditions of employment. The Act in Section 46 also provides for the publication of a Wage Order setting the minimum rates for remuneration among other work-related provisions, to be adhered to in employment of workers	The goods and services providers and employees shall be sensitized to the provisions of this Act to ensure compliance with its requirements. Employers will be required to adhere to the published Wage Orders that dictate the minimum rates for remuneration, among other provisions
42.	Persons with Disability Act, 2003	Part III Section 12 of the Act establishes the rights and privileges of PWDs including the access to opportunities for suitable employment, equal treatment, compensation privileges, benefits, fringe benefits, incentives or allowances as qualified able-bodied employees.	The proposed project shall facilitate inclusive mechanisms for PWDs such as access to adequate and quality water supply and sanitation services, PWD-friendly facilities, employment

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
			opportunities and public participation forums.
43.	National Gender and Equality Commission Act, 2011	The Act provides precedence for the prevention of discrimination based on sex in the national development process to improve social, legal/civic, economic and cultural conditions of women, men, girls and boys in Kenya.	The proposed project during hiring staff, procurement of suppliers and contracting of sub-consultants/contractors shall integrate gender equality strategies.
44.	Sexual Offences Act, 2009	The Act in Sections 3 – 21 identifies and prohibits sexual offences including rape, assault, indecent acts, defilement, harassment, including offences against minors. The Act in Section 26 also prohibits the deliberate transmission of HIV or any other life threatening sexually transmitted disease. Other prohibited acts include administering a substance with intent (Section 27), and distribution of a substance by juristic person (Section 28)	The proposed project shall establish measures that prohibit and act against sexual offences listed in the Act for staff, contractors and suppliers. The project will put in place mechanisms which are necessary to achieve or promote the objects of this Act, including for instance, a Sexual Exploitation and Abuse Prevention and Response Action Plan.
45.	Child Rights Act, 2012 [2010]	The Act makes provision for parental responsibility, fostering, adoption, custody, maintenance, guardianship, care, and protection of children. It also makes provision for the administration of children's institutions, gives effect to the principles of the Convention on the Rights of the Child and the African Charter on the Rights and Welfare of the Child. Section 15 states that a child shall be protected from sexual exploitation and use in prostitution, inducement, or coercion to engage in any sexual activity, and exposure to obscene materials.	The proposed project shall ensure measures are in place to observe the rights of children as well as avoid forced and child labour.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
46.	Children Act, 2022	The Act provides that No person shall subject a child, to child labour, domestic servitude, economic exploitation or any work or employment which is hazardous, interferes with the child's education or is likely to be harmful to the child's health or physical, mental, moral or social development. Section 22 of the Act provides for protection of children from abuse and Section 24 of the Act also provides for protection from drugs and substance abuse.	The proposed project activities will uphold the provisions of this Act and will comply with provisions of the Act implementation by ensuring that measures are in place to prevent violation of children's rights particularly protection from child labour and any forms of child abuse including SEA-H, drugs and other prohibited substances. No child will be employed under the proposed project as per the Act.
47.	Access to Information Act (No. 31 of 2016)	The Act mandates government agencies to make official information more freely available, to provide for proper access by each person to official information relating to that person, to protect official information to the extent consistent with the public interest.	The proposed project in relation to the Act shall ensure stakeholders have access to timely information on all project activities, including the effects of each project activity. For Vulnerable Marginalized Groups the project shall ensure prior disclosure and dissemination of relevant and easily accessible project information in a timeframe that enables meaningful consultations, in a culturally appropriate format, and in relevant local languages.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
48.	HIV/AIDS Prevention and Control Act, 2006	The Act gives provisions in Part 11, Section 7 that require HIV/AIDs education in workplaces. The government is expected to ensure provision of basic information and instruction on HIV/AIDs prevention and control to employees of all Government Ministries, Departments and Agencies, and employees of private and informal sectors. The information on HIV/AIDs is expected to be treated with confidentiality at the workplace and positive attitudes shown towards infected employees.	Contractors shall offer training on HIV/AIDs awareness, prevention and management to workers and the local community, as provided by law.
49.	Matrimonial Property Act, 2013	Ownership of matrimonial property Part III (clause 7), States that: Subject to section 6(3), ownership of matrimonial property vests in the spouses according to the contribution of either spouse towards its acquisition and shall be divided between the spouses if they divorce or their marriage is otherwise dissolved.	Provisions of the Act shall be considered in the acquisition of land/creation of public rights of way and compensation of matrimonial property affected by the acquisition.
50.	The Water Act (No 43), 2016	The Water Act, 2016, governs the ownership, use, regulation, management and development of water resources, water and sewerage services, and for other connected purposes. The Act vests the ownership of water resources on the people of Kenya, to be held in trust by the National government. The Act also establishes the Water Resources Authority (WRA) to serve as the agent of the National government and regulate the management and use of water resources. Section 134 of the Act makes it an offence to throw or convey or cause or permit to be thrown or conveyed any rubbish, dirt, refuse, effluent trade waste or other offensive or unwholesome matter or thing to water resources in such a manner to cause or likely to cause pollution of the water resources.	Water is significant to the general operation of the proposed project thus project activities can potentially cause water pollution, the best approaches to water resource management, including the protection of water resources and avoidance of pollution to nearby water sources such as rivers and streams shall be considered. Various permits from the Water Services Regulatory Board (WASREB) will be required for the proposed water

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
		The Water Act mandates that a permit is required for any of the following purposes: (a) any use of water from a water resource, except as provided by section 37; (b) the drainage of any swamp or other land; (c) the discharge of a pollutant into any water resource; and (d) any other purpose, to be carried out in or in relation to a water resource, which is prescribed by Regulations made under this Act to be a purpose for which a permit is required.	abstraction methods, whether surface or ground water.
51.	The Mining Act, of 2016	The Mining Act gives effect to Articles 60, 62(1)(f), 66 and 71 of the Constitution of Kenya (2010). Provides for: Prospecting, mining, processing, refining, treatment, transport and any dealings in minerals and related purposes. procedures for licensing for prospecting, mining, processing and any dealings with minerals Ownership of minerals, right of pre-emption, and discovery of minerals; restriction on the acquisition of mineral rights; powers of the Cabinet Secretary with respect to declaration of areas reserved for small-scale operations or tendering, restriction or exclusion of areas from operations, strategic minerals, and access to service, Establishment of the National Mining Corporation; National Mining Corporation Regulations, Establishment of a Minerals and Metal Commodity Exchange, access to geosciences information, Establishment of Mineral Rights Board and its functions of the Mineral Rights Board. http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/MiningAct_No12of2016.pdf	The proponent applied and paid for the mineral prospecting license in 2022 which is valid until 2025. The proponent will need to periodically update the Cabinet Secretary and consult to ensure compliance with the law as well as changing government policies.

S/N	Policy/ Legislations /Guidelines	Provisions as Written	Applicability to the Proposed Project
52.	The Explosives Act Cap.115	Obliges proponents to seek a blast permit, guided by state department of mining experts to allow purchasing, transportation and storage of the explosives. Specifies conditions for the use of explosives and outlines precautionary measures and storage requirements. Considers any explosion causing endangerment to life or property as an offense and imposes penalties for such offenses. Obliges the undertaking of precautionary measures, such as fencing blasting sites to prevent movement and injury to animals and people.	The proponent shall seek a blast permit which will allow purchasing, transportation and storage of explosives as guided by the experts from the state department of mining. All precautionary measures will be undertaken such as fencing the blasting sites to prevent movement and injury of animals and people. The geological stability of underground rock shall be assessed (and attached to the ESIA study) as there are homes near the proposed mining site, so there is no risk of damage of properties.
53.	Fisheries Act, Cap 378	Section 59 (Pollution prevention zone) states that for purposes of protecting the aquatic environment and ecology the Kenya fishery waters are hereby declared to be a pollution prevention zone.	The project shall be required to undergo an Environmental Impact Assessment (EIA) to evaluate potential impacts on fishery waters as mandated by the regulations. The proposed project shall not discharge any untreated wastewater into the nearby rivers

Table 3-3: International Agreements and Conventions Ratified.

<table>
<tr><th>International Framework</th><th>Description</th></tr>
<tr><td>International Finance Corporation (IFC) Performance Standards</td><td>
The International Finance Corporation (IFC) provides financing of private-enterprise investment in developing countries around the world, through both loans and direct investments. Affiliated with the World Bank, it also provides advisory services to encourage the development of private enterprise in nations that might be lacking the necessary infrastructure or liquidity for businesses to secure financing.
The Performance Standards (PS) on Environmental and Social Sustainability are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced.
In addition to meeting the requirements under the Performance Standards, clients must comply with applicable national law, including those laws implementing host country obligations under international law.
When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific Project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternative performance level is protective of human health and the environment.
<table>
<tr><th>Performance Standard</th><th>Description</th></tr>
<tr><td>Performance Standard 1: assessment and management of</td><td>Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a Project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management,</td></tr>
</table>
</td></tr>
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International Framework	Description	
	Environmental and Social risks and Impacts	and involves engagement between the client, its workers, local communities directly affected by the Project (the Affected Communities) and, where appropriate, other stakeholders
	Performance Standard 2: Labour and working conditions.	Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental1 rights of workers. For any business, the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. Failure to establish and foster a sound worker-management relationship can undermine worker commitment and retention and can jeopardize a Project. Conversely, through a constructive worker-management relationship, and by treating the workers fairly and providing them with safe and healthy working conditions, clients may create tangible benefits, such as enhancement of the efficiency and productivity of their operations.
	Performance Standard 3: Resource efficiency and pollution prevention	Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels
	Performance Standard 4: Community health, safety and security	Performance Standard 4 recognizes that Project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to Project activities. While acknowledging the public

International Framework	Description	
		authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from Project related activities, with particular attention to vulnerable groups.
	Performance Standard 5: Land acquisition and involuntary resettlement	Performance Standard 5 recognizes that Project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood as a result of Project-related land acquisition and/or restrictions on land use. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement.
	Performance Standard 6: Biodiversity conservation and sustainable management of living natural resources	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which 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 of ecosystems."

<table>
<tr><th>International Framework</th><th>Description</th></tr>
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<tr><td>Performance Standard 7: Indigenous peoples</td><td>Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development</td></tr>
<tr><td>Performance Standard 8: Cultural heritage</td><td>Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their Project activities. In addition, the requirements of this Performance Standard on a project’s use of cultural heritage are based in part on standards set by the Convention on Biological Diversity</td></tr>
</table></td></tr>
<tr><td>Equator Principles</td><td>Financial Institutions have adopted the Equator Principles in order to ensure that the Projects they finance and advise on are developed in a manner that is socially responsible and reflects sound environmental management practices. The Institutions recognize the importance of climate change, biodiversity, and human rights, and believe negative impacts on project-affected ecosystems, communities, and the climate should be avoided where possible. If these impacts are unavoidable, they should be minimized, mitigated, and/or offset. The Equator Principles are intended to serve as a common baseline and framework. The Institutions will not provide Project Finance or Project-Related Corporate Loans to Projects where the client will not, or is unable to, comply with the Equator Principles.

Equator Principles Financial Institutions (EPFIs) implement the 10 Equator Principles through their internal environmental and social risk management policies, procedures and standards in order to align with the</td></tr>
</table>

International Framework	Description
	Equator Principles. EPFIs may (at their own discretion) choose to utilize the Equator Principles for additional financial products outside the scope of the Equator Principles
World Bank Environmental and Social Framework	The Environmental and Social Framework (ESF) was approved by the Board of Executive Directors on August 4, 2016. It consists of a Vision for Sustainable Development; ten Environmental and Social Standards (ESSs), which set out the requirements that apply to Borrowers; an Environmental and Social Policy for Investment Project Financing (IPF), which sets out the requirements that apply to the Bank; and an Environmental and Social Directive/Procedure for IPF and a Directive on Addressing Risks and Impacts on Disadvantaged or Vulnerable Individuals or Groups. It applies to all IPF projects initiated on or after October 1, 2018. The ESF supports green, resilient and inclusive development by strengthening protections for people and the environment and making important advances in areas such as labour, inclusion and non-discrimination, gender, climate change, biodiversity, community health and safety, and stakeholder engagement. It uses a risk-based and proportionate approach that applies increased oversight and resources to complex projects and allows for greater responsiveness to changes in Project circumstances through adaptive risk management and stakeholder engagement. It promotes integrated environmental and social risk management. The ESF places an emphasis on strengthening national environmental and social management systems and institutions and supporting Borrower capacity building. It promotes enhanced transparency and stakeholder engagement through timely information disclosure, meaningful and ongoing consultations throughout the project life cycle, and responsive grievance mechanisms to facilitate resolution of concerns and grievances of project-affected parties. Environmental and Social Standards:

International Framework	Description
	• **Environmental and Social Standard 1**: Assessment and Management of Environmental and Social Risks and Impacts; • **Environmental and Social Standard 2**: Labor and Working Conditions; • **Environmental and Social Standard 3**: Resource Efficiency and Pollution Prevention and Management; • **Environmental and Social Standard 4**: Community Health and Safety; • **Environmental and Social Standard 5**: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement; • **Environmental and Social Standard 6**: Biodiversity Conservation and Sustainable Management of Living Natural Resources; • **Environmental and Social Standard 7**: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities; • **Environmental and Social Standard 8**: Cultural Heritage; • **Environmental and Social Standard 9**: Financial Intermediaries; and • **Environmental and Social Standard 10**: Stakeholder Engagement and Information Disclosure.
Vienna Convention on the Protection of the Ozone Layer	This was an Intergovernmental negotiation for an international agreement to phase out ozone depleting substances concluded in March 1985 which saw the adoption of the Vienna Convention for the Protection of the Ozone Layer. This Convention encourages intergovernmental cooperation on research, systematic observation of the ozone layer, monitoring of CFC production, and the exchange of information

International Framework	Description
United Nations Convention on Biological Diversity (UNCBD)	The purpose of this convention is to ensure the conservation and sustainable use of biodiversity. Kenya signed the convention on 5th June 1992 and ratified the same on 26th July 1992. The National Environment Management Authority (NEMA) is the National Focal Point to this Convention. The provisions of this Convention have been integrated in many laws of Kenya.
United Nations Convention to Combat Desertification (UNCCD	The above Convention was adopted on 17th June 1994 in Paris and came into force on 26th December 1976.Kenya ratified the Convention in 24th June 1997. The purpose of the UNCCD is to address the problem of the degradation of land by desertification and the impact of drought particularly in arid and dry semi-humid areas. NEMA is the focal point for the Convention.
The 1992 United Nations Framework Convention on Climate Change (UNFCCC)	The primary purpose of the convention is to establish methods to minimize global warming and in particular the emission of greenhouse gases. The UNFCCC was adopted on 9th May 1992 and came into force on 21st March 1994. The Convention has been ratified by 189 states. Kenya ratified the Convention on 30th August 1994. NEMA is the focal point for the Convention
Kyoto Protocol to the United Nations Framework Convention on Climate Change	The Kyoto Protocol requires signatories to the United Nations Framework Convention on Climate Change to reduce their greenhouse emissions levels to 5% below 1990 levels by the year 2012. The Protocol came into force on 16th February 2005, after it received the pre-requisite signatures. However, major countries like United States, China, India, and Australia are not signatories to the Protocol. NEMA is the national focal point for this Protocol.
Earth Summit on Sustainable Development Agenda 21	Agenda 21 is a non-binding, voluntarily implemented action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992. It is also regarded as an action agenda for the UN, other multilateral organizations, and individual governments around the world that can be executed at local, national, and global levels. The "21" in Agenda 21 refers to the 21st Century. Agenda 21 Section I on Social

International Framework	Description
	and Economic Dimensions is directed toward combating poverty, especially in developing countries, changing consumption patterns, promoting health, achieving a more sustainable population, and sustainable settlement in decision making. Section II on Conservation and Management of Resources for Development Includes atmospheric protection, combating deforestation, protecting fragile environments, conservation of biological diversity (biodiversity), control of pollution and the management of biotechnology, and radioactive wastes. Section III focuses on strengthening the Role of Major Groups including the roles of children and youth, women, NGOs, local authorities, business and industry, and workers; and strengthening the role of indigenous peoples, their communities, and farmers. Kenya continues to implement Agenda 21 to support sustainable development through the integration of environmental concerns into the national development policies, plans, and programmes. Also relevant is the implementation of Agenda 17. The proposed Project would need to be consistent with the objectives of Agenda 21.
Sustainable Development Goals (SGDs)	The SDGs include 17 Sustainable Development Goals and 169 targets. They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: economic, social and environmental.

4. Prevailing Biophysical Baseline Environment

This Chapter presents a summary of the prevailing biophysical environment for the regional, local, and Project areas.

As specified in Section 1.7 (EIA Phase Methodology), a variety of specialist studies were conducted to characterise the biophysical environments. The specialist studies conducted and used to inform this baseline description have been appended to this report as referenced Table 4-1 below.

Table 4-1: Associated Appendices for Specialist Reports

Specialist Baseline Studies	Appendix
Biological Environment - Soils, Land Use	Appendix E
Hydrology	Appendix F
Hydrogeology, Hydrocensus, Physiography	Appendix G
ARD, AMD (Geochemistry)	Appendix H
Biological Environment - Aquatic, Sediment	Appendix I
Biological Environment - Flora, Fauna	Appendix J
Wetlands Impact Assessment	Appendix K
Atmosphere and Air Quality	Appendix L
Ambient Noise	Appendix M
Vehicular Traffic Assessment	Appendix N
Visual Impact Assessment	Appendix O
Cultural Heritage, Archeaeologist	Appendix P
Human Rights Assessment	Appendix Q
Critical Habitat Assessment	Appendix R
Ecosystems Services	Appendix S
Seismicity, Blasting, Vibration	Appendix T
Climate Vulnerability Assessment and Greenhouse Gas Estimation	Appendix U
Social Economic, ASM (SIA)	Appendix V

4.1. Baseline Climate Conditions

Site-specific MM5-modelled meteorological data was then requested for three years (2021-2023) from Lakes Environmental Software. Data availability was 100%. The meteorological records encompass temperature, rainfall, relative humidity wind speed, and direction.

Onsite meteorological data from March 2023 to March 2024 was provided. A conscious decision was taken to analyse the records for 2023 only, after analysis of the data, 79.7% data availability was confirmed. Data was missing for January and February 2023, the 4-8 November, and 20-31 of December 2023.

4.1.1. Temperature

The monthly temperature for the Project site (3-year average) is presented in Figure 4-1 and Figure 4-2. The data indicates that the mean monthly temperature varied between 22°C - 24°C. The monthly maximum temperatures varied between 29°C - 34°C and the annual average was 31°C. Onsite data show that the mean temperature is between 22°C - 23°C and the maximum units vary between 32°C - 35°C

4.1.2. Relative Humidity

The mean relative humidity (RH) records (3-year average) ranged between 57% and 76% Table 4-2 and Figure 4-1). Ravi *et al.*, (2006)[2], investigated the effect of near-surface air humidity on soil erodibility. Results show that the *threshold friction velocity* increases with air humidity i.e. in air-dry soils (RH < 65%), the soils are too dry for the liquid-bridge bond to exist. However, with humidity conditions (RH > 65%) water condenses into liquid and forms bridges between the soil grains, and then the liquid-bridge bonding dominates, increasing the *threshold friction velocity*. RH > 65% was observed almost throughout the year.

Analysis of the onsite data revealed that the relative humidity varies between 66%-83% although 20.3% of the data is missing. The mean RH peaks were higher during the two rainfall periods, 82% in April and 83% in November 2023.

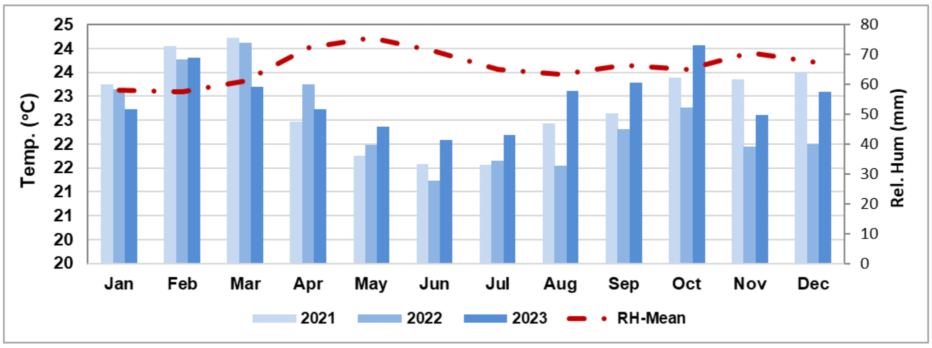


Figure 4-1: Monthly Mean Temperature and Relative Humidity

4.1.3. Rainfall

The total monthly rainfall records (3-year average) for the modelled data are provided in Table 4-2 and Figure 4-2. Kenya experiences two main wet seasons, which are summarised below:

- The long rains (March to June); and

[2] Ravi S; Zobeck TM; Over TM; Okin GS; D'Odorico P (2006) On the effect of moisture bonding forces in air-dry soils on threshold frictional velocity of wind erosion. *Sedimentology, 53, 597-609*

- The short rains (October to December).

Most of the precipitation is in the highlands and southwest region of Lake Victoria. This may explain why winds with high windspeed are often common from that direction. The annual total rainfall can reach >2000 mm (Miller et al., 2021). The Lake Environmental reports an annual total rainfall average of 1689 mm.

Based on the Lakes Software rainfall data, the long-wet season (March – June) and the short-wet season (October – December) received 71% of the annual total rainfall, with peaks in April (525 mm) and November (306 mm) (Figure 4-2). The dry season accounts for 29% of the annual total rainfall.

The onsite meteorological records show that the mean monthly rainfall varies between 53 mm and 525 mm. The rainfall peaks were during the two wet seasons, recording 525 mm in April and 306 mm in November. The annual total rainfall of 2193 mm is very much in line with known statistics available for the area as stated above.

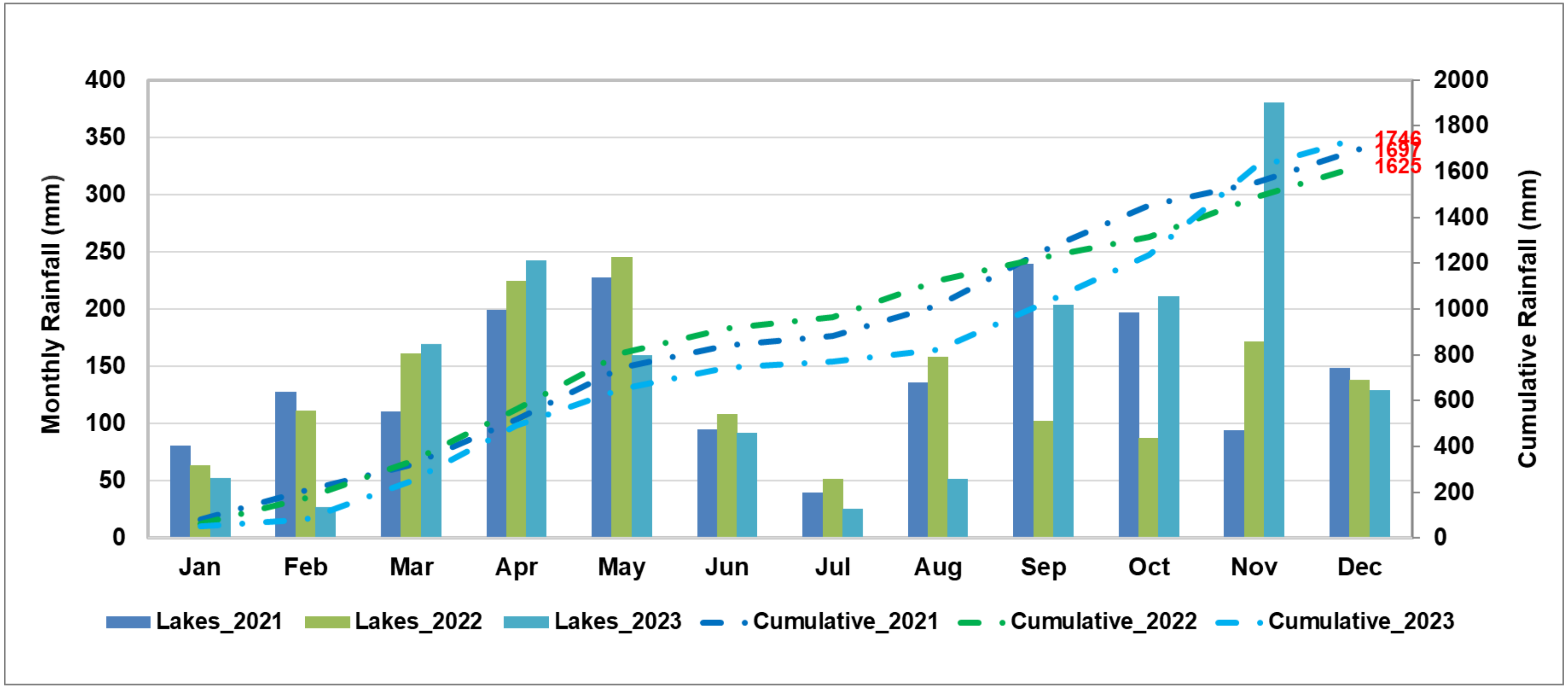


Figure 4-2: Total Monthly Rainfall and Cumulative Rainfall

Table 4-2: Climate Statistics

Parameters	3-year average												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temp. Min (◦C)	15	15	16	16	16	15	14	14	16	16	16	15	15
Temp-Mean (◦C)	23	24	24	23	22	22	22	22	23	23	23	23	23
Onsite Temp-Mean (◦C)			22	22	23	23	23	23	23	23	22	23	22
Temp-Max (◦C)	33	34	34	32	29	29	29	31	31	32	31	33	31
Total Mon. Rain (mm)	66	89	147	222	211	98	39	115	182	165	216	139	1689
Onsite Total Mon. Rain (mm)	0	0	478	525	317	173	54	62	127	116	306	36	2193
Rel. Hum. Mean (%)	58	57	61	72	76	71	65	63	66	65	71	67	66
Onsite Rel. Hum. Mean (%)			76	82	76	73	67	66	73	73	83	77	62

4.1.4. Wind Speed

The wind roses generated comprise 16 spokes which represent the directions from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence.

The wind rose characterisation for the period (3-year average) and seasonal scenarios are depicted in (Figure 4-3 and Figure 4-4). The dominant winds are from the east-northeast (11.14%) and east (10.3%) respectively. The secondary contribution is from the west-southwest (10.5%).

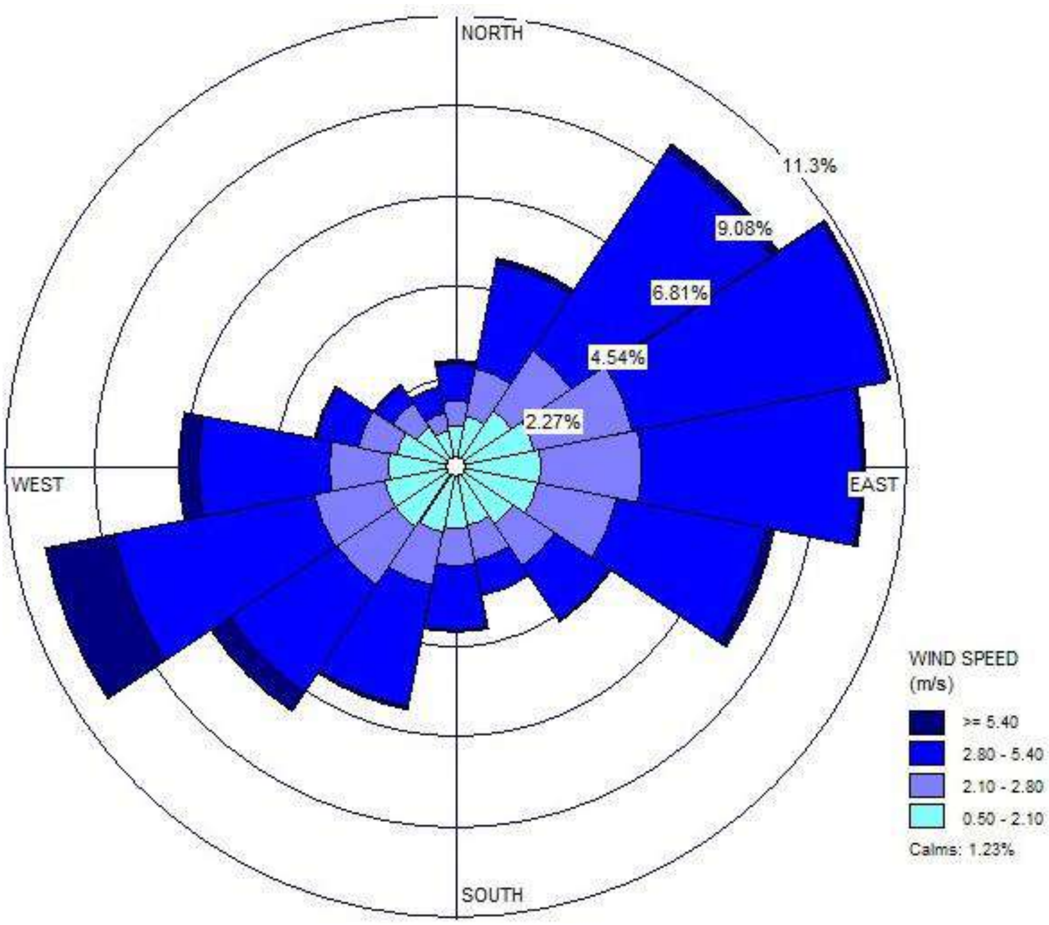


Figure 4-3: Wind Rose (Period)

The average wind speed at the Project site is 2.88 m/s and calm conditions (<0.5 m/s) occurred 1.23% of the time. Wind speed capable of causing wind erosion, i.e. ≥5.4 m/s, occurred about 4.0% of the time (Figure 4-4). The wind class frequency distribution is depicted in Figure 4-4. This equates to about 1052 hours per year and 15 days of high wind speed each year.

The seasonal variability in wind speed and wind direction is depicted in Figure 4-4. The seasonal signature shows the dominance of winds from the southwest sector and northeast for both the wet season and the dry season.

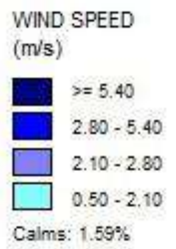
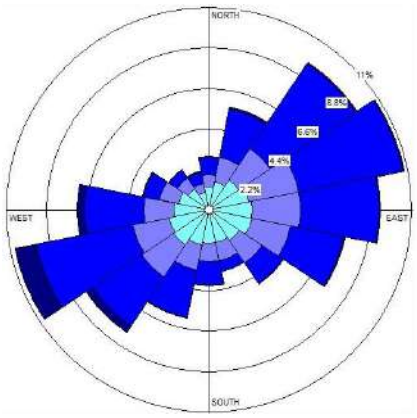
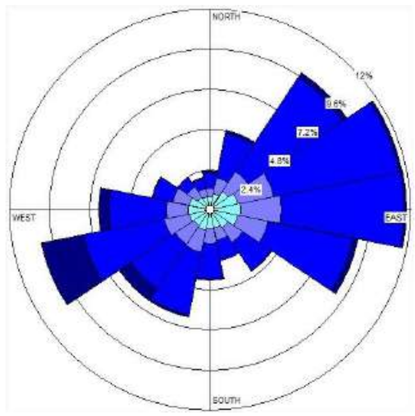
	Wet Season	Dry Season
		

Figure 4-4: Seasonal Wind Roses (Wet Season [mar-June; Oct-Dec] and Dry Season [Jul-Sep]

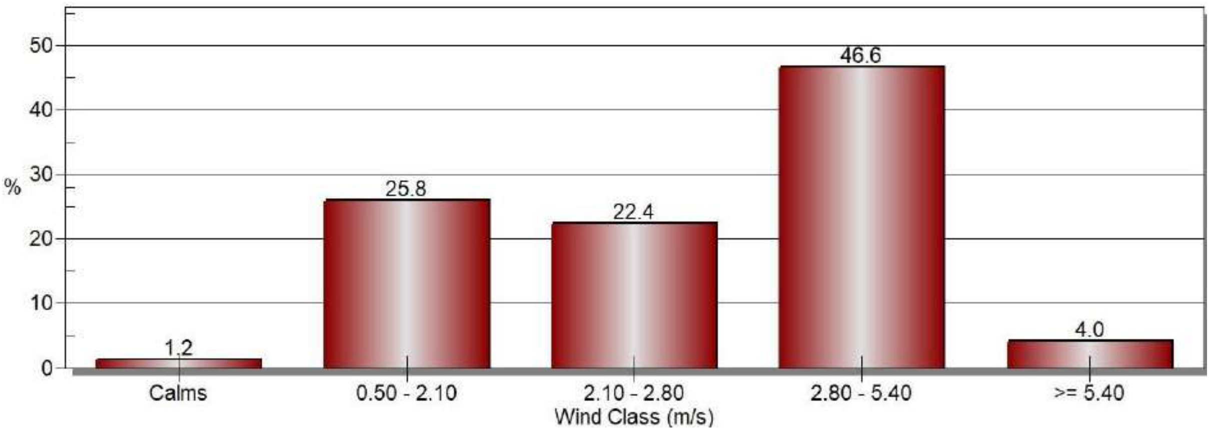


Figure 4-5: Wind Class Frequency

4.2. Seismicity

Based on the website referenced ThinkHazard indicated that most of Kenya lies within a medium-risk zone for earthquake activity, this is illustrated in Figure 4-6. The Siaya County of Kenya, where the Ramula open pit is located, is indicated to fall within a medium-risk area, as shown in Figure 4-6.

There are several comprehensive studies of the seismotectonic model and seismicity of Kenya and the neighbouring counters (e.g. Zana et al., 1989; 1990; 2004; Vittori et al., 1997; Delvaux et al., 2012, and most recent and most advanced by Poggi et al., 2017). Most of the research agrees that the region's earthquakes are shallow, within a depth range of 10 – 20 km, and with a few exceptions, the predominant stresses are of normal faulting type (Zana and Hamaguchi, 1978; Mavonga and Durrheim, 2009).

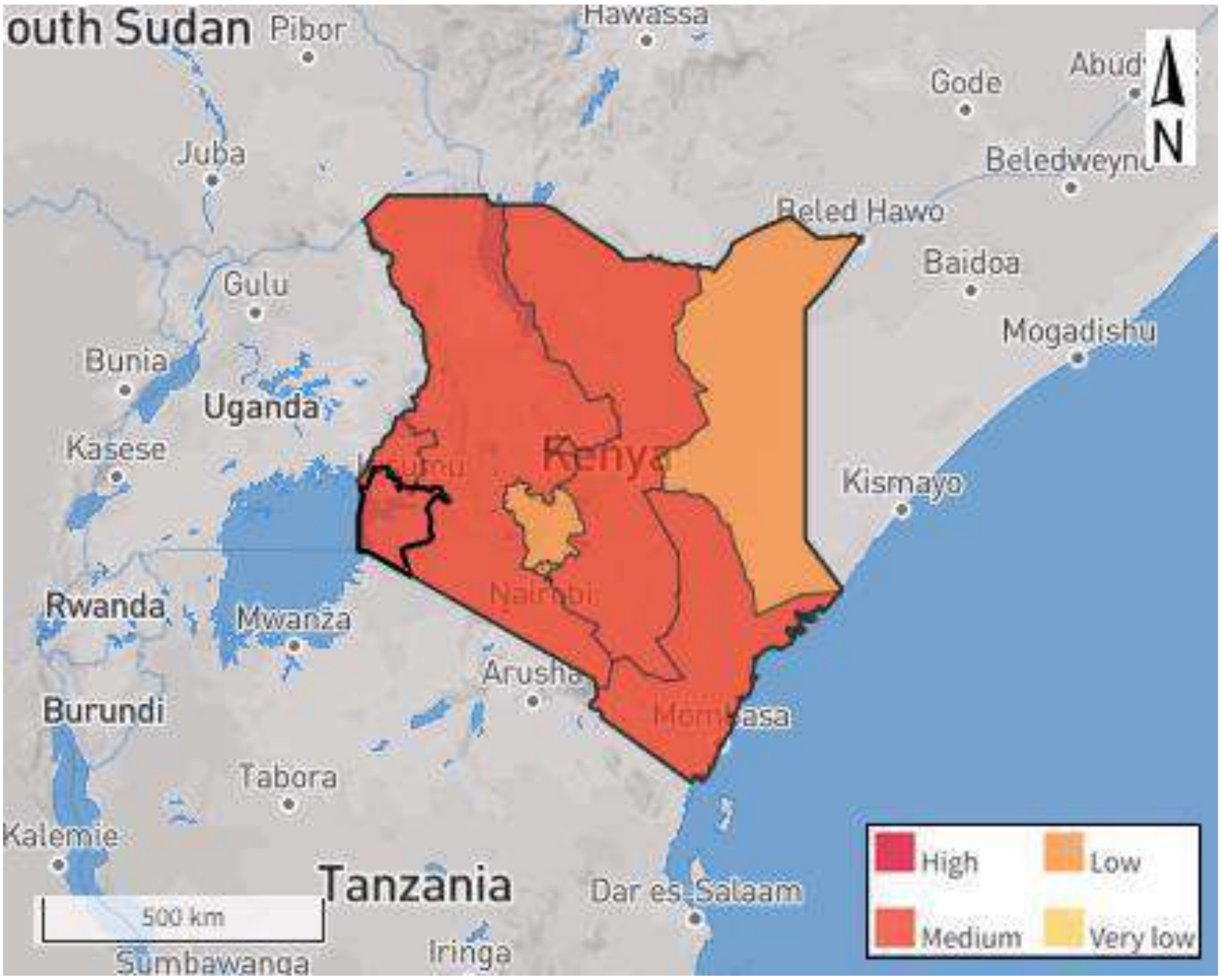


Figure 4-6: Kenya Earthquake Hazard map (Thinkhazard, 2024).

The seismicity of Kenya was assessed using the Earthquake hazard map of Africa (Figure 4-7), which implies that the Ramula project area is located in a zone where peak ground acceleration range between 0.8 m/s^2 to 1.6 m/s^2.

This range represents a moderate seismic hazard, suggesting that the project area lies within a region of medium seismic activity. Therefore, the open pit design provided herein includes the influence of ground motion.

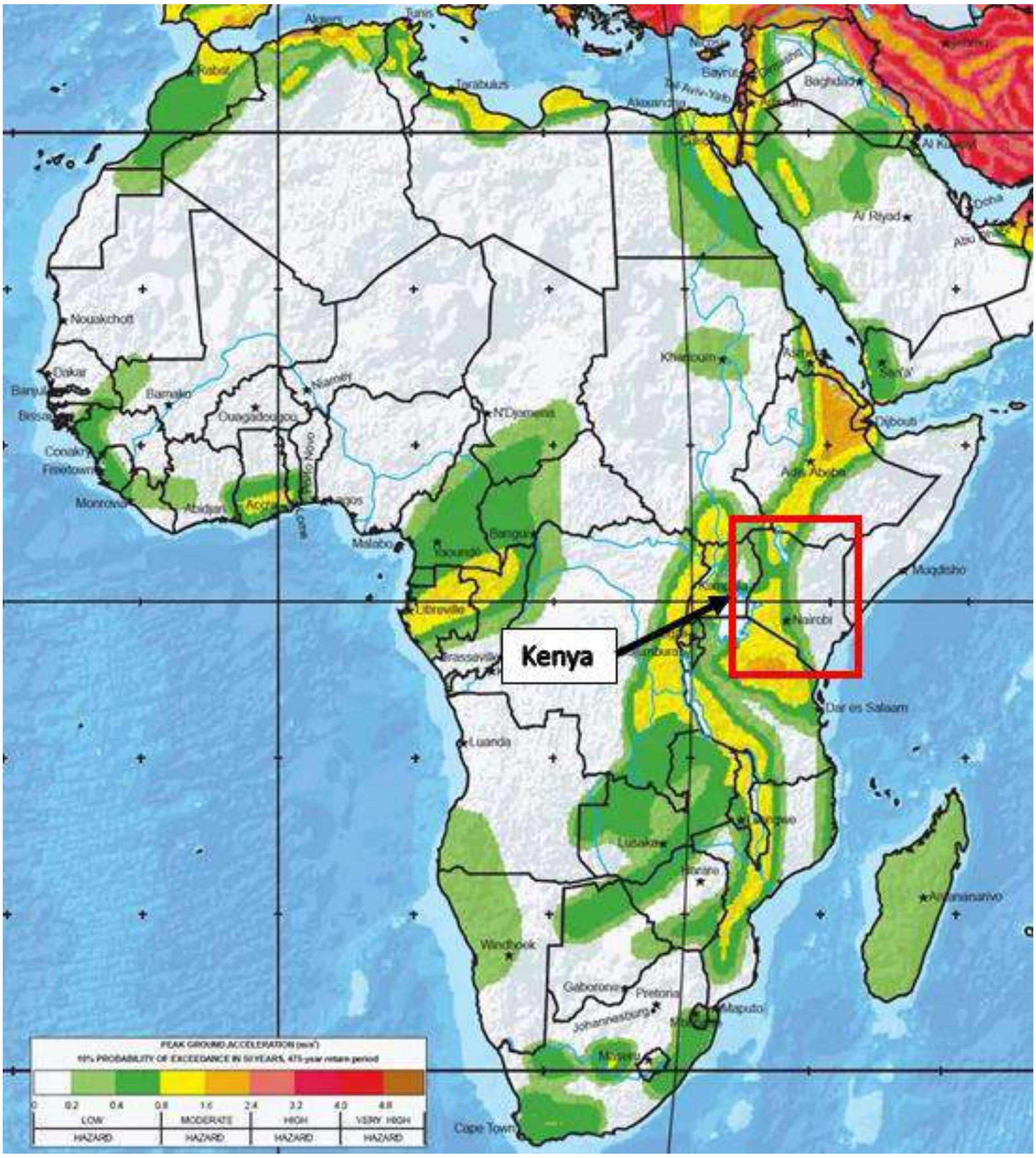


Figure 4-7: Seismic hazard map of Africa (Thoughtco, 2024).

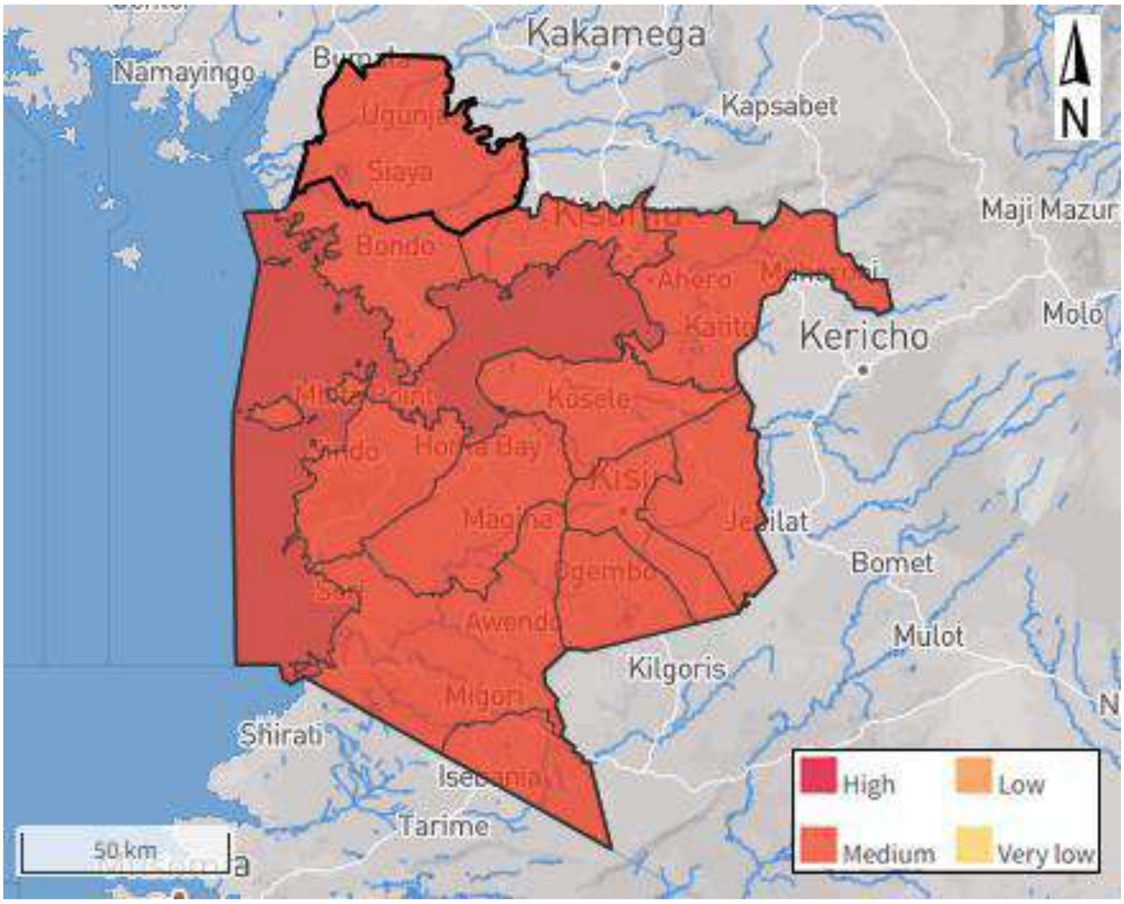


Figure 4-8: Siaya County Earthquake Hazard map (Thinkhazard, 2024).

4.3. Topography and Drainage

4.3.1. Topography

The topography of the Yala and the Awach catchment has a maximum altitude of approximately 1 590 metres above mean sea level (mamsl). The topography of the Project area has an altitude that ranges between 1 330 and 1 498 mamsl. The area can be described as having moderate to steep terrain (Figure 4-9) (Boye, et al., 2008).

4.3.2. Drainage

The Syayusi, Auromena, and Ko'Tiende streams flow in a northerly direction through the proposed Project area before joining the Dhene River, the Auralwanda stream flows along the east side of the proposed Project area boundary before it drains into the Dhene River. The Madawo stream confluences the Ko'Tiende stream before it drains into the Dhene River.

The Dhene River confluences the Yala River in a southwest direction, while the Yala River flows in a westerly direction. The Yala River feeds into the Yala Swamp before draining into Lake Victoria (Okune, 2019). It is estimated that 18% of the Yala River drains into Lake Victoria (Anon., 2022). The Munungo stream flows in a south-easterly direction and confluences the Awach River which flows in a south-easterly direction and drains into Lake.

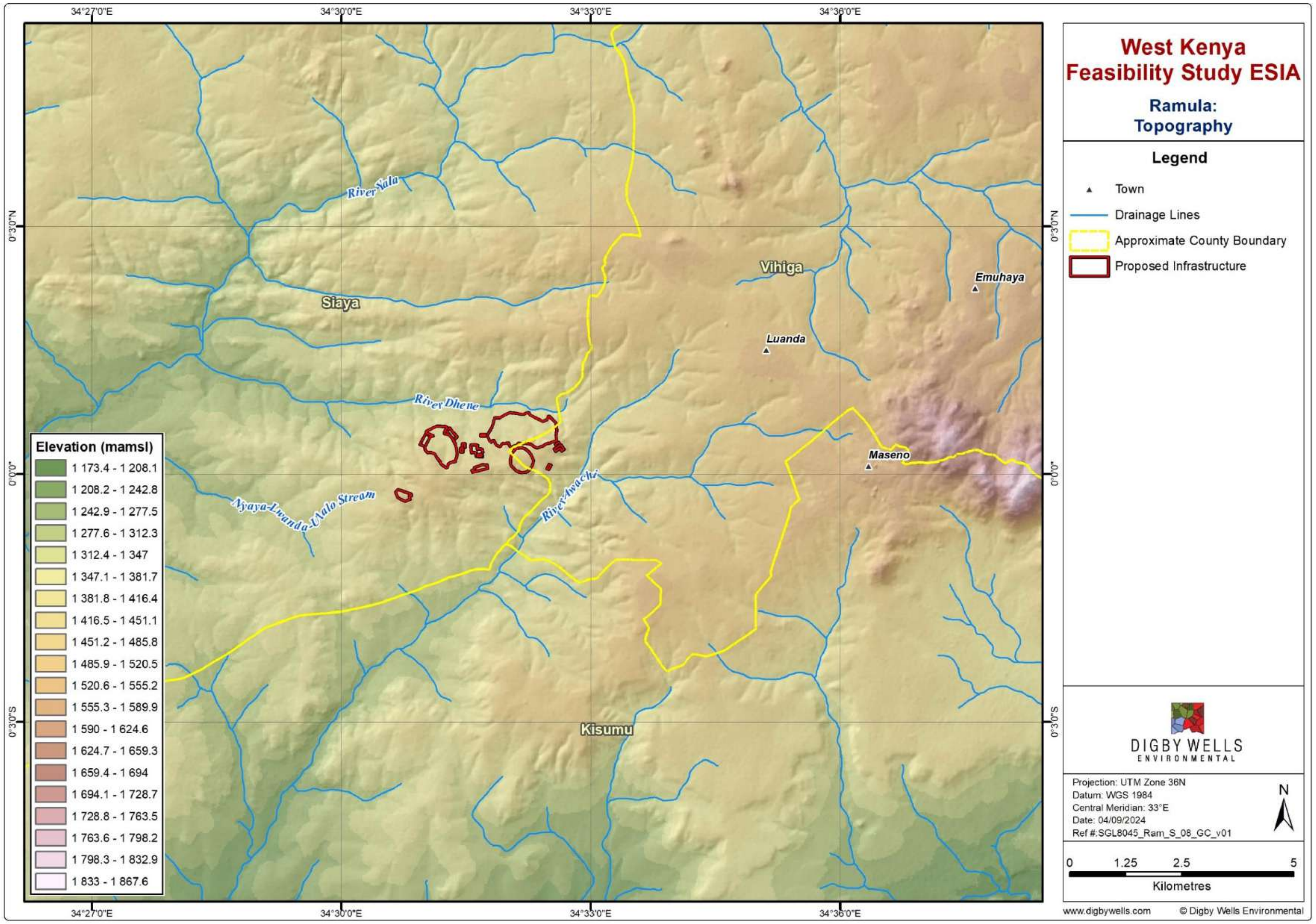


Figure 4-9: Regional Topography

4.4. Geology

4.4.1. Regional Geology

The Ramula-Mwibona Project is found within the Tanzania Craton, which forms the southern extent of the Archaean Eastern Congo Craton, a 2000 km long corridor that extends from Tanzania in the south, to the Central African Republic in the northwest (Figure 4-10). Younger mobile belts flank the Tanzania Craton. The southern part of the Tanzania Craton is dominated by felsic Dodoma Gneiss, granitoid rocks, and local supracrustal Dodoma Schist (Mine Scope, 2018). The northern part of the craton is composed of the Neoarchean granite-greenstone terrane of the Lake Victorian Goldfields (LVG), which provides the host environment for the gold deposits (Bara Consulting, 2024).

The LVG comprises seven greenstone belts which include the Busia-Kakamega greenstone belt where the Ramula-Mwibona Project is located. The Busia-Kakamega Greenstone Belt lies on the northern edge of Lake Victoria extending northwest from Kakamega in Kenya, into Uganda (Figure 4-11). The belt comprises an overall northeast facing sequence of volcanic and sedimentary rocks intruded by granitoids (Mine Scope, 2018; Bara Consulting, 2024).

The volcanic units, and their intrusive equivalents, include rocks of komatiitic, tholeiitic, calcalkaline, and high potassium adakitic composition. The adakitic rocks within the Yala River Group are intercalated with sandstone and conglomerate which was previously included in the Kavirondo Group. The komatiitic suite hosted by the Ndori Group includes high-Mg basalts and ultramafic volcaniclastic. The stratigraphy for the Busia-Kakamega greenstone belt is provided in Figure 4-12 (Bara Consulting, 2024).

The granitoids can be separated into two groups: an older calcic syn-volcanic suite predating deposition of the Kavirondo Group sedimentary rocks and a younger (circa 2650 Ma) high potassium suite which post-dates the Kavirondo Group. Most of the rocks throughout the Busia-Kakamega Greenstone Belt show remarkably little strain at the outcrop scale. Exceptions are occurrences of mafic volcanic meta-tectonites. Field relations suggest these meta-tectonites are passively intruded by the (circa 2670 Ma) Assembo granitoid, which provides a minimum age for this early deformation (Pells Sullivan Meynik, 2017; Bara Consulting, 2024).

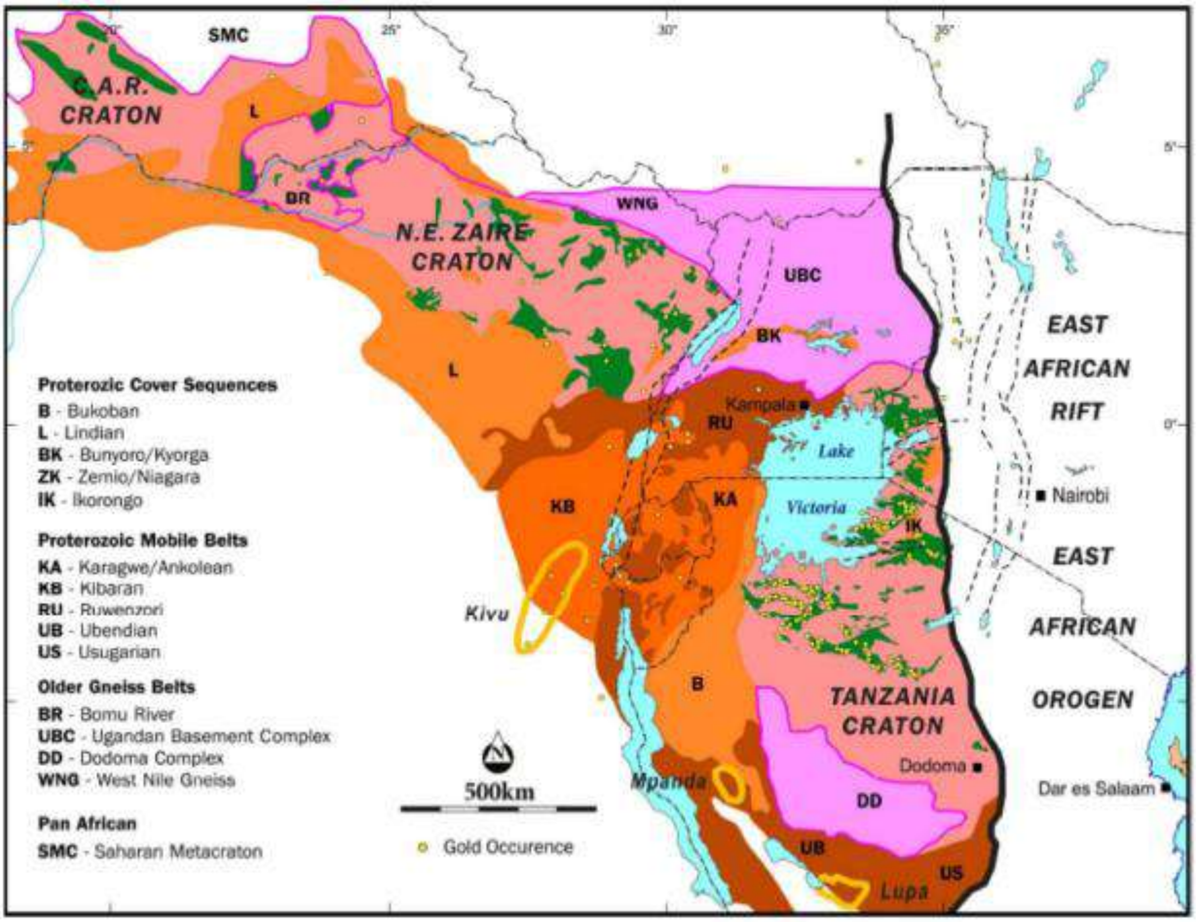


Figure 4-10: Regional Geology[3]

[3] Sourced from (Holmes, 2023)

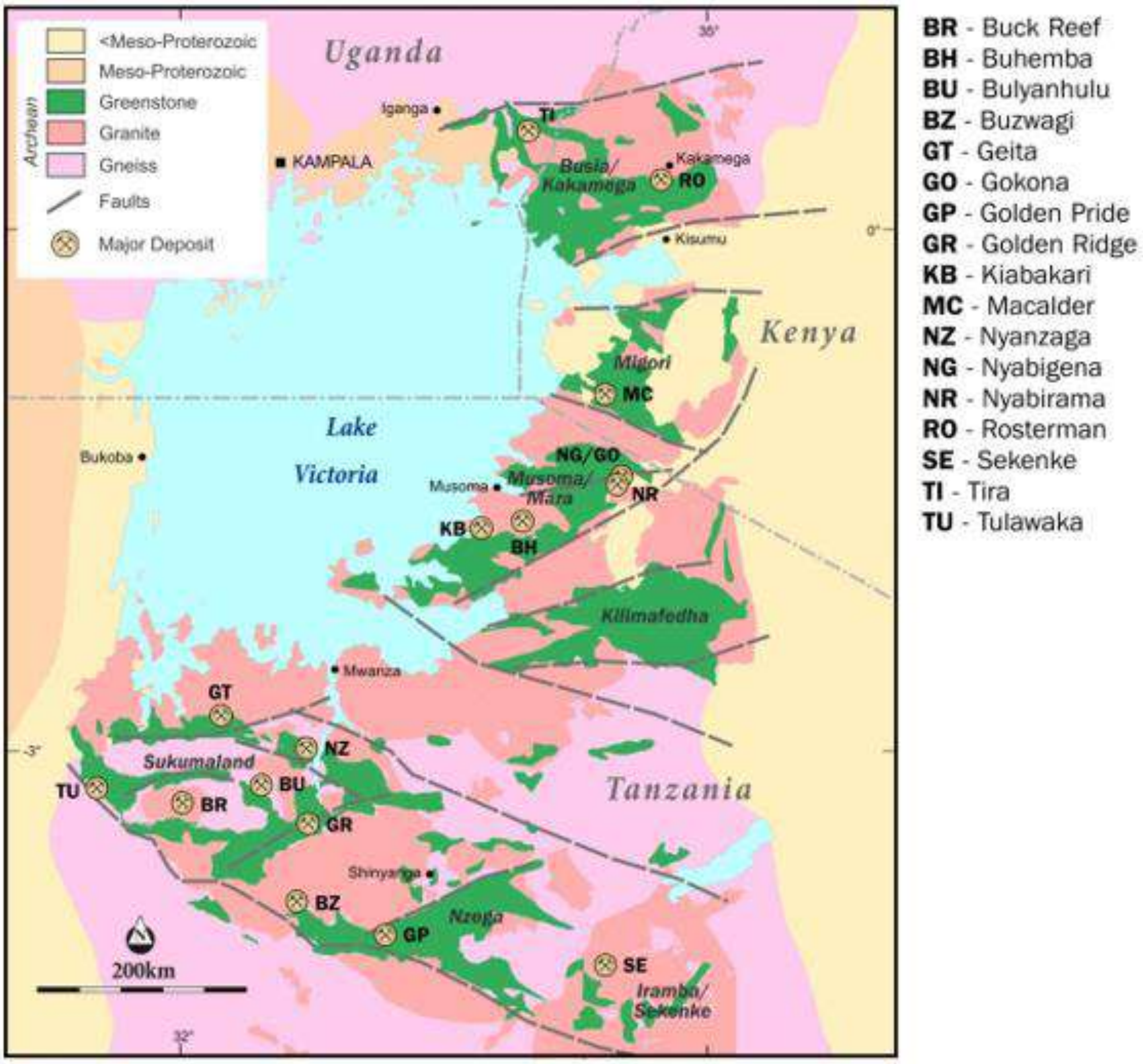


Figure 4-11: Distribution of Greenstone Belts within the Tanzanian Craton[4]

[4] Sourced from (Bara Consulting, 2024)

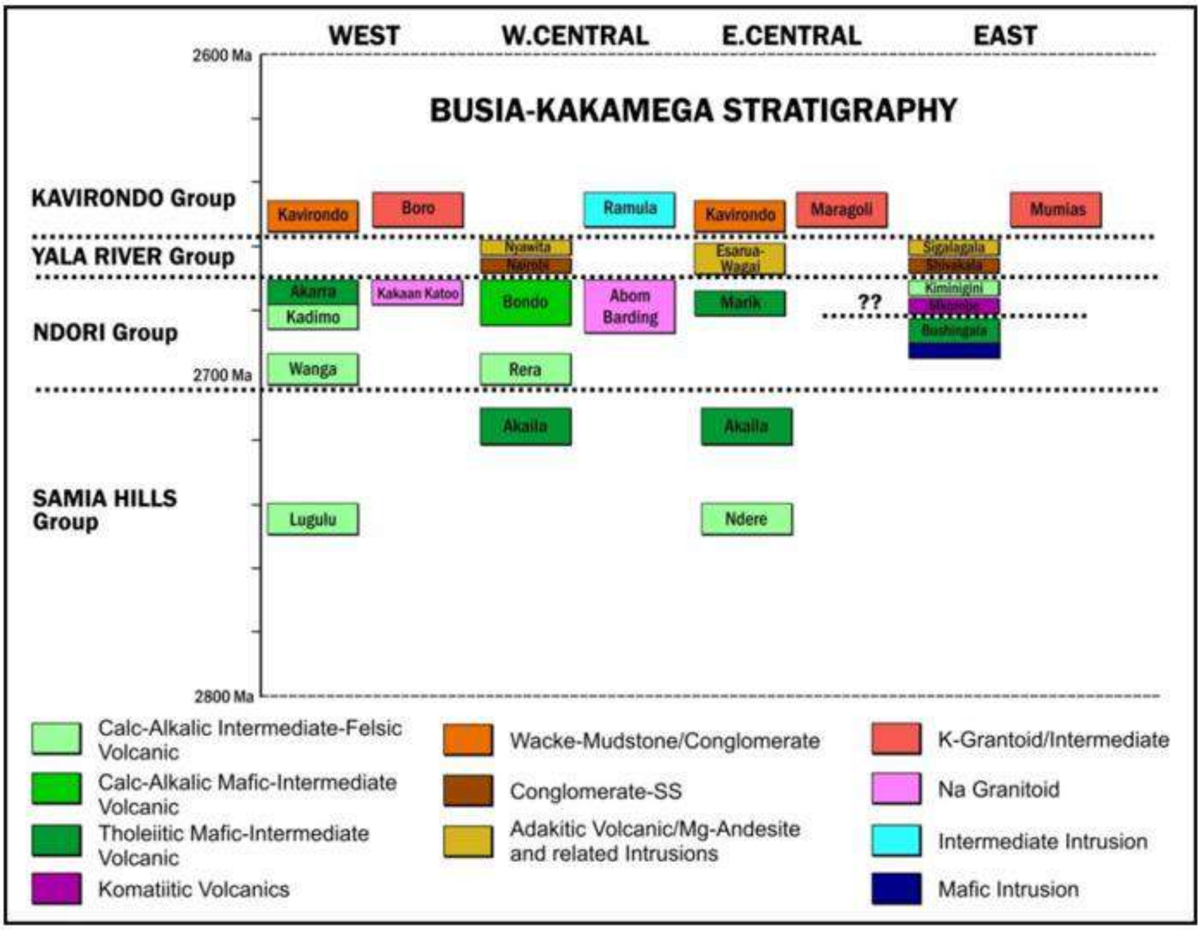


Figure 4-12: Busia-Kakamega Lithostratigraphy[5]

4.4.2. Local Geology

The Ramula-Mwibona deposit is located in Siaya County about 40 km northwest of Kisumu City and 40 km west-southwest of the Liranda Region, which also contains the high grade Isulu and Bushiangala deposits. The Ramula region currently holds seven high priority deposits including Ramula-Mwibona, Miruka, Anomaly 22, Ramba-Lumba, Aila, Masumbi, and the former colonial mine Kiboko, all within 20 km of the Ramula-Mwibona deposit.

The Ramula-Mwibona deposit is located in the center of the Busia-Kakamega greenstone belt. The deposit is hosted within a small elongated (200 m by 400 m) dioritoid stock which has intruded into a sequence of intermediate volcanics (Figure 4-13). Quartz feldspar porphyry intrusions are also present (Bara Consulting, 2024).

Mineralisation within the Ramula-Mwibona deposit is classified as orogenic, shear-zone-hosted quartz carbonate vein subtype. Mineralisation at Ramula-Mwibona is hosted within a series of stacked, shallow-dipping, thin quartz tension veins primarily hosted in the strongly altered dioritoid and extending into the surrounding intermediate volcanic units. Gold-bearing

[5] Sourced from (Bara Consulting, 2024)

quartz veins are clustered in well identifiable zones. Lower grade gold mineralisation also occurs between the veins (Shanta Gold, 2022; Bara Consulting, 2024) .

The main stratigraphic units within the Ramula-Mwibona deposit include:

- *Dioritoid Unit* – comprise of massive, medium-grained, mesocratic crystalline rock, predominantly of felsic minerals. The dioritiods are pervasively altered with haematite which pre-dates the gold mineralization. Gold mineralization is strongly associated with sericite-chlorite-carbonate-silica-sulphides and ± rutile alteration near quartz veins. Sulphide mineralization in the form of pyrite is present within the veins and alteration halos. The dioritoid unit has intruded the intermediate volcanics and hosts the felsic phorphyry intrusions (Bara Consulting, 2024);
- *Intermediate Volcanic Unit* – comprises of a sequence of massive, vesicular and porphyritic lava and breccia. The breccia is predominantly located at the contact with the dioritoid and hosts some of the gold mineralization. The intermediate volcanic rocks are strongly overprinted by alteration from infiltrating silica-carbon dioxide-sulphur-calcium-potassium-(gold)-bearing and carbon dioxide-sulphur-gold-poor hydrothermal fluids (Bara Consulting, 2024); and
- *Felsic Porphyry* – comprise of minor, random, 0.2 m to 3 m thick subvertical intrusions of medium grained felsic rock. Felsic porphyries are weakly altered, pre-mineralised and display preserved igneous texture (Bara Consulting, 2024).

A regional west-northwest to east-southeast fault is located to the north of the Ramula-Mwibona deposit which is intruded by post-Archean doleritic dykes. The dioritoid unit is highly faulted with various orientations and dips but this does not displace mineralization.

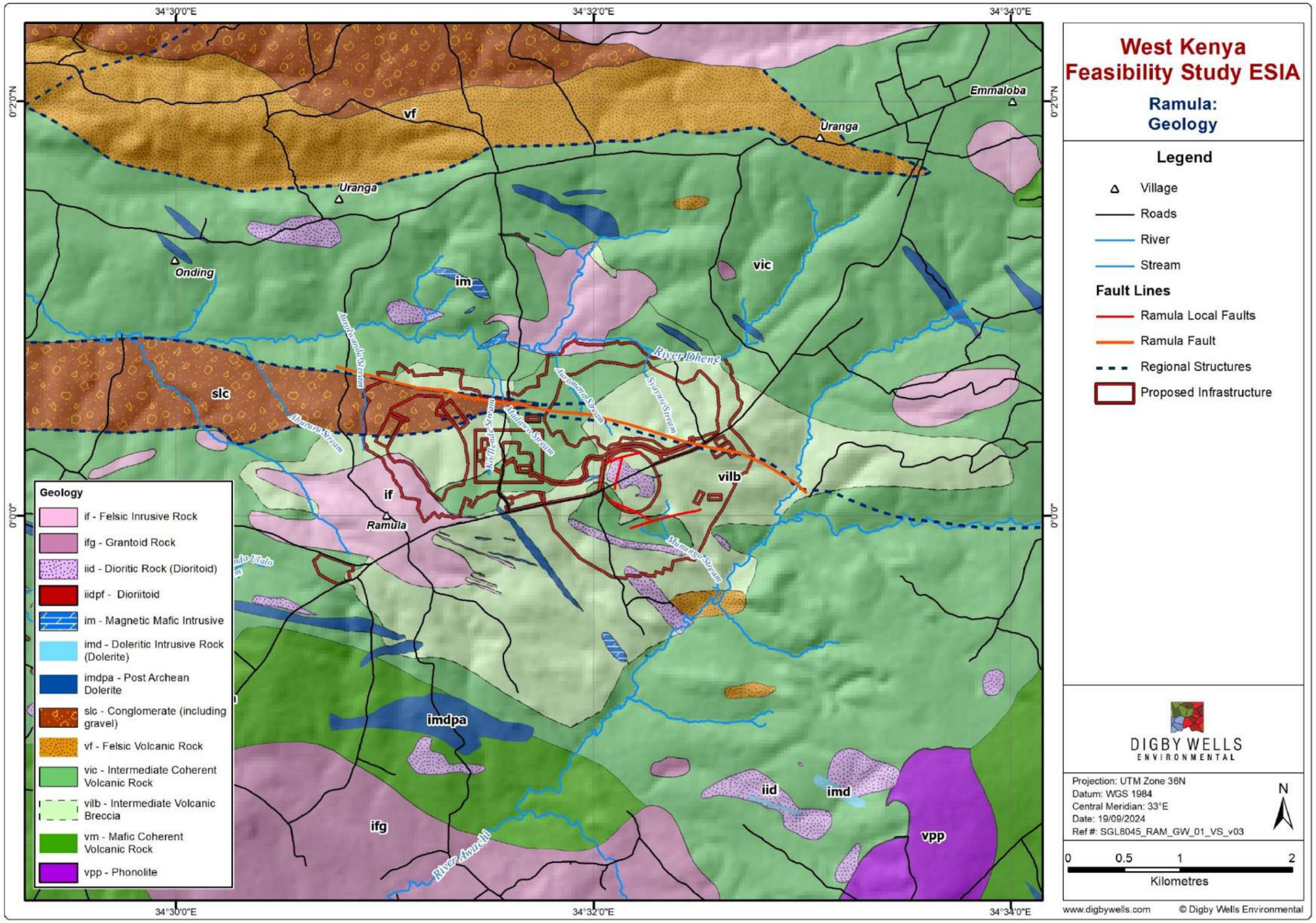


Figure 4-13: Local Geology

4.5. Soils and Land Use Characteristics

Soils, Land Use, and Land Capability Assessment was conducted as part of the EIA process and is included in Appendix E. A two-seasonal site assessment was conducted between 14 and 17 March 2024 (dry season) and again from 1 to 2 August 2024 (wet season). The objective of the second site assessment was to determine any seasonal changes to the land uses and assess cumulative impacts on soil resources.

4.5.1. Regional Soils

According to the Food and Agricultural Organization (FAO) soil classification system (FAO (2014)), the AoI is dominated by Humic Nitosols. These soils are common in Eastern Africa and are characterised by a deep structure. This soil is fertile and is defined by a clay accumulation of more than 30%. The dominance of this soil form emphasizes the likelihood of the area being classified as having high agricultural potential and soil sensitivity (Figure 4-16).

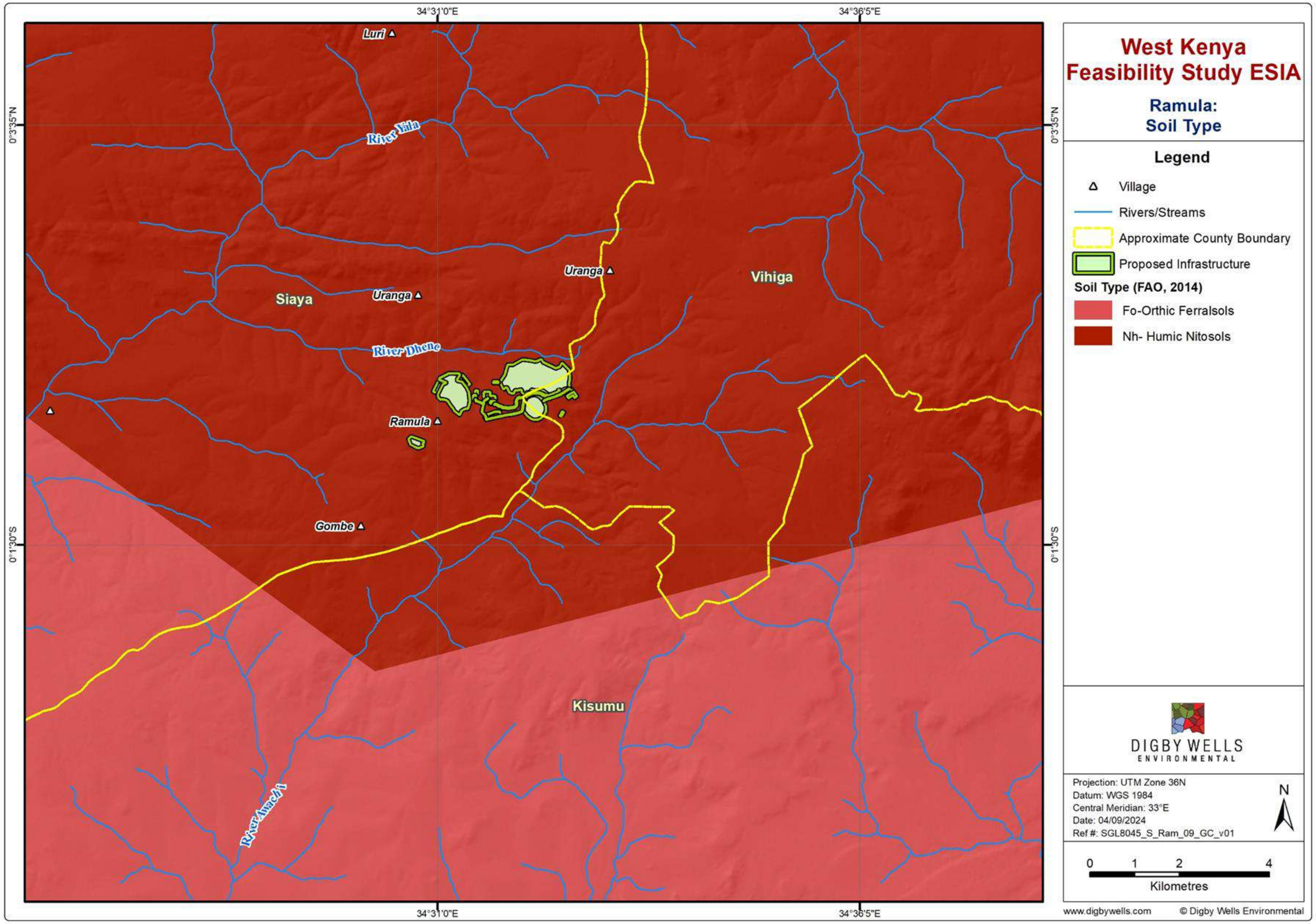


Figure 4-14: Regional Soils of the AoI

4.5.2. Land Use

Latest land use/cover data from the Environmental Systems Research Institute (ESRI) (2023) was used to define the common land uses within the AoI. The AoI and its direct surroundings are dominated by various land uses, specifically “Built Areas“ and “Crops”. The dominance of these land uses emphasizes the likelihood of significant soil degradation in the form of compaction and utilisation of soil resources for subsistence crops. The dominance of crops emphasizes the likelihood of soils having a high agricultural potential. The “Trees” land uses indicate forested areas, which are continuously utilized for wood. The “Bare Ground” areas indicate severe disturbances in the form of clearances and excavations, likely for building material.

4.5.3. Slope and Elevation

Slope and elevation play an integral role in understanding the potential land capability of an area. As a rule of thumb, the gentler the slope, the higher the land capability and agricultural potential. The slope percentage of the AoI and its surroundings ranges from 5% to 52%, with only the upper crest/ plato and low-lying areas being characterised by gentle slopes (between 5% and 8%) (Figure 4-15). The remainder of the area is dominated by rolling hills and steep slopes. The elevation ranges from 1 327 to 1 460 mamsl (Figure 4-9). The AoI generally slopes towards the Awachi River to the south-east and the Dhene River to the north.

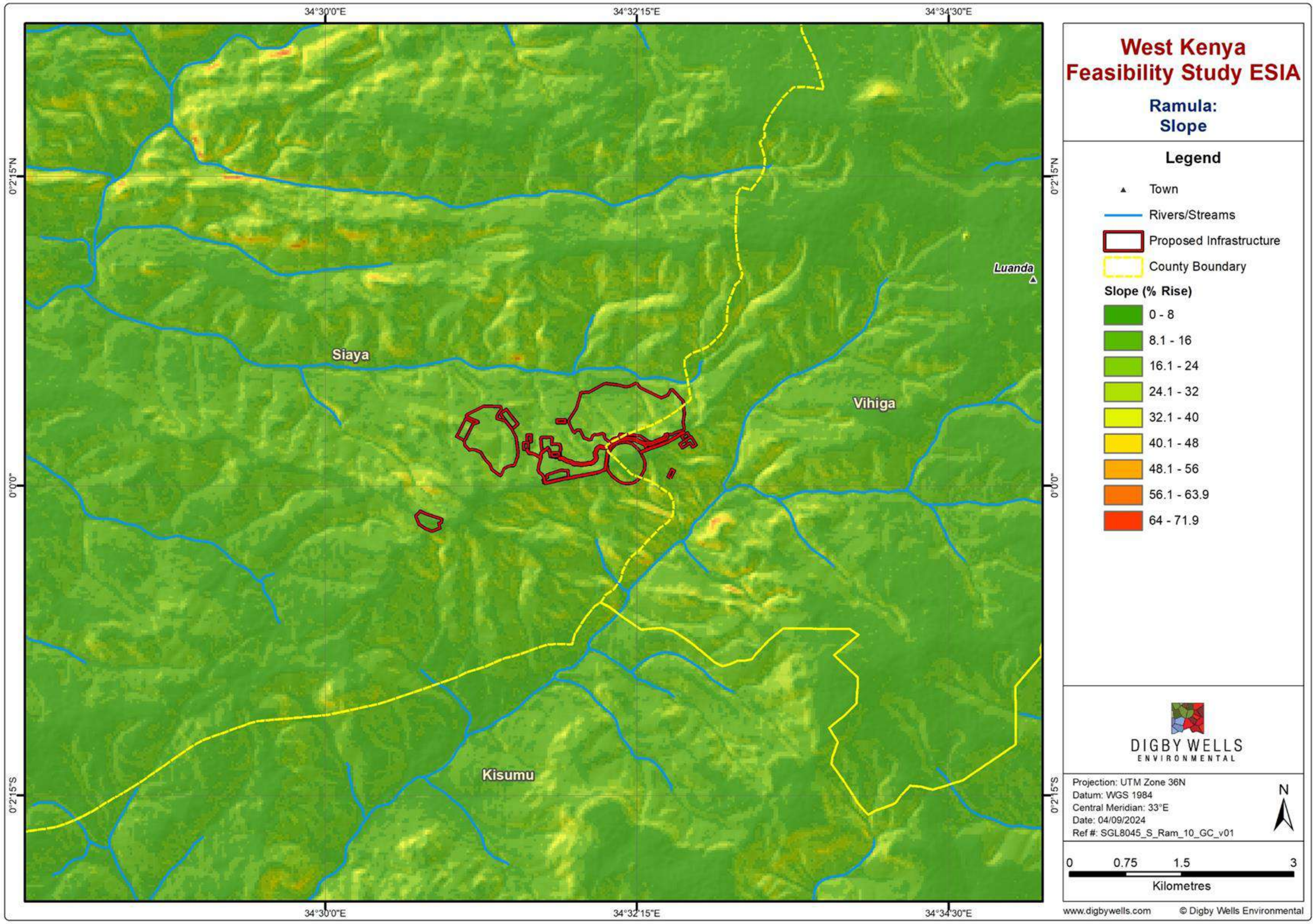


Figure 4-15: Slope Percentage of the AoI

4.5.4. Soils within the Project Area

During the site assessments, various soil forms were identified. These soil forms have been delineated and are illustrated in Figure 4-17. The identified soils are described according to depth, clay percentage, indications of surface crusting, signs of wetness, and percentage of rock (see Table 4-3). Soils have been classified according to the International Soil Classification System (FAO, 2022). Seven dominant soil forms were identified, which are listed and described in Table 4-3 below. These soils include Ferritic Nitisols, Skeletic Leptosols, Nitic Plinthosols, Dystric Arenosols, Argic Ferralsols, Fluvisols, and general hydromorphic soils (wetland soils).

4.5.4.1. __Nitisols__

Nitisols are characterised by a nitic horizon within 1 000 mm of the soil surface and a gradual transition between soil horizons. These soils are deep and well-drained, red, tropical soils and are characterised by a subsoil with a clay percentage higher than 30 and a strong, angular, blocky structure. The subsoil is characterised by a red or reddish-brown color and is generally considered fertile despite the usual low base status (ISRIC World Soil Information, 2024). The Nitisols identified within the AoI were classified as being Ferritic Nitisols due to the deep iron-rich soils lacking plinthic properties with an approximate 10% rock concentration within the subsoil.

4.5.4.2. __Leptosols__

Leptosols are shallow soils containing large amounts of coarse fragments and large builders overlying continuous rock (ISRIC World Soil Information, 2024). These soils are often associated with mountainous regions or alternating hills. Areas where erosion has occurred often result in exposed rock with little or no vegetation cover. The exposed rock is often resistant to weathering, resulting in very shallow soil depths. The Leptosols identified throughout the extent of the AoI are divided into permeable and impermeable rock layers, depending on the characteristics of the rock layer. The Leptosols identified within the AoI are classified as Skeletic Leptosols due to a course fragment concentration higher than 40% up to a depth of 1 000 mm.

4.5.4.3. __Plinthosols__

Plinthosols (laterites) comprise plinthite, petroplinthite, or pisoliths. Plinthosols are rich in Iron (Fe) and Manganese (Mn); however, are low in organic material (ISRIC World Soil Information, 2024). These soils are weathered from plinthic material comprising gibbsite, quarts, and other constituents. The soils are often sandy and reddish due to the oxidation of Fe and Mn. Plinthosols often have a hard, continuous, or fractured sheet that is strongly cemented, restricting soil depth. These soils are generally stable and are often utilised for construction materials. The Plinthosols identified within the AoI have been classified as Nitic Plinthosols considering a prominent plinthic layer within 1000 mm and the blocky structure of the subsoil overlaying the plinthic layer.

4.5.4.4. Arenosols

Arenosols are sandy soils developed in residual sands, *in situ* after the weathering of old quartz-rich material or bedrock. These soils are either deep (up to 1 000 mm) or overlay a plinthic, petro-plinthic, or salic horizon between 500 and 1 000 mm of depth. These soils are characterised by a rock fragment concentration lower than 35% (ISRIC World Soil Information, 2024). The Arenosols identified within the AoI were classified as Dystric Arenosols due to the low base status of the soils and the general low fertility (low nutrient status due to visible deficiencies as a result of leaching).

4.5.4.5. Ferralsols

Ferralsols represent deeply weathered, red, or yellow soils of the humid tropics which are characterised by diffuse transitions between soil horizons. These soils are dominated by low-activity clays and are known for their good physical, but poor chemical properties (ISRIC World Soil Information, 2024). The Ferralsols identified within the AoI have been classified as Argic Ferralsols due to the prominent increase in clay concentration with an increase in soil depth.

4.5.4.6. Hydromorphic Soils

Hydromorphic soils were identified within delineated wetland boundaries and consist of morphological properties signifying temporary and seasonal saturation. Fluvisols are genetically young soils formed from fluvial deposits (sediment). These soils are often associated with low-lying areas such as river plains, fans, valleys, lakes, depressions, dams, and ox-bows (ISRIC World Soil Information, 2024). Fluvisols in the AoI are associated with rivers and some of the tributaries. These soils are periodically flooded during the rainy season and contain large amounts of silt and sand particles

Table 4-3: Summary of Soils Identified within the AoI

FAO (2022)	A-horizon					B-horizon			
	Average Depth (mm)	Clay (%)	Signs of wetness	Rock %	Surface crusting	Depth (mm)	Clay (%)	Signs of wetness	Rock %
Fluvisols	0-300	0-15	Saturated only, no morphological properties	R0	None	N/A			
Skeletic Leptosols	0-150	0-15	None	R4	None	N/A			
Nitic Plinthosols	0-300	0-15	None	R1	None	300-900	15-30	None	R3
Dystric Arenosols	0-300	0-15	None	R0	None	300-1 200+	0-15	Leaching only (lateral movement of water)	R0
Argic Ferralsols	0-300	0-15	None	R1	None	300-1 200+	15-30	None	R2
Ferritic Nitisols	0-300	15-30	None	R0	None	300-1 200+	15-30	None	R0
Hydromorphic/Gleysols	0-300	0-15	W4	R0	None	300-800	15-35	W4	0

W4: Semi-permanent wet
R0: No rock
R1: 2-10% rock
R2: 10-20% rock
R3: 20-30% rock
R4: >30% rock

Figure 4-16: Soil Forms Identified within the AoI. A) Ferritic Nitisol. B) Nitic Plinthosol. C) Skeletic Leptosol. D) Dystric Arenosol. E) Argic Ferralsol Topsoil. F) Ferritic Nitisol Cross Profile (Example of 10% Fine Rock Material). G) Hydromorphic Soil (Gleysol). H) Argic Ferralsol Subsoil.

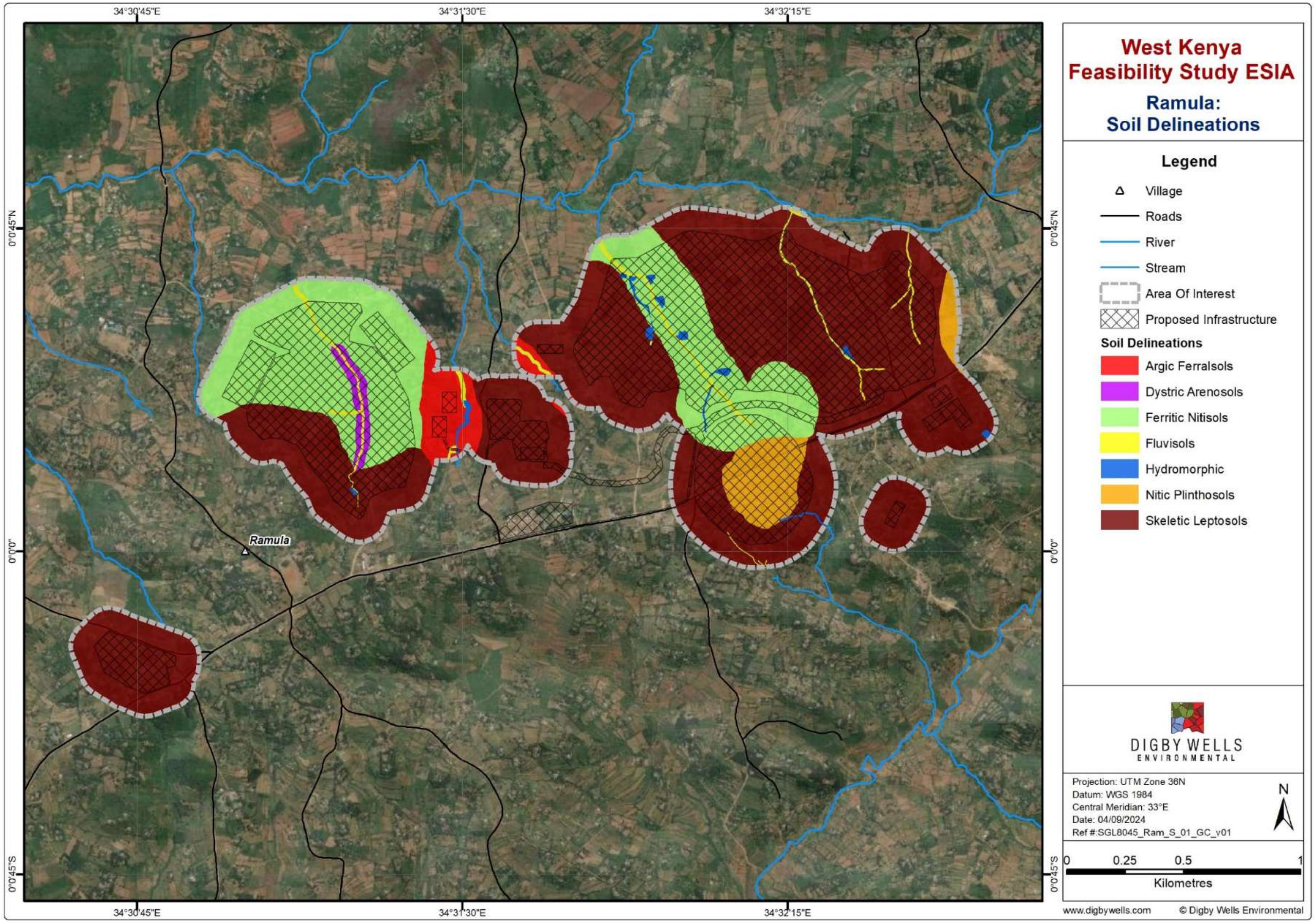


Figure 4-17: Soil Delineations within the AoI

4.5.5. Agricultural/Land Potential

The following sections include the baseline findings associated with the climate capability, land capability, and land potential of the AoI.

4.5.5.1. Climate Capability

The MAP of the region is 1 689 mm (Figure 4-2) with the annual potential evaporation rate determined to be between 1 800 mm and 2 000 mm (Dagg, Woodhead, & Rijks, 2009) (an average of 1 900 mm was considered).

The climate capability for this region was calculated and determined to be “C1” considering the MAP to evaporation rate ratio as well as monthly and annual average temperatures. The C1 climate capability class is characterised by ”none to slight” limitations. This climate is deemed favourable for good yields for a wide range of adapted crops throughout the year (Smith, 2006).

4.5.5.2. Land Capability

A breakdown of the land capability classes is shown in Table 4-4. This information provides vital inputs into the land capability of the AoI. Slope percentage plays an integral role in land capability calculations, this necessitates the need to group the relevant slope classes. The slope percentages (that contribute to land capability calculations) have been divided into five slope classes as per the methodology described in (Smith, 2006) as follows:

1. Slope Class 1 (0-3%);
2. Slope Class 2 (4-8%);
3. Slope Class 3 (8-12%); and
4. Slope Class 4 (>12%).

These slope classes, together with other physical properties were used to calculate the land capability classes (referred to as Land Capability (LC) Class I to VIII). Table 4-5 and Figure 4-18 illustrate the land capability results calculated for the AoI. The land capability results indicate a dominance of non-arable soils in the form of Leptosols. Regardless of the slope percentage, the land capability of these soils will always be Class VI considering the limited depth of the soil. 34.52% of the AoI was calculated to be arable (Class II, III and IV). All wetland areas are classified as Class V land capability considering restrictions on saturation. The parameters considered for each soil form in calculating the land capability is detailed in Table 4-4.

Table 4-4: Parameters Used for Land Capability Calculations

Soil Form	Topsoil Clay Percentage	Depth of Soil Form (mm)	Permeability Class (7 highest and 1 lowest)
Ferritic Nitisols	15-35	>800	3/4
Nitic Plinthosols	0-15	>800	3/4
Dystric Arenosols	0-15	>800	5/6
Argic Ferralsols	0-15	>800	4/5
Hydromorphic	Hydromorphic due to signs of wetness within first 200 mm		
Fluvisols	0-15	<200	7
Skeletic Leptosols	0-15	<300	7

Table 4-5: Land Capability in the AoI

Soil Form	Slope Class	Land Capability Class	Percentage Coverage in AoI	Definition of Class	Conservation Actions Needs	Land Use Suitability	Land Capability Group
Ferritic Nitisols	1 and 2	Class II	6.62	Slight limitations, high arable potential and low erosion hazard.	Adequate run-off control.	Annual cropping with special tillage or ley (25%)	Arable
Nitic Plinthosols	1 and 2	Class III	11.76	Moderate limitations with some erosion hazard.	Special conservation practice and tillage methods are required.	Rotation of crops and ley (50%).	
Dystric Arenosols							
Argic Ferralsols							
Ferritic Nitisols	3						
Nitic Plinthosols	3 and 4	Class IV	16.14	Severe limitations, low arable potential, and high erosion hazards.	Intensive conservation practices are required.	Long-term leys (75%).	
Dystric Arenosols							
Argic Ferralsols							
Ferritic Nitisols	4						
Hydromorphic	All	Class V	0.66	Watercourse and land with wetness indicators.	Protection and management of groundwater table.	Improved pastures, suitable for wildlife.	Grazing
Fluvisols	All	Class VI	64.82	Limitations preclude cultivation. Suitable for perennial vegetation.	Protection measures for the establishment, e.g., sod-seeding.	Grazing pasture and afforestation.	
Skeletic Leptosols							

Ley farming is the practice of growing grasses or legumes in rotation with grain or tilled crops.
Sod-seeding is the method used to place seeds directly into the soil.

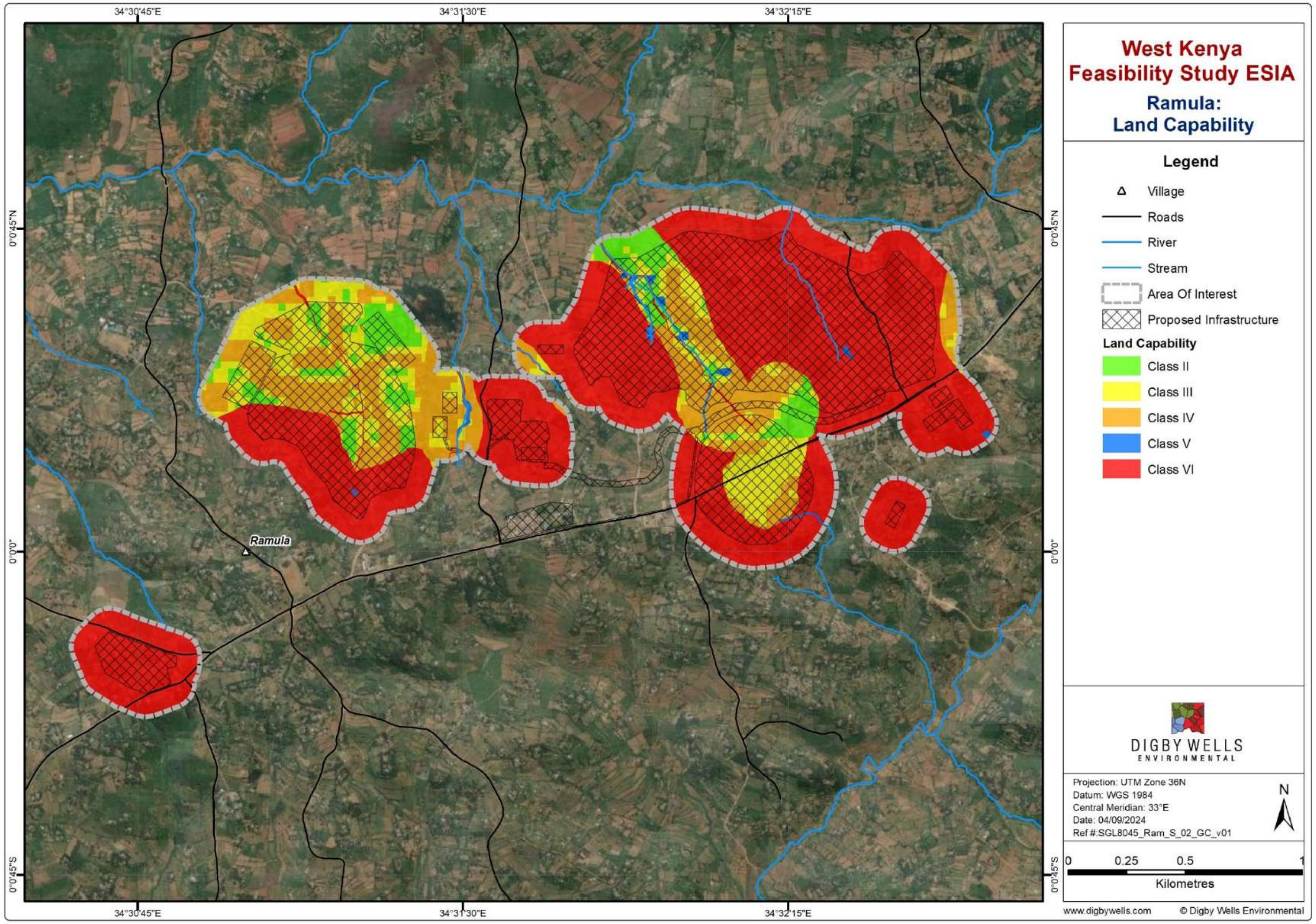


Figure 4-18: Land Capability Classes within the AoI

4.5.5.3. Land Potential

The land potential is defined as a combination of the land capability and the climate capability of the area. It therefore represents the potential of land, for dry-land cultivation considering the potential of the soil as well as the climate. The land potential was determined using the methodology described in Table 4-6 and illustrate in Figure 4-19. The land potential has been grouped as follows:

- The land capability Class II is classified as land potential “L1”;
- The land capability Class III and IV has been determined to be a land potential level of “L2”;
- The land capability Class VI has been determined to be a land potential level of “L4”; and
- The wetland areas classified as Class V have been classified as having a land potential of “Hydromorphic/Marsh”.

The land potential of watercourses (hydromorphic/ march) is not assigned a specific land potential class (according to the relevant methodology) but is rather considered to be Hydromorphic regardless of the slope percentage of the area classified. Figure 4-19 illustrates the land potential of the AoI.

The highest land potential is that of “L1”, which is classified as having very high potential and little limitations due to a combination of soil, slope and climate. The land potential with the highest coverage is that of “L4” which is characterised by a moderate potential. The climate is ideal for crop production in the area, however, the largest portion of the AoI is characterised by shallow soils, which only allow a moderate potential. Overall, 6.62% of the AoI is characterised by a very high potential, 27.9% by a high potential and 64.82% by a moderate potential.

Table 4-6: Land Potential for the AoI

Land Capability Class	Land Potential	Percentage Coverage in AoI	Description of Land Potential Class
Class II	L1	6.62	Very High Potential. No limitations and appropriate contour protection must be implemented and inspected.
Class III	L2	27.9	High potential. Very infrequent and/or minor limitations due to slope, temperature, soil or rainfall. Appropriate contour protection must be implemented and inspected.
Class IV			

Land Capability Class	Land Potential	Percentage Coverage in AoI	Description of Land Potential Class
Class V	Hydromorphic[6]/Marsh	0.66	This land potential is associated with hydromorphic/marsh conditions and is not suitable for agriculture and acquires necessary management discussed in the Wetland Baseline and Impact Assessment (Digby Wells, 2024).
Class VI	L4	64.82	Moderate potential. Moderately regular and/or severe to moderate limitations due to soil, temperatures, slope or rainfall.

[6] All watercourses on-site are classified as a "hydromorphic / watercourse" land potential instead of being assigned a land potential class as per the relevant methodology.

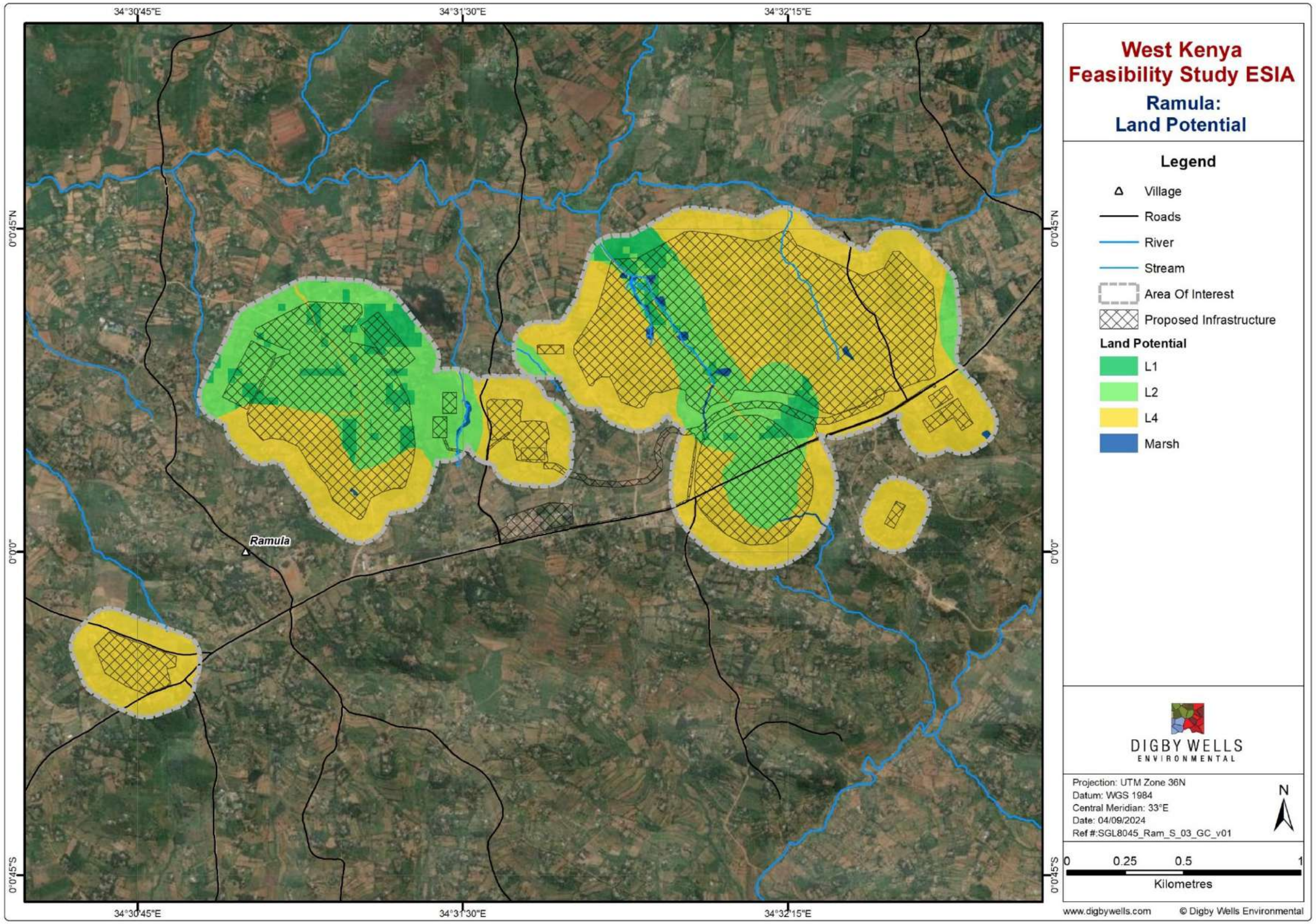


Figure 4-19: Land Potential for the AoI

4.5.6. Soil Sensitivity

The sensitivities are based on the land potential levels. The land potential level “L1” is the highest land potential level within the AoI and is scored a “Very High” sensitivity. The hydromorphic/marsh soils have not been assigned any sensitivities, as these sensitivities are detailed in the Wetland Baseline and Impact Assessment (Digby Wells, 2024). The sensitivity of the land potential levels is illustrated in Table 4-7 and Figure 4-20, and ranges from moderate to very high. These sensitivities will be used to refine the impact assessment significance ratings.

Table 4-7: Sensitivity of the AoI

Land Potential Level	Sensitivity	Percentage Coverage
Hydromorphic/Marsh	Not Applicable*	0.66
L1	Very High	6.62
L2	High	27.9
L4	Moderate	64.82

* Hydromorphic/Marsh areas have not been assigned sensitivity scores, as this has been assessed in more detail in the Wetland Baseline and Impact Assessment (Digby Wells, 2024)

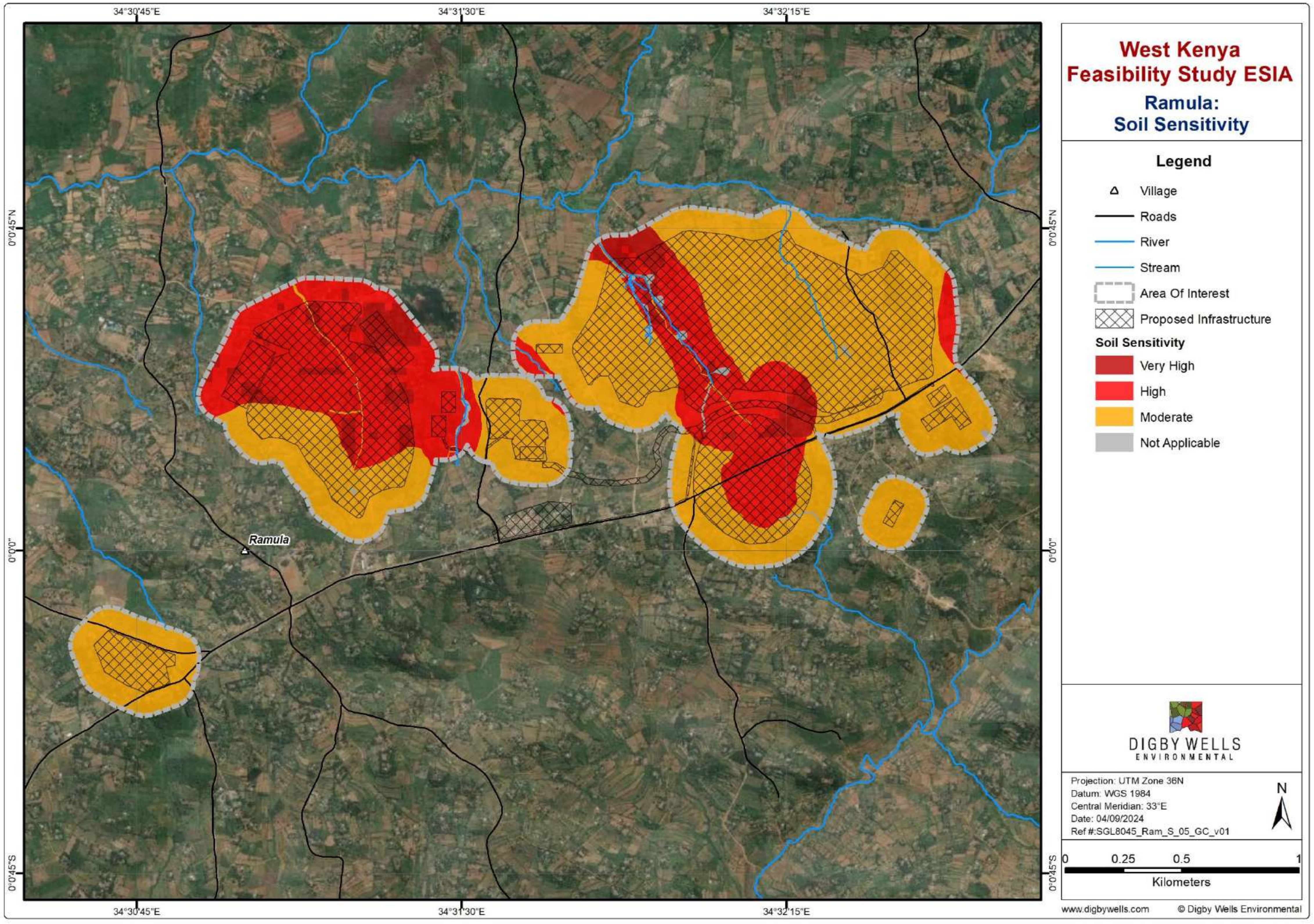


Figure 4-20: Land Potential Sensitivity for the AoI

4.5.7. Current Land Use/Cover

The land use within the AoI was identified through aerial imagery (Google Earth imagery 2024) during the desktop assessment and was verified during the field survey. The dominant land uses (Figure 4-21) were identified as:

- Built Areas;
- Crops;
- Rangeland; and
- Eucalyptus Trees.

Built-up areas completely transform the soil's land capability (either arable or non-arable) to built-up (no land capability). Crop fields do not change the land capability of soil resources but do have an impact on soil physical and chemical properties. Crops extract nutrients which in most-cases are permanently depleted unless amelioration takes place. Tillage in turn affects the physical properties of soils and exposes soils to irregular evaporation rates which could affect the soil organic material composition.

Rangelands have less of an impact on soil resources, besides regular Alien Invasive Plant (AIP) infestation and overgrazing. *Eucalyptus* plantations result in a complete loss of basal cover due to a lack of sunshine to the soil surface. This in turn leads to higher overland flow velocities and subsequent erosion. The AoI is dominated by crops, followed by built areas. Rangeland and *Eucalyptus* trees both cover 3% of the AoI. These land uses all contribute to levels of modification to soil resources throughout the AoI. The coverage of the identified land uses is shown below and illustrated in Figure 4-21.

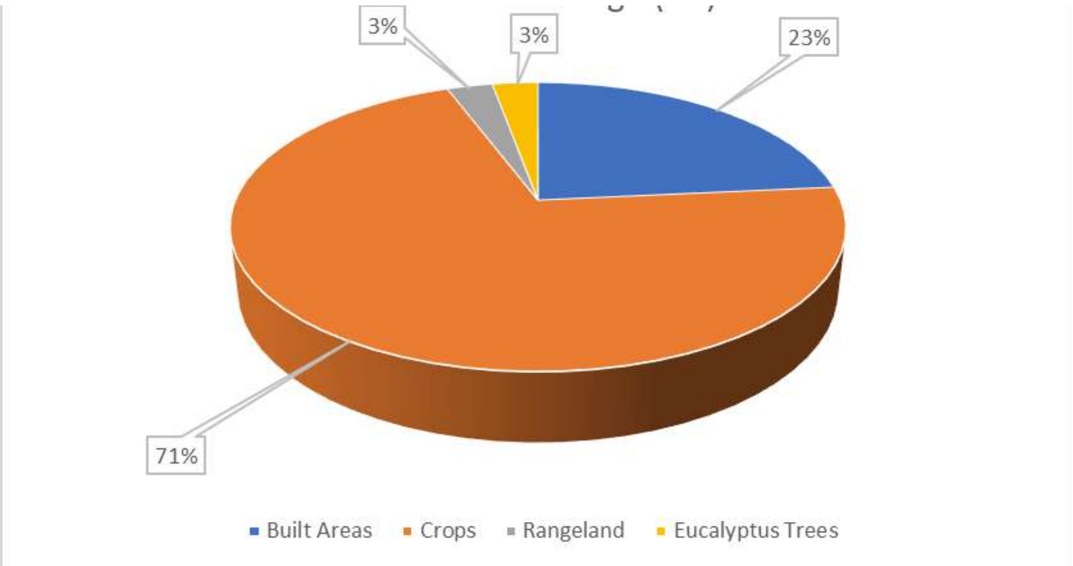


Figure 4-21: Land Use Coverage of the AoI (ha)

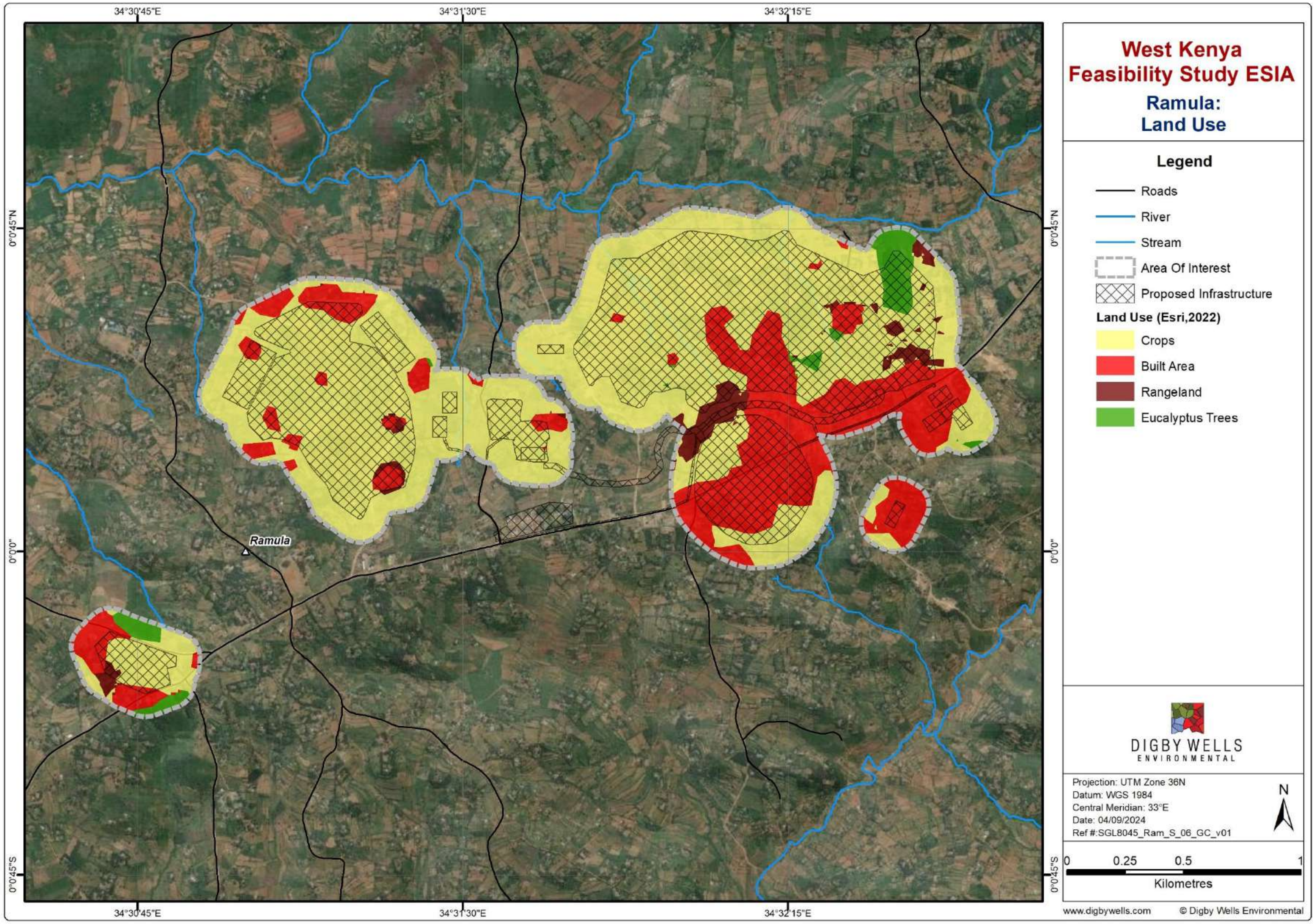


Figure 4-22: Land Uses for the AoI

4.5.8. Soil Chemical and Physical Characteristics

A total of 15 soil samples were collected (from topsoil only). The soil sample location selection process was completed during the desktop assessment phase based on the proposed layout as provided on the 08 August 2024. The infrastructure layout together with areas likely to be contaminated by existing land uses were sampled. It is worth noting that these sample sites were based on the layout received prior to the site visit, which has slightly changed. The justification for site selection is detailed in Table 4-9 and is based on the initial layout.

Topsoil samples were collected within each of the proposed infrastructure areas (i.e. open pit, processing plant etc.) and sent for laboratory analysis. This will serve as the pre-mining baseline, to which soil should be rehabilitated back to and used as a target for monitoring. This pertains to the level of contamination and current fertility of the soils. Where visible signs of discharging by ASM were observed, the soil was sampled to determine if contamination is present pre-mining. The soil sample sites together with justification as to why the specific sample site was selected are illustrated in Table 4-8 and Figure 4-23.

Fertility analysis was undertaken for the following parameters:

- Electrical Conductivity (EC);
- pH (KCl) (KCl method used to include the reserve acidity in the colloids);
- Phosphorus (Bray I) (methodology used for extracting of a solution with the combination of 0.03 M NH_4F and 0.025 M HCl);
- Texture; and
- Macro nutrients (Calcium (Ca), Magnesium (Mg), Potassium (K) and Sodium (Na).

In addition, the sample were analysed for heavy metals and potential harmful elements. These parameters included:

- Arsenic (As);
- Cadmium (Cd);
- Copper (Cu);
- Lead (Pb);
- Manganese (Mn);
- Mercury (Hg);
- Nickel (Ni);
- Selenium (Se);
- Sulphate (SO_4); and
- Zinc (Zn).

- As a basis for interpreting the data, Soil Screening Values (SSV) and soil fertility guidelines are presented in Appendix B. Yellow indicates values below the SSV, and red indicates values above the SSV, non-coloured values are within the SSV guideline ranges. Various levels of pH exist and range from acidic to alkaline. The colour codes associated with these ranges are noted below 4-11.
- Standards and guidelines were assessed to compensate for thresholds not available in one standard/guideline. The values are representative of the lowest and highest risks to human and animal exposure. Where two or more international standards contradict one another, the conservative/more stringent approach has been implemented. Various parameters are subject to the guidelines presented in the South African Framework of the Management of Contaminated Land (Department of Environmental Affairs, 2010) (South Africa). These guidelines include threshold values for various parameters for respective land uses. The thresholds used in this report are based on the lowest value calculated for each parameter for both the Human Health and Water Resource Protection pathways calculations (Department of Environmental Affairs, 2010) (South Africa).

Table 4-8: Coordinates and Description of Selected Soils Sample Sites

Site	GPS Coordinates (Decimal Degrees)		Description
	X	Y	
1	671633.9	10000703	Office Rental Footprint Area
2	670973.1	10000132	Open Pit Footprint Area
3	670982.4	10000343	Open Pit Footprint Area
4	671212.7	10000161	Alluvial Stream Discharged into by Artisanal Mining
5	670749.9	10000513	Alluvial Stream Discharged into by Artisanal Mining
6	671099.5	9999236	Stream Discharged into by Artisanal Processing
7	669332	10000487	Tailings Storage Facility Footprint Area
8	669199.5	10001076	Stormwater Pond Footprint Area
9	666588.4	10002716	Camp Option 2 Footprint Area
10	668310.9	10001521	Camp Option 1 Footprint Area
11	669768	10000676	Processing Plant Footprint Area
12	670453.7	10001096	Waste Rock Facility Footprint Area
13	669939.9	10000730	Run of Mine Footprint Area
14	670788	10000541	Open Pit Footprint Area
15	670649	9999964	Waste Rock Dump Footprint Area

Table 4-9: Justification of Sample Sites

Sample Number	Justification for Site Selection	Current Impacts	Soil Properties
1	Directly located within the office rental option	Minor physical modifications	Shallow Leptosol
2	Directly located within Ramula Pit	Subsistence Cultivation	Nitic Plinthosol
3	Directly located within Ramula Pit	Subsistence Cultivation	Nitic Plinthosol
4	Downstream of ASM activities. Water is being pumped out from underground and into the watercourse.	ASM activities and potential contamination (no visible signs, water seams clean on basic inspection)	Alluvial sediments from watercourse
5	Downstream of ASM activities. Water is being pumped out from underground and into the watercourse.	ASM activities and potential contamination (no visible signs, water seams clean on basic inspection)	Alluvial sediments from watercourse
6	Downslope of ASM activities (washing material)	Visible alterations to soil morphological properties that could indicate contamination from washing material	Washed sediments
7	Directly located within the proposed TSF	Subsistence Cultivation	Ferritic Nitisol
8	Directly located within the proposed stormwater pond	No significant modifications	Ferritic Nitisol
9	Directly located within proposed camp option 2	No significant modifications	Shallow Leptosols
10	Directly located within proposed camp option 1	No significant modifications	Ferritic Nitisol
11	Directly located within proposed plant shops	No significant modifications	Shallow Leptosols
12	Directly located within the proposed WRD	Subsistence Cultivation	Ferritic Nitisol
13	Directly located within the proposed ROM Pad	Subsistence Cultivation	Shallow Leptosols
14	Directly located within the proposed Ramula Pit	Significant erosion and physical modifications	Ferritic Nitisols
15	Directly located within the proposed WRD	No significant modifications	Shallow Leptosols

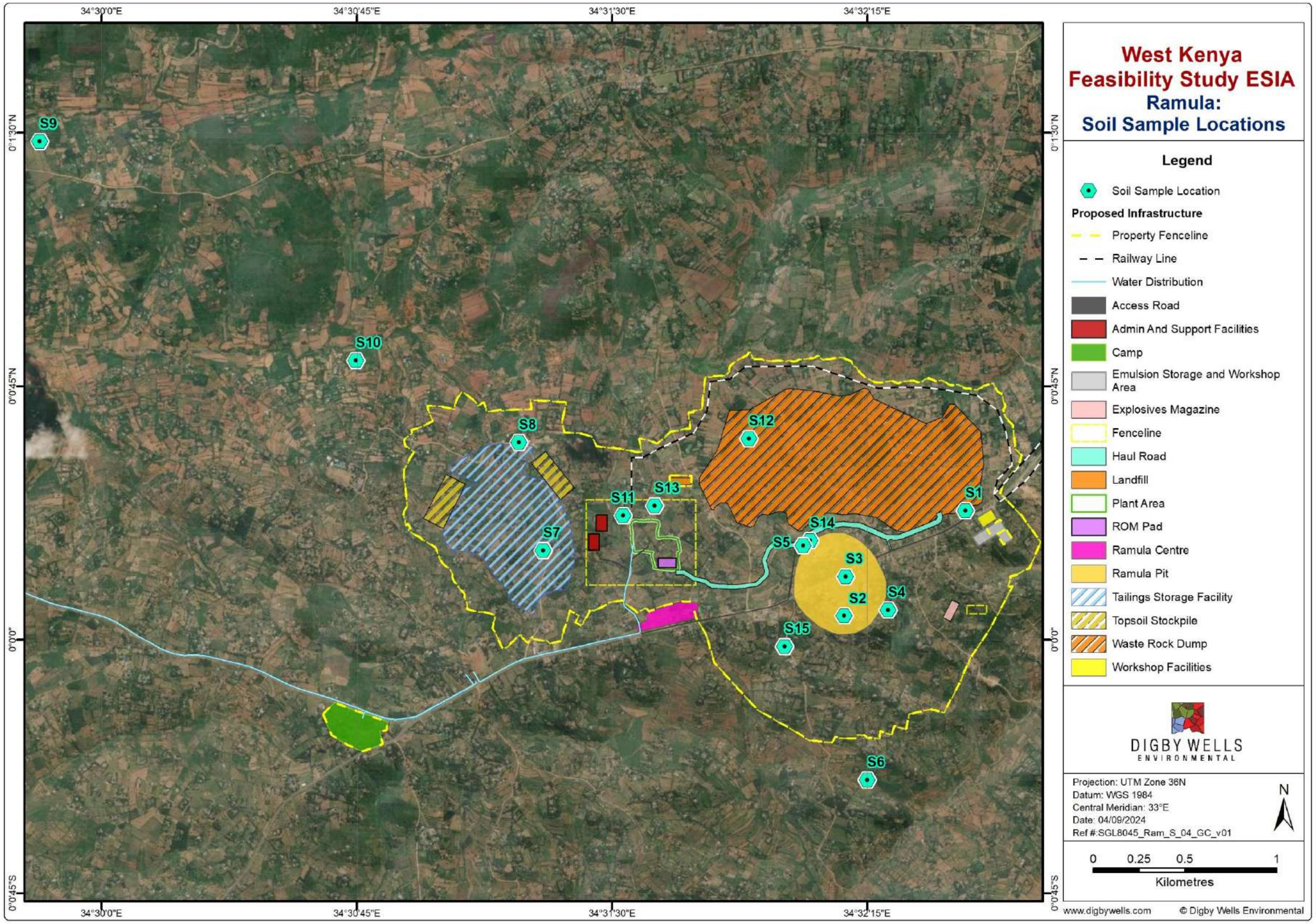


Figure 4-23: Locations of Soil Sample Sites

Table 4-10: Soil Physico-Chemical Properties

Parameters	Units	Lower Limit	Upper Limit	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
Boron (B)	mg/kg	<0.5	>1.5	4.46	1.85	1.15	1.21	1.43	1.17	1.03	1.23	1.05	0.97	1.07	1.07	1.18	1.22	1.26
Calcium (Ca)	mg/kg	<200	>3000	2658.54	998.12	603.46	1412.41	1456.69	781.66	819.38	945.18	701.8	573.07	781.4	863.87	556.19	1440.57	585.22
Electrical Conductivity (EC)	mS/m	110	570	2	16	4	4	7	5	3	6	3	5	7	6	5	2	7
Magnesium (Mg)	mg/kg	<50	>300	640.94	214.19	97.91	494.49	581.95	218.48	163.33	212.42	165.17	247.73	158.14	230.67	123.83	506.11	236.46
pH	-	Scale below*		5.19	6.71	5.03	5.93	6.45	6.1	4.41	5.17	4.48	4.17	5.46	4.83	4.65	5.14	4.72
Phosphorus (P)	Mg/kg	<5	>35	1.03	72.41	12.13	7.22	4.68	2.34	3.49	6.26	4.74	1.3	11.3	2.21	5.8	2.57	9.26
Potassium (K)	mg/kg	<40	>250	80.43	288.76	57.53	88.81	53.56	17.95	58.24	100.87	62.83	84.24	116.82	63.1	67.6	72.75	102.99
Sodium (Na)	mg/kg	<50	>200	163.28	135.71	112.14	129.22	142.78	111.85	77.14	98.69	110.43	121.39	99.85	94.45	80.19	154.6	174.92
Sulphate (SO4)	mg/kg	-	>4 000	9.33	12.03	7.81	6.78	6.84	6.34	6.17	6.49	9.37	8.64	75.65	71.74	79.07	79.06	77.53
Texture				Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam

*pH Scale	
Very Acidic	<4
Acidic	4.1 - 5.9
Slightly Acidic	6 - 6.7
Neutral	6.8 – 7.2
Slightly Alkaline	7.3 - 8
Alkaline	>8

Table 4-11: Soil Physico-Chemical Properties (Harmful Elements)

Parameters	Units	Upper Limit	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
Arsenic (As)	mg/kg	>5.8	1.24	4.74	2.48	1.46	2.73	2.33	3.49	1.61	0.79	1	2.07	1.56	2.64	4.46	1.79
Cadmium (Cd)	mg/kg	>7.5	0.25	0.25	0.2	0.14	0.19	0.28	0.24	0.24	0.18	0.21	0.23	0.22	0.29	0.29	0.27
Copper (Cu)	mg/kg	>16	25.18	18.88	13.23	13.06	16.57	18.03	21.3	15.51	7.56	17.14	14.77	15.61	20.5	24.18	22.18
Lead (Pb)	mg/kg	>20	58.29	12.4	5.97	9.85	10.04	17.33	14.64	16.48	7.61	20.86	2.8	3.59	3.63	3.81	4.17
Mercury (Hg)	mg/kg	>0.93	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
Manganese (Mn)	mg/kg	>740	110.24	195.94	275.86	300.34	657.05	289.38	266.4	255.71	160.06	114.08	191.07	211.3	203.99	125.45	223.74
Nickel (Ni)	mg/kg	>45	1.19	4.7	4.93	1.78	3.04	1.96	5.36	4.18	3.2	3.73	14.54	11.74	19.24	11.31	23.94
Selenium (Se)	Mg/kg	>100	0.17	0.2	0.14	<0.02	<0.02	<0.02	0.14	0.5	0.31	<0.02	<0.02	0.32	0.26	<0.02	<0.02
Zinc (Zn)	mg/kg	>240	29.33	29.28	19.67	18.96	23.78	19.82	27.11	23.27	21.79	15.87	19.72	17.81	19.39	23.21	24.34

4.5.8.1. Soil pH

The pH of the soil samples ranged from 4.17 (Sample 10) to 6.71 (Sample 2), indicating that the soils range from acidic to slightly acidic. The optimal pH for vegetation growth ranges between 5.5 and 7.5. However, some plants have adapted to thrive outside this optimal range. The following can be derived from the data:

- The majority of sample sites are acidic, this includes sample sites constituting unmodified/reference conditions. This is therefore deemed to be natural and can be explained by the sandy loam texture of soils. Where contamination is expected, the pH is closer to being ideal than for reference/unmodified sample sites as is the case with other unmodified areas. No correlation exists between any potential contamination and pH when comparing modified to unmodified sample sites;
- The pH is relatively constant throughout and is not of concern considering that all values represent natural conditions;
- The naturally acidic conditions associated with the AoI could be subject to the following conditions:
  - Damage of plant roots;
  - Effects on plant available nutrients;
  - Aluminium and/or iron toxicity;
  - Effects on micro-organisms; and
  - Poor soil structure.

4.5.8.2. Electrical Conductivity

Electrical Conductivity (EC) is a measure of the amount of soluble salts in the soil. According to the Australian Guidelines, Department of Agriculture and Rural Affairs (1986), the thresholds for low and high EC levels are between 110 and 570 mS/m. The EC values for all sample sites are well below the minimum threshold. This is a natural occurrence considering that the natural/reference sample sites are also characterised by low values. These results indicate very low concentrations of soluble salts. Considering the fact that macro nutrient concentrations are considered to be good, the low EC values are not of concern to fertility.

4.5.8.3. Basic Cations

The Ca concentrations of all soil samples are ideal with no changes from disturbed sample sites to undisturbed sample sites. This indicates that subsistence farming and ASM activities have not affected the Ca concentration of any sample sites.

Four sample sites are characterised by excessive Mg, namely Sample Site 1, 4, 5 and 14. Sample Sites 4 and 5 are associated with ASM activities, whereas Sample Site 1 and 14 are characterised by physical disturbances only which is unlikely to cause an increase in Mg. The sample sites associated with ASM were collected from watercourses. It is assumed that weathering processes within these watercourses are likely responsible for the increase in Mg, considering the fact that a terrestrial area characterised by severe ASM (Sample Site 6) activities did not indicate an increase in Mg.

The Na values for all sample sites are considered ideal in respect to the fertility guidelines. The Na concentrations within soil should ideally be lower than K. If Na levels exceed that of K, the Na cations will replace that of K from a CEC point of view seeing that plants require large amounts of K compared to other elements (Fertilizer Society of South Africa, 2007). This is the case for most sample sites due to naturally lower K levels and is therefore not deemed to have been caused by any land use activities.

Only Sample Site 2 exceeds the maximum thresholds of K potentially due to over fertilization of K-rich fertiliser. This sample site only slightly exceeds the maximum threshold and is not deemed to be of concern. One sample site (Sample Site 6) is characterised by a K concentration below the minimum threshold. The material washed into the area sampled (from ASM activities) have undergone significant modifications due to excessive washing. This has likely caused K to leach out. This deficiency can easily be rectified by means of fertiliser application.

4.5.8.4. Phosphorus

The P concentrations in the majority of sites are below the minimum fertility guidelines. This is normal for Nitisols, which dominate the area (ISRIC World Soil Information, 2024). One key concern is the P concentration of Sample Site 2, which exceeds the maximum fertility threshold two-fold. This sample site was flagged for a high K concentration potentially due to over-fertilising. Over fertilising with K and P-rich fertiliser is likely the cause for these excessive nutrient concentrations.

4.5.8.5. Anions

The South African Framework for the Management of Contaminated Land (DEA, 2014), guides contamination from anions. The SO_4 concentrations of all of the sample sites are very low and within the DEA thresholds.

4.5.8.6. Heavy Metals and Potential Harmful Elements

Only two heavy metals are found to exceed the relevant SSV values (indicating contamination through inorganic compounds), including Cu and Pb. The Cu SSV value is exceeded at seven sample sites, of which only one has been affected by ASM activities. The majority of these sample sites are unmodified concerning land uses that potentially could cause contamination. No correlation exists between Cu concentrations and land uses to suggest contamination. The high Cu concentrations are therefore deemed to be natural.

The Pb SSV threshold is exceeded at two sample sites, namely Sample Site 1 and 10. No land use activities were identified in these sample areas to suggest contamination. Unlike Cu, Pb is an uncommon element in soil material. Sample Site 10's Pb concentration exceeds the SSV threshold by 0.86 mg/kg only, which is deemed acceptable. Slight discrepancies from laboratories are common and could be the reason for the slight exceedance. As for Sample Site 1, the Pb concentration exceeds the SSV threshold three-fold. Even though no direct evidence of contamination was noticed on-site or from historical satellite imagery, a once-off spillage from ASM miners passing by could be an explanation for contamination at this sample site as Pb is one of the heavy metals commonly associated with ASM activities (Landrigan, et al., 2022).

4.6. Surface Water

A Surface Water Assessment was conducted as part of this EIA process and is included in Appendix F. A baseline assessment was conducted to establish the prevailing hydrological and climate characteristics of the Project area prior to the establishment of the proposed infrastructure and relative activities.

To establish the baseline conditions surface water quality was analysed using the latest and previous historical surface water quality results. Water quality was then benchmarked against the 2006 Kenya Environmental Management and Co-ordination (Water Quality) Regulations for Domestic Water Use, the 2022 World Health Organisation (WHO) drinking water guidelines, and the 2007 IFC effluent guidelines.

The subsections below describe the hydrological setting of the Project area and the assessed surface water quality.

4.6.1. Hydrological Setting

This section provides a detailed description of the regional and local hydrological setting of the Project area which includes rivers, its natural drainage, and catchment area. Figure 4-24 shows the hydrological setting of the Project area.

4.6.1.1. Regional Hydrological Setting

The Project area is found within the Siaya County while a small portion of the Project area resides within the Vihiga and Kisumu County. The Project area is situated within the Yala Catchment which is one of the important tributaries of the Lake Victoria North Basin (LVB) (MineScope Services Pty Ltd , 2018). The Yala catchment is divided into three sub-catchments, the upper, lower, and middle catchments, the division is based on the gauging station at each outlet (Sabuni, Wanambacha, & Kiluva, 2015) and the Project area is found in the lower catchment.

The Yala River stretches a distance of 219 km which originates in the Nandi Escarpments, located in the Rift Valley Province (Okune P. O., 2019). Its catchment area is estimated to be 3 111 km^2 (Sang, et al., 2008). One of the main water sources for the Yala River is Lake Lessos (Boye, Verchot, & Zomer, 2008). The Yala River feeds into the Yala Swamp (Kenya's largest freshwater wetland) which covers 175 km along the northern shores of Lake Victoria, before draining into Lake Victoria (Okune P. O., 2019).

The Dhene River is located north-west of the Project area and it is a major tributary of the Yala River. Awach River arises from the Meneno highlands and flows along the south-east boarder of the Project area and drains into Lake Victoria further downstream of the Project area.

Lake Victoria is one of the outstanding features of the LVB and it is one of Africa's largest freshwater lakes shared between Tanzania, Uganda, Kenya, Rwanda, and Burundi (Britannica , 2023). The Lake has a catchment area of 18 500 km^2 and the water contained in the lake from the LBV is further carried out by the Nile River (Miriti, n.d; Water Resource Authority, 2022).

4.6.1.2. Local Hydrological Setting

The proposed Project area and associated infrastructure are drained mostly by tributaries of the Dhene River (namely, Syayusi Stream, Auromena Stream, Madawo Stream, Abururu Stream and Auralwanda Stream) and Awach River (namely, the Munungo Stream).

The Project area is found upstream of the Abururu stream that confluences the Dhene River in a north-easterly direction. The proposed WRD is found upstream of the Syayusi and the Auromena streams which both discharge into the Dhene River. The proposed ROM is found upstream of the Madawo stream which confluences the Ko'Tiende stream and further flows into the Dhene River. The Auralwanda stream, which is east of the Ramula resource, flows in a northerly direction before joining the Dhene River, the proposed fence line will be situated where Auralwanda stream flows. The proposed Ramula-Mwibona pit will be situated upstream of the Munungo stream which flows in a south-eastly direction and joins the Awach River.

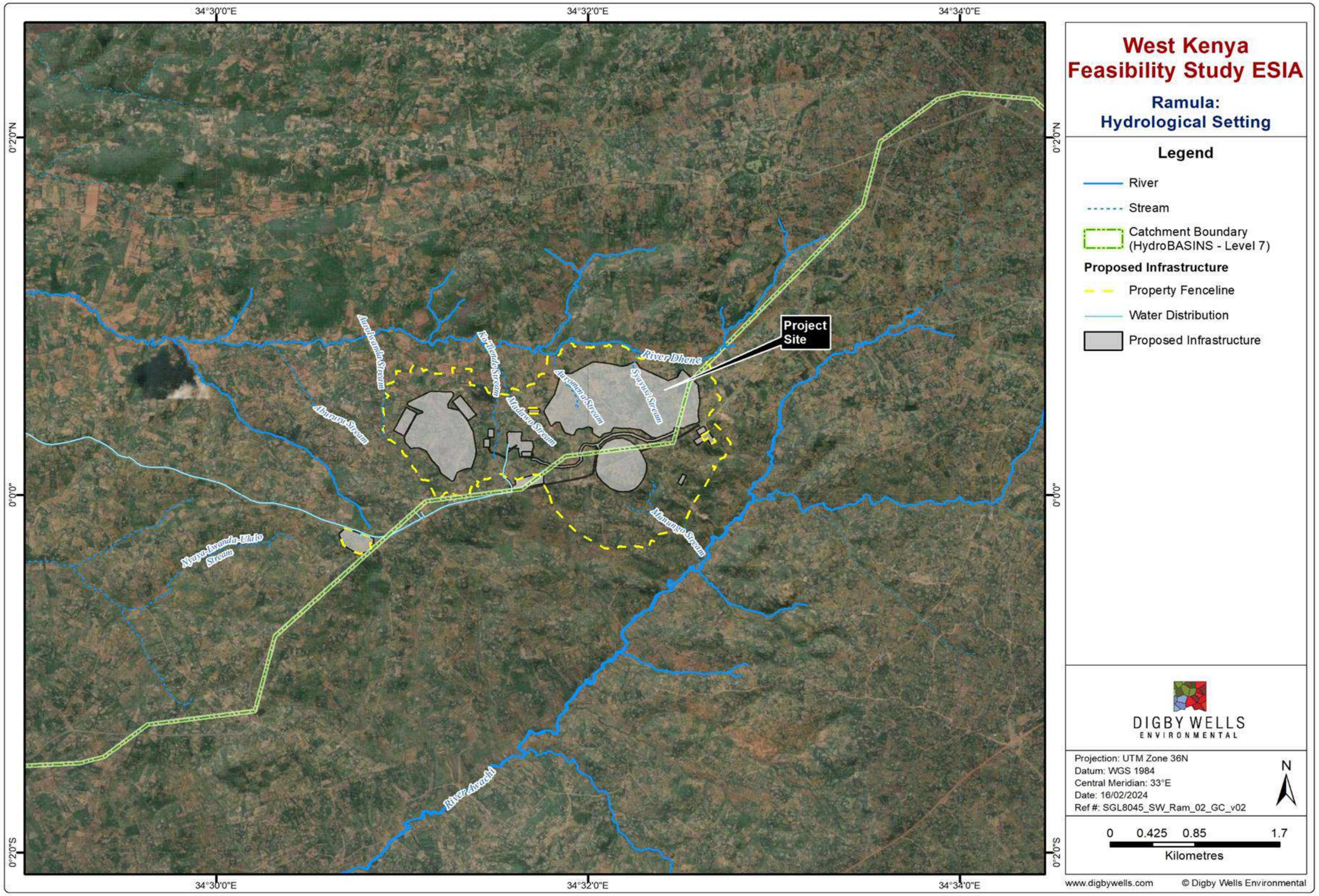


Figure 4-24: Regional Hydrological Setting

4.6.2. Surface Water Quality

The water quality results used to describe the baseline water quality conditions were obtained from the Government Chemist’s Department for the period of 2021 – 2023 (Goverment Chemist's Deparment Kisumu Laboratorty, 2023).

4.6.2.1. Surface Water Quality and Monitoring Locations

Table 4-12 and Figure 4-25 present the selected monitoring points within the proximity of the Project area. The results were benchmarked against the 2006 Kenya Environmental Management and Co-ordination (Water Quality) Regulations for Domestic Water Use, the 2022 WHO drinking water guidelines and the 2007 IFC effluent guidelines.

Table 4-12: Surface Water Monitoring Points

Description	Latitude	Longitude
River Awach Downstream	0° 1'40.44"S	34°31'18.31"E
River Dhene Downstream (Siala-Onding' Bridge)	0° 1'15.64"N	34°28'30.10"E
River Dhene Midstream (Nyangulu/Onding Bridge)	0° 0'52.97"N	34°30'48.07"E
River Dhene Upstream Emmuli Elukala	0° 1'26.90"N	34°33'15.38"E
River Yala Downstream (Rera/Wagai Bridge)	0° 0'35.56"N	34°26'27.66"E
River Yala Wagai Bridge	0° 0'35.56"N	34°26'27.66"E

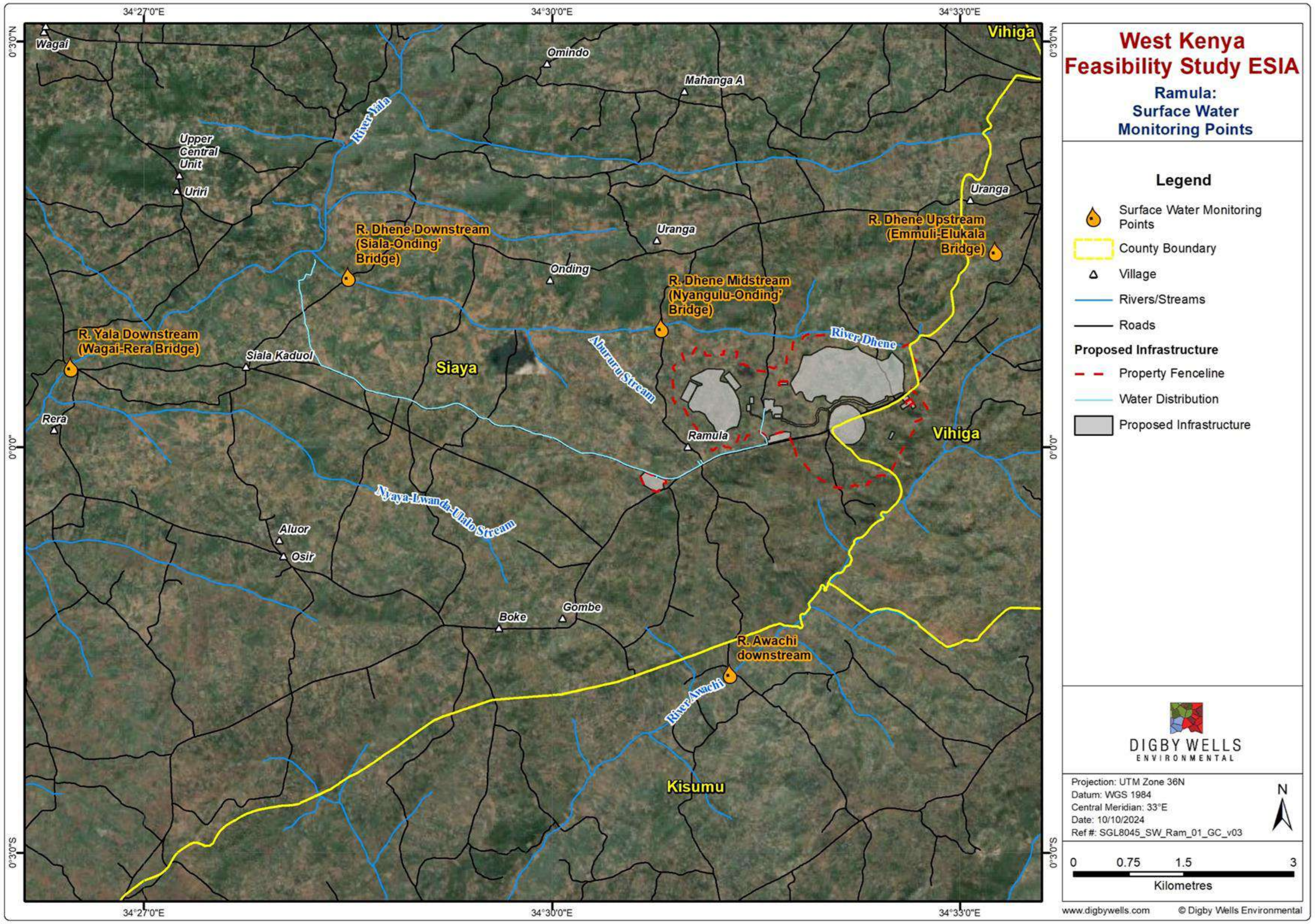


Figure 4-25: Surface Water Monitoring Points

4.6.2.2. Surface Water Quality Description

The results are presented on Table 4-13, the follow observations were made:

- *Nitrate* (NO_3) exceeds the Kenya Standards for domestic water use of 10 mg/L and does not meet the required target of the WHO guidelines of 50 mg/L in 2022 for upstream and downstream monitoring locations of the Dhene River and in 2023 for the downstream monitoring location of the Yala River (Rera/Wagai Bridge) and midstream of the Dhene River. High level of NO_3 could be as a result of livestock and farming practices that occur in the area or the result of artisanal mining;
- The concentration of *Fluoride* (F) exceeds both the Kenya standards and the WHO guidelines of 1.5 mg/L at the downstream monitoring location of the Yala River and Midstream of River Dhene. The downstream monitoring location of the Yala Rive only started exceeded the stipulated limits in October 2023, however recent results show that the limits are still being exceeded. This increase could be a result of natural processes such as weathering of rocks and sediments;
- *Manganese* (Mn) concentrations did not meet the WHO guidelines downstream of Yala River and midstream of River Dhene during October 2023 and January 2023, respectively. The presence of Mn in streams and rivers is due to human activities or Mn being dissolved into water from rocks;
- *Total Dissolved Solids* (TDS) describe the amount organic material and salts that are present in water. Various monitoring points in the Dhene river and the Awach River do not meet the IFC guideline of 50 mg/L for TDS, however it does not exceed 1 200 mg/L for the Kenya standards. TDS that exceeds 1 000 mg/L is regarded as a level of concern (World Health Organisation, 2022). The amount of TDS could be due to runoff from wastewater; and
- *pH* is a measure of acidity and basicity. pH values that are above 7 is usually described as basic or alkaline in water and pH values below 7 is described as acidic. The pH of water samples ranges from 7.56 – 8.05 which meets the target range of the IFC guideline of 6 – 9 and Kenya Standards for domestic water use of 6.5 - 8.5.

Overall, the water quality results indicates that NO_3 is a parameter of concern. Parameters such as $NO_{3,}$ F, Mn, and TDS are being influenced by agricultural activities, anthropogenic activities and the weathering of rocks and sediments. It is recommended that continuous monitoring should be done on streams that confluence the Dhene and Yala river to ensure that the Project area is not a contributing factor to the elevated parameters. Surface water quality monitoring should continue to detect pollution sources that would potentially rise from the Project area in order to implement mitigation measures at source before pollutants spread to other areas.

Table 4-13: Water Quality Results

Parameters		Kenya standards for Domestic Water (2006)	IFC Effluent Guidelines (2007)	WHO Drinking Water Guidelines (2022)	River Awach	River Dhene Downstream Ciala-Rera Bridge	River Dhene Upstream Emmuli Elukala	River Dhene Onding Bridge	River Yala Wagai Bridge	River Yala Downstream (Rera/Wagai Bridge)				River Dhene Midstream (Nyangulu/Onding Bridge)
Dates	Units				30/09/2021	01/02/2022		05/05/2022		24/01/2023	12/10/2023	19/12/2023	6/01/2024	24/01/2023
PH		6.5 -8.5	6.0-9.0	NG	7.56	8.05	7.41	7.60	7.64	7.80	7.49	7.7	7.45	7.72
Temperature (Ambient)	ºC	NG	NG	NG	25.90	26.90	26.10	25.10	24.00	26.10	ND	ND	ND	26.20
Turbidity	NTU	NG	NG	NG	303.00	347.00	71.30	332.00	171.00	44.60	151	284	150	357.00
Colour		NG	NG	NG	0.00	1.33	0.00	0.00	0.00	0.00	ND	ND	ND	0.00
Sodium (Na+)		NG	NG	50	0.17	1.13	1.35	0.11	0.07	0.83	14.6	4.46	5.04	1.16
Chlorides (Cl-)		NG	NG	NG	5.03	6.15	5.51	3.38	3.85	6.53	2.86	2.11	3.11	5.51
Phosphorous (PO_4)		NG	NG	NG	0.30	0.02	0.01	0.10	0.01	0.02	0.095	0.056	0.14	0.03
Nitrates (NO_3)		10	NG	50	2.30	83.00	68.00	3.72	3.73	67.00	ND	5.14	5.62	66.00
Nitrites (NO_2)		3	NG	3	0.60	0.03	0.03	0.02	0.01	0.22	0.009	0.018	0.011	0.15
Iron (Fe^{2+})		NG	2	NG	0.00	0.07	0.05	0.01	0.03	0.12	< 0.01	2.13	6.45	0.59
Fluorides (F)		1.5	NG	1.5	0.11	0.07	0.07	0.08	0.00	0.10	0.29	0.39	0.21	0.24
Manganese (Mn)		NG	NG	0.08	0.00	0.01	0.01	0.01	0.02	0.01	0.096	< 0.01	< 0.01	0.11
Sulphates (SO_4^{2+})		NG	NG	NG	0.00	10.00	11.00	8.00	3.00	0.00	1.92	2.03	3.22	0.00
Total Alkalinity ($CaCO_3$)		NG	NG	NG	66.00	112.00	342.00	34.00	44.00	48.00	ND	43.9	78.1	136.00
Total Hardness ($CaCO_3$)	mg/L	NG	NG	NG	32.00	168.00	404.00	60.00	60.00	82.00	77.4	25.7	24.6	164.00
Electrical Conductivity		NG	NG	NG	137.30	220.00	1140.00	130.20	76.80	99.00	0.077	0.078	0.07	217.00
TDS		1200	50	NG	67.00	108.00	659.00	64.00	38.00	49.00	48	49	44	106.00
Oil, Gas and Fats		NG	NG	NG	0.00	0.00	0.00	0.00	0.00	0.00		0.008	0.012	0.00
Lead (Pb)		0.05	0.2	0.01	0.00	0.00	0.00	0.00	0.00	0.00	< 0.009	< 0.009	< 0.009	0.00
Cadmium (Cd)		0.01	0.05	0.003	0.00	0.00	0.00	0.00	0.00	0.00	< 0.002	< 0.002	< 0.002	0.00
Arsenic (AS)		0.01	0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00	< 0.007	< 0.007	< 0.007	0.00
Copper (Cu)		0.05	0.3	2	0.00	0.00	0.00	0.00	0.00	0.00	< 0.01	< 0.01	< 0.01	0.00
Nickel (Ni)		NG	0.5	0.07	0.00	0.00	0.00	0.00	0.00	0.00	< 0.003	< 0.003	< 0.003	0.00
Zinc (Zn)		NG	0.5	NG	0.03	0.02	0.02	0.00	0.00	0.07	< 0.01	< 0.01	< 0.01	0.04
Total Coliform Count		NG	NG	NG	0.00	770.00	257.00	0.00	0.00	197.00	ND	> 1800	920	47.00
E.coli Count		NG	NG	NG	7.00	229.00	43.00	0.00	0.00	31.00	ND	ND	7	8.00

Key

Green Highlight: Exceeds Kenya standards for Domestic Water (2006)
Yellow Highlight : Exceeds IFC Effluent Guidelines (2007)
Blue Highlight: Exceeds WHO Drinking Water Guidelines (2022)
Light Red: exceeds more than one set of Guidelines

ND: No data

4.7. Groundwater

A groundwater assessment was conducted as part of the EIA process and is indicated in Appendix G. Rural Focus was appointed by SGKL to undertake the hydrocensus, geophysical surveys, drilling supervision, and aquifer testing supervision. Digby Wells provided remote support to Rural Focus, reviewed the information collected as well as interpreted the results.

4.7.1. Hydrogeological Setting

4.7.1.1. Aquifer Characterisation

The Project area is underlain by rocks of mainly volcanic and volcaniclastic origin that are intensively jointed, fractured and faulted, and covered with a layer of weathered materials. The Project is situated in an area characterised by intermediate groundwater potential (DHV Consultants, 1988).

Based on the local geology, the following hydrogeological units are present:

- *Alluvial Sediment Unit* - are locally present at surface, mainly associated with rivers and streambeds. These zones may have higher hydraulic conductivities, but will likely be limited in extent and depth;
- *Weathered zone* – chemical weathering processes within tropical climate areas results in the formation of a saprolite layer. The saprolite in the Project area varies spatially but has an average thickness of 20 m. The hydraulic properties of the Kavirondian (Conglomerate) rocks produces slightly higher yields of between 2 m^3/hr to 5 m^3/hr (DHV Consultants, 1988; County Government of Siaya, 2018). Typical hydraulic conductivities for weathered igneous rocks range between 4.8×10^{-2} m/d and 4.5 m/d (Domenico & Schwartz, 1990);
- *Transitional zone* – below the highly weathered saprolite zone, weathering can extend for an additional 6 m (on average) which is represented by saprock lithologies. Saprock comprises of fresh parent rock core-stones which are enclosed by weathered material. The thickness of the transitional zone also varies spatially across the Project area. Water strikes were encountered at the contact of this zone with the underlying fresh bedrock (County Government of Siaya, 2018);
- *Fresh bedrock* – the fresh bedrock comprises of conglomerates, diorite and intermediate volcanic rocks. The hydraulic properties within this hydrostratigraphic unit are typically controlled by the presence of fractures. Conglomerates may have primary porosity present which would increase the hydraulic properties within this lithological unit (County Government of Siaya, 2018). Typical hydraulic conductivities for fractured igneous and metamorphic rocks range between 6.9×10^{-4} m/d and 2.6×10^{-1} m/d. Unfractured igneous and metamorphic rocks typically range between 2.6×10^{-9} m/d and 1.7×10^{-5} m/d (Domenico & Schwartz, 1990);

- *Dolerite and mafic intrusions* - these are mainly linear units which have intruded into the surrounding volcanics. These units mainly have low hydraulic properties with possible increased hydraulic properties for contact zones (County Government of Siaya, 2018) ; and
- *Ramula fault* - a regional fault with a west-northwest and east-northeast orientation which transects the site along the northern side of the proposed Ramula-Mwibona open pit. This fault may be open to groundwater flow, while possible secondary faulting with similar orientation may also increase hydraulic properties (County Government of Siaya, 2018).

4.7.1.2. Aquifer Properties

4.7.1.2.1. Aquifer Test Results

Rural Focus undertook aquifer testing on six boreholes between August and September 2024 (Figure 4-27). The results were analysed by Digby Wells using Aqtesolv Cooper-Jacob and Theis solutions for confined aquifers to provide the hydraulic properties of the intersected aquifers. The constant discharge test results are provided in Table 4-14. The interpretations are provided in Appendix D. The results give a range in hydraulic conductivities of between 0.006 m/d and 0.5 m/d, with a harmonic mean of 0.02 m/d.

Boreholes RBH01 and RBH06 do not have a water strike (but did intersect seepage) show a range in hydraulic conductivity between 0.006 m/d and 0.1 m/d. Boreholes Munungo, RBH02, RBH04, RBH05 and RBH07 have water strikes within the weathered and fractured aquifers and show a range in hydraulic conductivity of 0.02 m/d and 0.5 m/d. Borehole RBH08 only has water strikes in the fractured aquifer with a lower hydraulic conductivity of 0.06 m/d.

Table 4-14: Constant Discharge Test Results

BH ID	Depth	Pump Depth	SWL	Saturated Aquifer Thickness	Lithology and Water Strikes	Available Drawdown	Pump Yield	Total Drawdown	Test Duration	Recovery time	Recovery %	Transmissivity					Hydraulic Conductivity
												Cooper-Jacob - early T	Cooper-Jacob - late T	Theis	Theis Recovery	Average	
	mbgl	mbgl	mbgl	m		m	l/s	m	min	min	%	m^2/d					m/d
Munungo BH	116	70.0	5.2	110.8	Clay, phonolite (1 WS at 32 m) and basement rock (1 WS at 44 m)	64.8	2.42	20.9	1440	60	100%	9.51	10.42	5.93	2.97	**7.21**	**0.065**
RBH01	43	47.5	18.27	24.7	Saprolite, saprock and intermediate volcanic rock	29.2	0.23	4.93	600	70	95%	2.99	2.76	2.84	0.04	**2.16**	**0.1181**
RBH02	68.9	48.18	17.12	51.8	Saprolite (1 WS at 11 m), saprock and intermediate volcanic rock (3 WS at 26 m, 27 m, 37 m)	31.1	6	5.42	1440	150	96%	25.5	16.2	16.12	15.41	**18.31**	**0.3536**
RBH04	73.5	67.0	7.9	65.6	Saprolite, saprock (2 WS at 18 m, 23 m) and intermediate volcanic rock (2 WS at 36 m, 43 m)	59.1	1.03	32.6	1440	200	85%	1.3	1.7	1.9	1.4	**1.57**	**0.0239**
RBH05	70	62.0	9.1	60.9	Saprolite (1 WA at 35 m), felsic intrusive rock (1 WS at 40 m) and andesite (1 WS at 62 m)	52.9	8	16.9	1440	240	109%	60.17	24.70	24.70	20.45	**32.51**	**0.534**
RBH06	70	47.5	12.0	58.0	Saprolite and intermediate volcanic rock	35.5	0.197	17.3	50	1200	68%	0.95	0.17	0.19	0.17	**0.37**	**0.006**
RBH07	70.2	67	14.1	56.1	Saprolite, saprock (1 WS at 26 m) and intermediate volcanic rock (2 WS at 35 m 65 m)	52.6	1.04	25.7	1440	150	93%	2.43	2.62	2.16	2.07	**2.32**	**0.041**
RBH08	67.5	62.0	17.77	49.7	Saprolite, saprock and intermediate volcanic rock (4 WS at 49 m, 51 m, 55 m, 65 m)	44.2	1.08	18.6	1440	360	68%	2.9	2.85	2.5	2.72	**2.74**	**0.0551**
Average																**8.40**	**0.16**
Geometric mean																**2.96**	**0.05**
Harmonic mean																**1.13**	**0.020**

4.7.1.2.2. *Packer Test Results*

Knight Piesold (2024) undertook packer testing of four boreholes drilled within the Ramula-Mwibona Pit area during January and February 2024 (Figure 4-27). The borehole details and results are presented in Table 4-15 and Table 4-16, respectively. The stability issues in RMD0112 limited the packer tests in this borehole and it was suggested that the andesite in the western area of the pit may be more fractured than the andesite in the eastern area of the proposed pit. The bedrock was observed to be competent with hydraulic conductivities in the order of 10^{-5} m/d to 10^{-3} m/d. Fractured bedrock was observed between 80 m and 170 m with slightly higher hydraulic conductivities in the order of 10^{-3} m/d to 10^{-2} m/d. High permeabilities where present in RMD0111 at depths of 150 m and 190 m, with hydraulic conductivities of 3.2×10^{-2} m/d and 1.3×10^{-1} m/d, respectively. The high permeabilities were attributed to faulting or highly fractured zones (Knight Piesold, 2024). The fault zones within the pit area are shown in Figure 4-28.

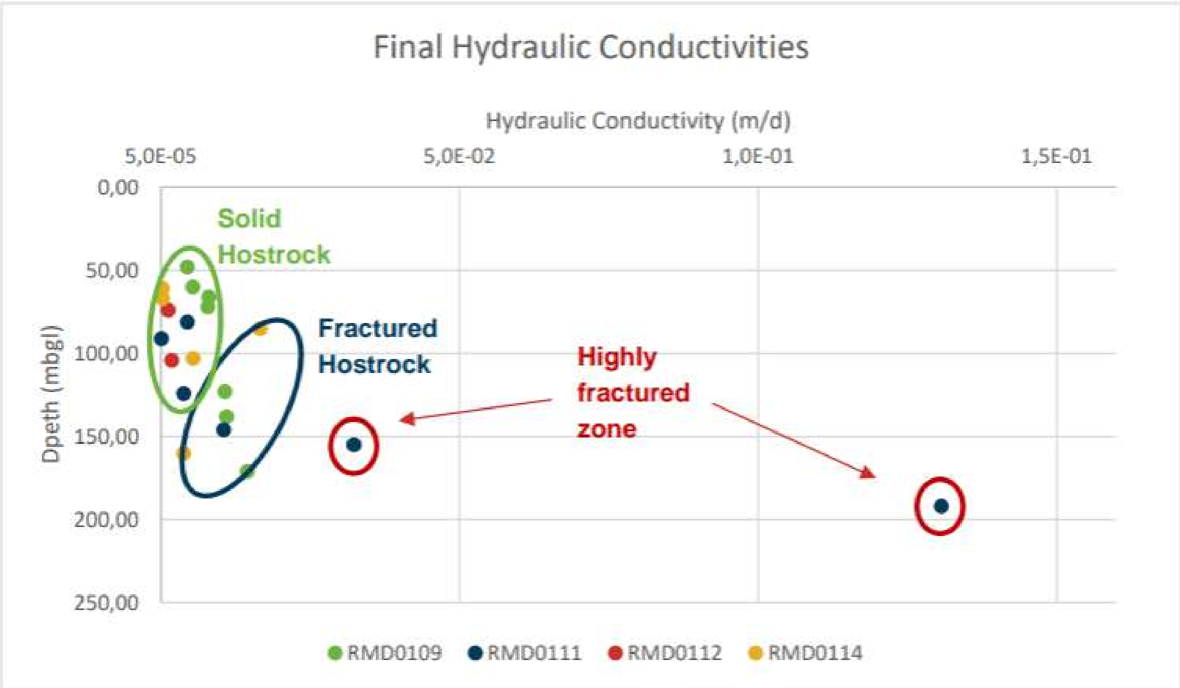


Figure 4-26: Packer Test Summary[7]

[7] Sourced from (Knight Piesold, 2024)

Table 4-15: Packer Test Borehole Summary[8]

Hole ID	Easting[9]	Northing	Elevation (mamsl)	End of Hole (m)	Dip (º)	Geology	Comment
RMD0109	671020	358	1 451	203.5	70	Diorite	
RMD0111	671112	258	1 446	239.5	60	Diorite / Andesite	Stability issues
RMD0112	670835	266	1 453	206.5	60	Andesite	Stability issues
RMD0114	670868	452	1 442	195.4	60	Diorite / Andesite	

Table 4-16: Final Packer Test Results[10]

Hole ID	From (mbgl)	To (mbgl)	Final Hydraulic Conductivity (m/d)
RMD0109	171	164.6	1.45×10^{-2}
	138	131.6	1.1×10^{-2}
	123	116.6	1.08×10^{-2}
	72	65.6	7.88×10^{-3}
	66	59.6	8.05×10^{-3}
	60	53.6	5.35×10^{-3}
	48	41.6	4.48×10^{-3}
RMD0111	192	186.6	1.31×10^{-1}
	155	148.6	3.23×10^{-2}
	146	139.6	1.06×10^{-2}
	124	117.6	3.84×10^{-3}
	91	84.6	8.91×10^{-5}
	81	75.6	4.48×10^{-3}
RMD0112	104	97.6	1.84×10^{-3}
	74	67.6	1.25×10^{-3}
RMD0114	160	154.6	3.84×10^{-3}
	103	96.6	5.42×10^{-3}
	85	78.6	1.66×10^{-2}
	67	60.60	3.22×10^{-4}
	61	54.60	3.06×10^{-4}

[8] Adapted from (Knight Piesold, 2024)
[9] UTM Zone 36N
[10] Adapted from (Knight Piesold, 2024)

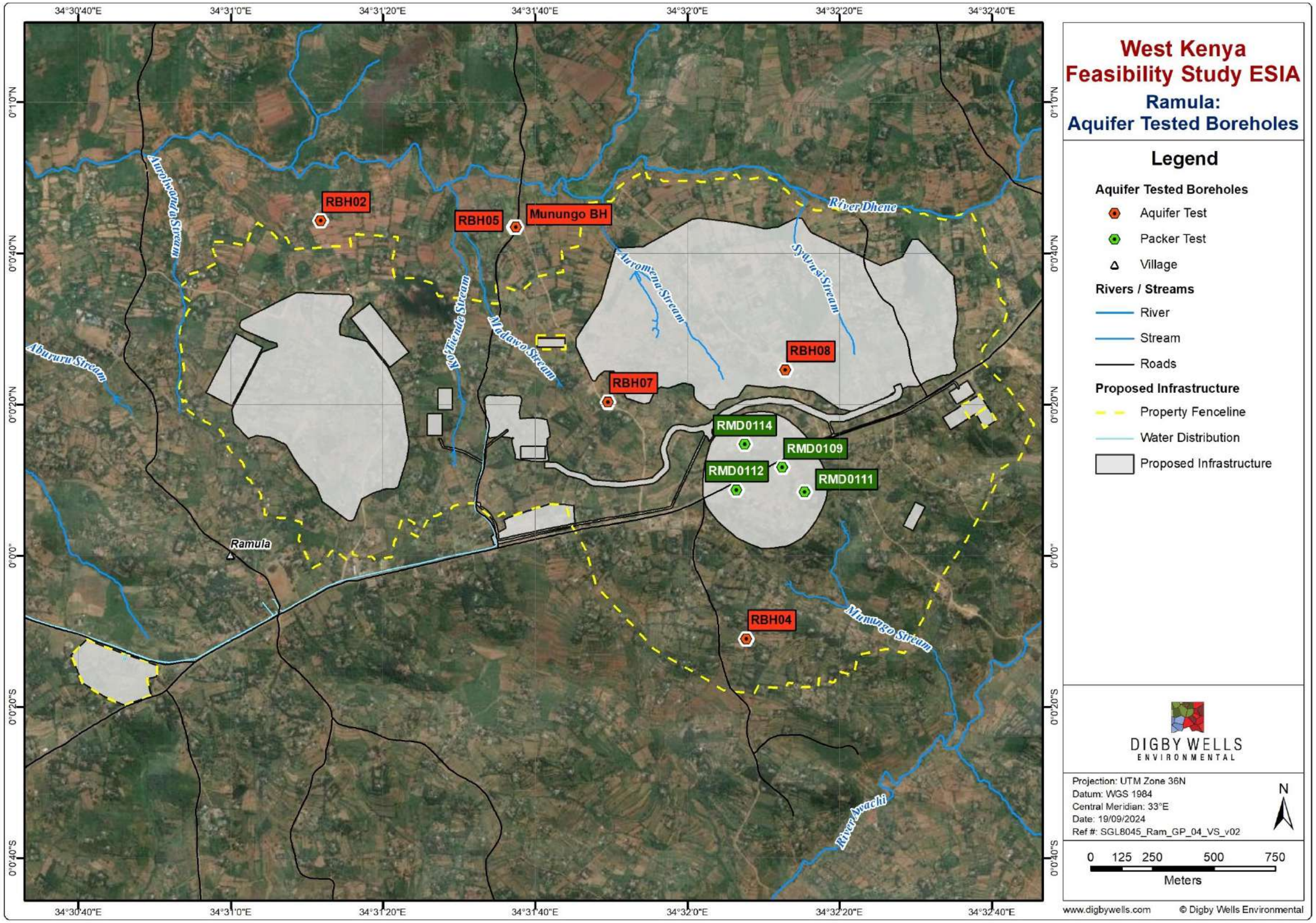


Figure 4-27: Aquifer Tested Locations

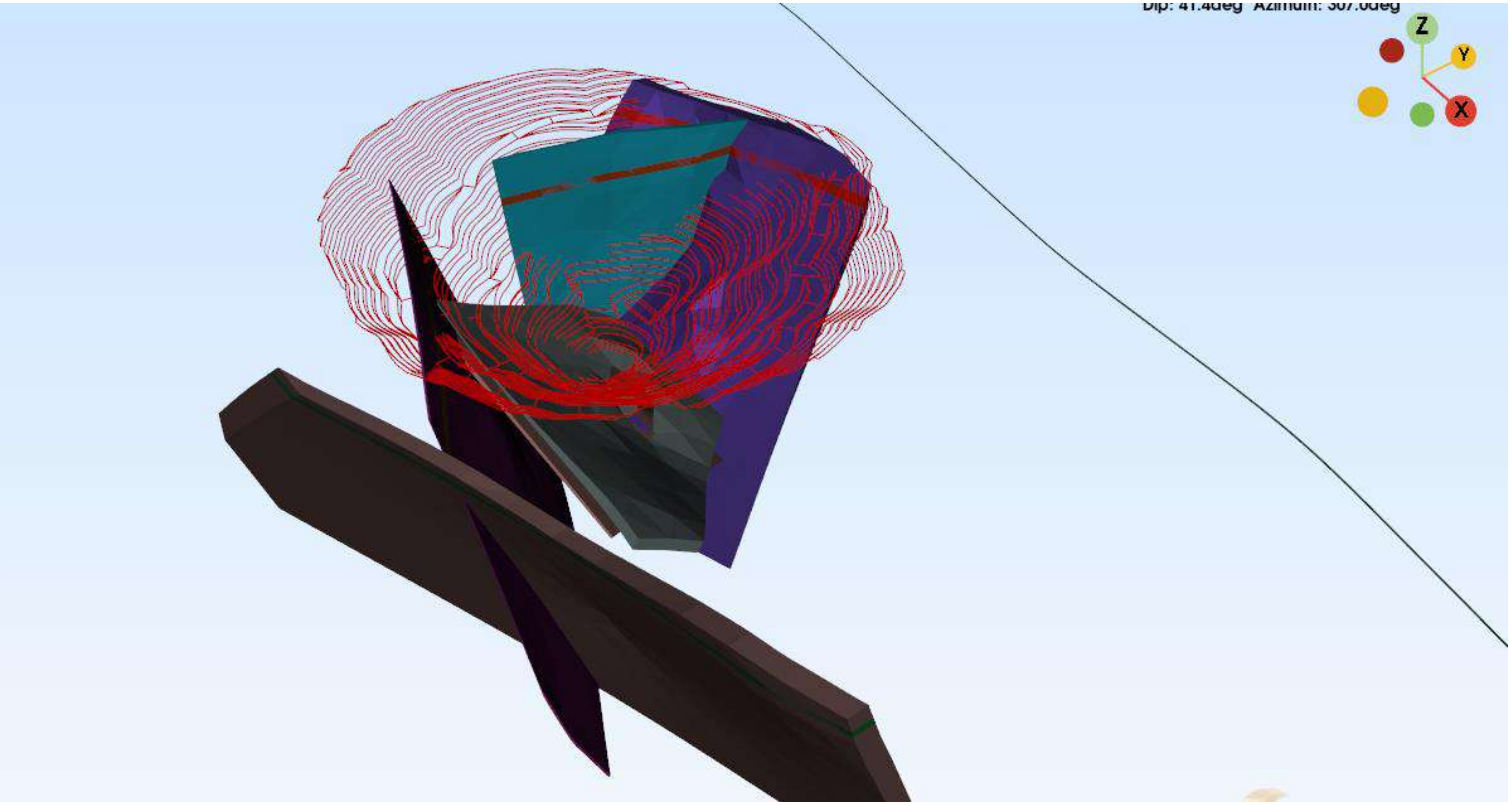


Figure 4-28: Faults within the Ramula-Mwibona Pit Area

4.7.1.3. Hydrocensus

Rural Focus undertook a hydrocensus survey during August and September 2023 (Rural Focus, 2023). A total of 119 water feature points were identified during the hydrocensus which comprised of springs, boreholes, hand dug wells, artisanal mine shafts as well as surface water streams and rivers. A summary table of the hydrocensus locations is provided as in Appendix B of the Hydrogeology report attached as Appendix G and the sample locations are provided in Table 4-17.

4.7.1.3.1. Groundwater Levels

Groundwater levels were measured in four of the identified boreholes and nine hand dug wells. Groundwater levels range between 0.3 mbgl and 40 mbgl, with an average of 12 mbgl. There is a good correlation between groundwater levels and topography indicating that groundwater will typically flow from topographical highs to topographical lows. The Project is located on a catchment divide and therefore groundwater will flow towards the north-west and south-east from the Project site.

Water levels measured in the Ramula Market and Ochieng boreholes have an elevated water level in comparison with the trend. These water levels align with the spring data indication potentially confined or artesian conditions in these boreholes. The water level measured in the Owach borehole (40 mbgl) has a poor correlation with topography, this could be influenced by abstraction and/or presence of a less permeable aquifer.

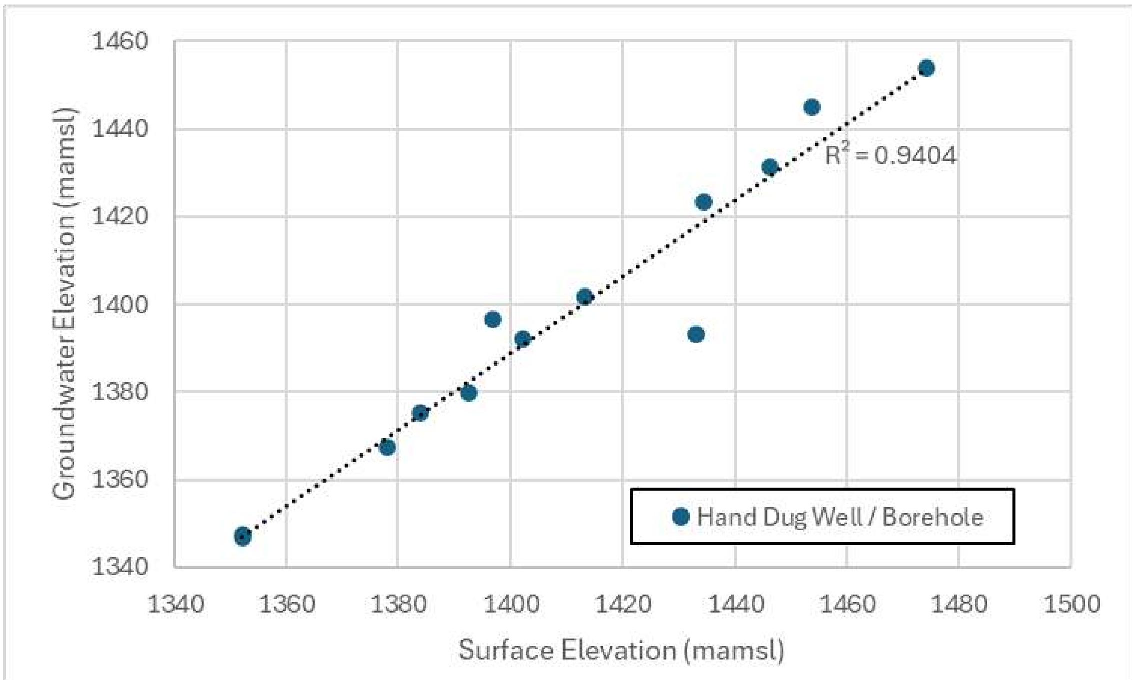


Figure 4-29: Groundwater Correlation with Topography

Table 4-17: Sampled Locations

Sample ID	Location ID	Easting[11]	Northing
RSW 01	RS1-Existing	671295	-249
RSW 03	Awach Upstream (RSW3_Existing)	672001	-322
RSW 05	Awach Midstream	671681	-769
RSW 06	Awach Downstream	669353	-3085
RSW 07	Nyangulu-Onging' Bridge	668418	1627
RSW 09	RSW9_Existing	669954	1517
RSW 10	RSW10_Existing	664152	2323
RSW 12	Yala Midstream	663760	2537
RSW 13	Yala Downstream	660366	1092
RSW 15	Aura-omena Stream (RS3_Existing)	670296	1318
RSW 16	RS4_Existing	669701	1343
RSW 17	RS2_Existing	670496	-651
RSW 18	RSW2	672773	-177
RSW 20	UNknown additional stream sampling point	668988	1294
RSW 21	Awach-Munungo Confluence	670496	-650
RSP 01	Munungo Spring	671280	103
RSP 02	Opere Spring	671126	-234
RSP 05	Kotiende Spring B	669681	402
RSP 06	Hussein Spring	669737	621
RSP 08	Ombeyi Spring	668570	582
RSP 09	Kadero Spring	667871	918
RSP 10	Nyameme Spring	688431	-310
RSP 11	Madawo Spring A	670126	687
RSP 13	Mihou Spring	670457	-299
RSP 16	Karmatin Spring	669671	-566
RSP 17	Kodino Spring	669675	793
RBH 02	Ramula Secondary BH (BH02)	669040	-91
RBH 03	Ramula Market BH (BH03)	669916	124

[11] UTM Zone 36N

RHDW 04	Ang'ang'o HDW	671626	42

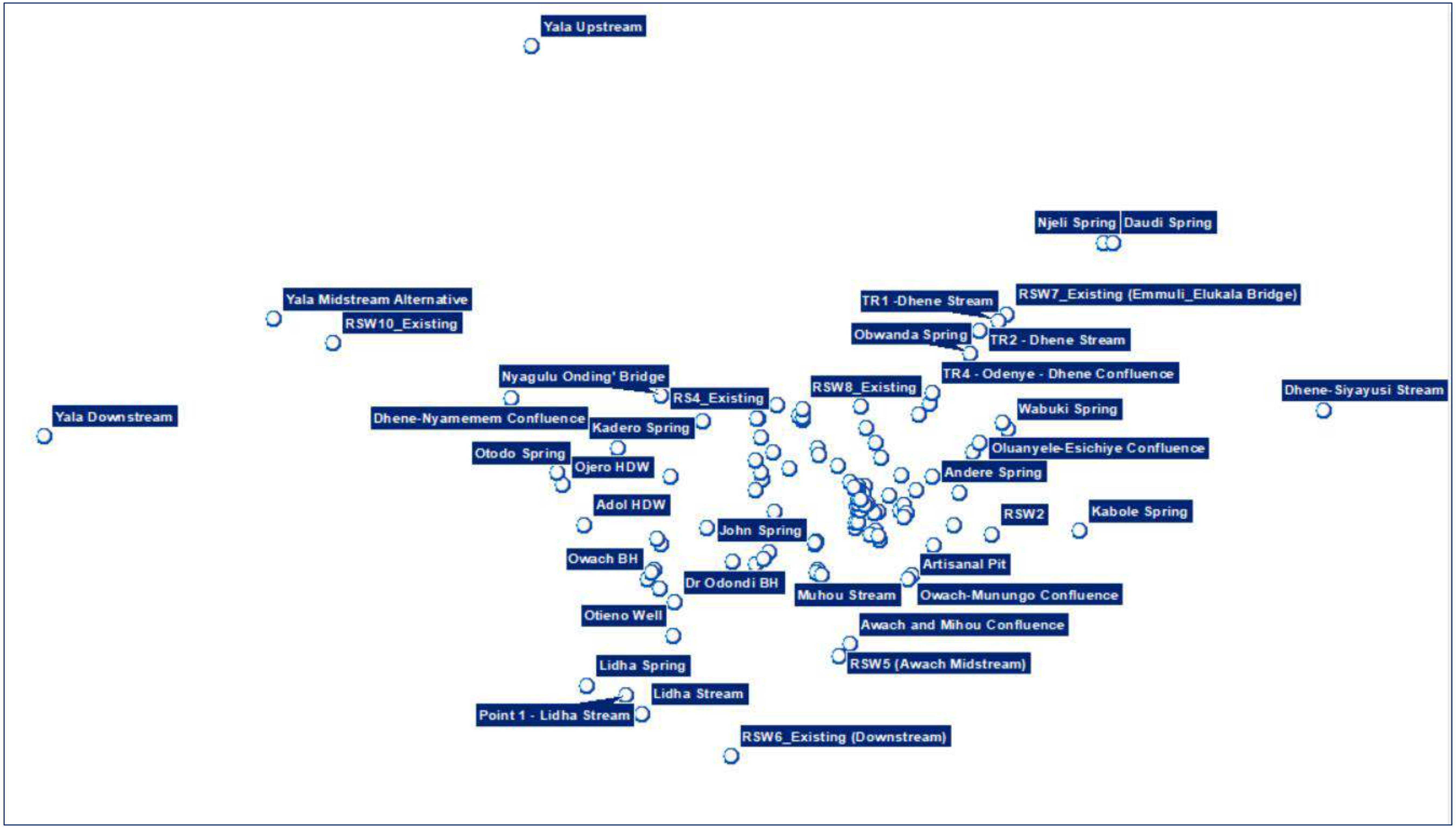


Figure 4-30: Hydrocensus Survey Locations

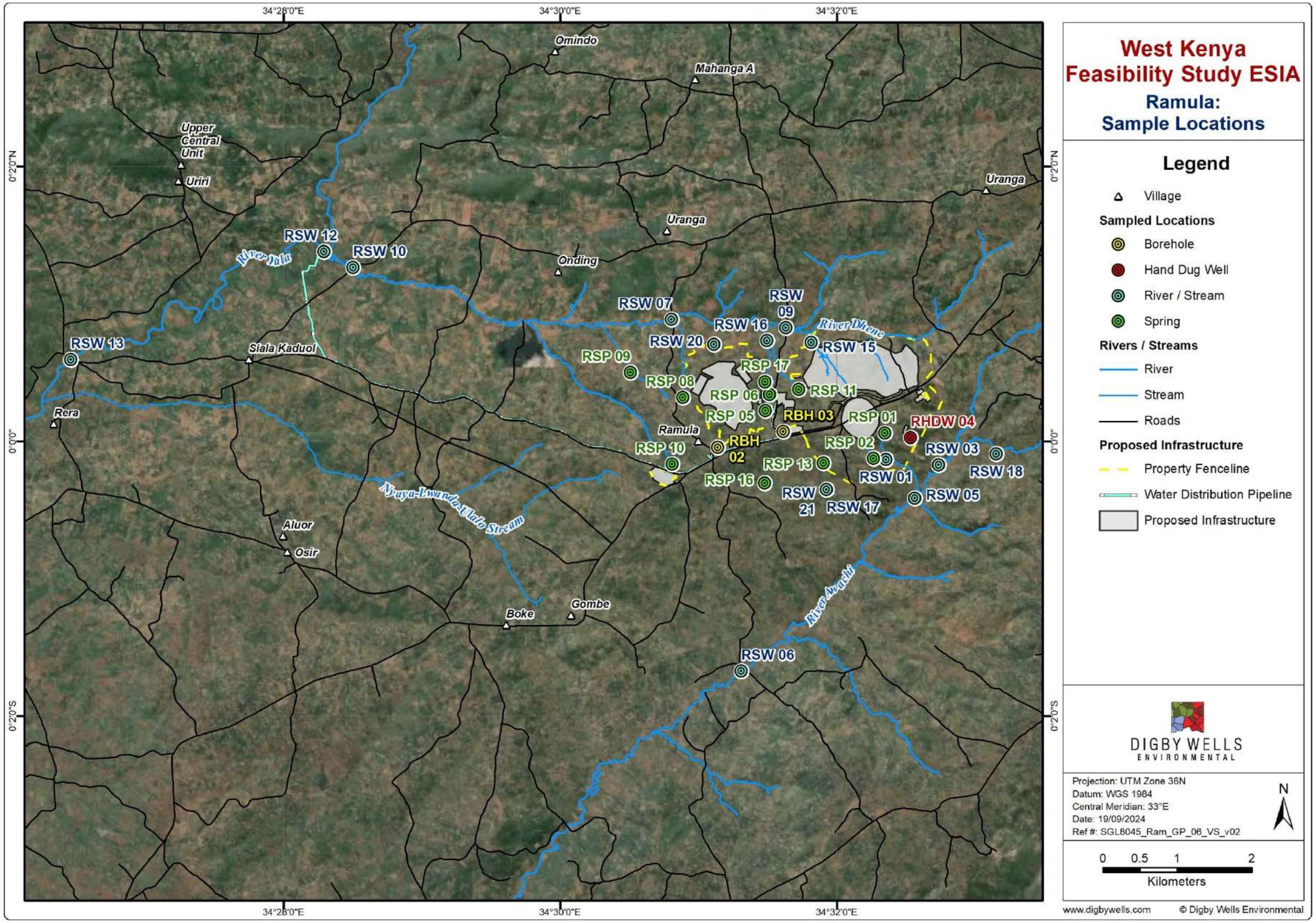


Figure 4-31: Hydrocensus Sample Locations

4.7.1.3.2. Groundwater Quality

During the hydrocensus field parameters (pH, electrical conductivity and temperature) were assessed in 57 locations. The field parameters indicate the water quality is circumneutral to slightly alkaline (pH of 6.5 to 8) with low salts (0.12 uS/cm to 0.7 uS/cm). The Piper (Figure 4-32) and Expanded Durov (Figure 4-33) Diagrams indicate that the following water types are present in the Project area:

- *Magnesium-sulphate* – this is the dominant water type, represented by two boreholes, one hand dug well, three springs and four surface water samples;
- *Magnesium-bicarbonate* – this is the second most dominant water type, represented by five springs and three surface water samples;
- *Magnesium-chloride* – this is the third most dominant water type represented, by one spring and four surface water samples;
- *Sodium-bicarbonate* – represented in one spring and two surface water samples;
- *Sodium-sulphate* – only represented by one surface water sample;
- *Sodium-chloride* – only represent by one surface water sample; and
- *Calcium-chloride* – only represented by one spring sample.

The dominance of magnesium and sodium typically indicate ion-exchange processes attributed to longer residence times in the aquifer. Diorite is dominated by plagioclaise which has a chemical composition varying between sodium (Albite) to calcium (anorthite). Intermediate volcanic rocks (such as andesite) are the extrusive equivalents of diorite. Both diorite and intermediate volcanic rocks contain the mafic minerals of amphibole and pyroxene, which both have a chemical composition containing magnesium. Minerals weather at different rates, however mafic minerals (pyroxene) tend to weather faster than felsic minerals (quartz and feldspar), which would be indicative of the stronger magnesium signatures compared.

The water quality results are presented in Table 4-18. The pH is circumneutral to slightly alkaline with an average pH of 7.4. The total dissolved solids range between 48 mg/l and 421 mg/l, with an average of 121 mg/l, indicating that I general surface as well as groundwater is low in salts. This is confirmed by electrical conductivity results which show an average low value of 192 µS/cm.

Exceedances over the Kenyan Drinking Water Limits (KS EAS 12: 2014) were observed for:

- *Manganese* – two samples exceed the limit of 0.1 mg/L defined in the KS EAS 12:2014 guidelines. The WHO have a more stringent limit for manganese (0.08 mg/L) which is only exceeded by one other sample;
- *Turbidity* - 16 samples exceed the limit of 25 NTU as defined in the KS EAS 12: 2014 guidelines;

- *Suspended matter* – the KS EAS 12: 2014 limit for suspended matter is defined as not detectable, this is more stringent than the WHO limit of 50 mg/L. Only two samples are compliant to the KS EAS 12: 2014 limits, whereas nine samples exceed the WHO limit;
- *Nitrite* – all samples exceed the KS EAS 12: 2014 limit for nitrate (0.003 mg/L), which is very stringent in comparison the WHO limit of 3 mg/L. All samples are within the WHO limits; and
- The Kenyan EAS12: 2014 limits are also more stringent than the IFC discharge limits (2007) with the exception of zinc, however no samples exceed the IFC limit for zinc.

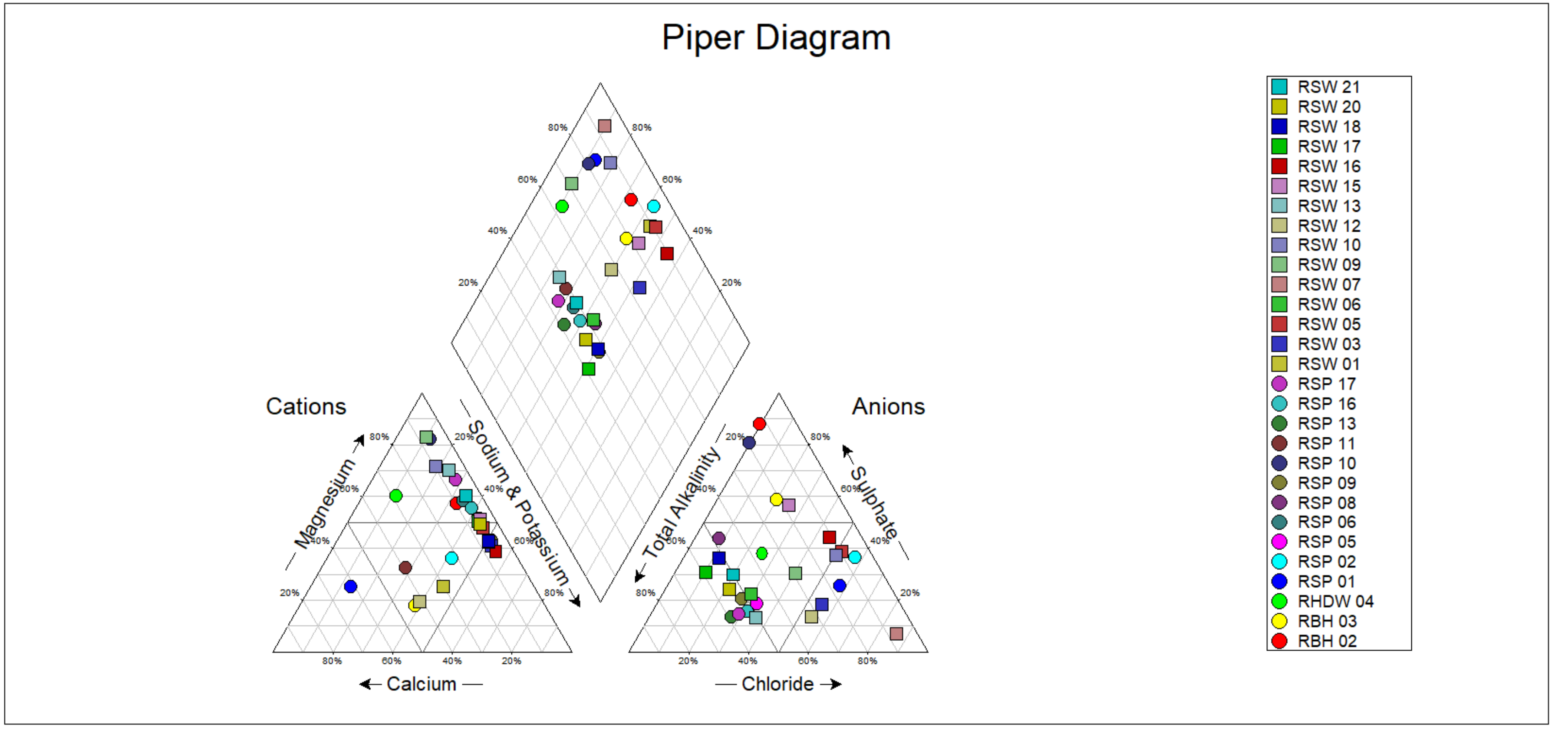


Figure 4-32: Hydrocensus Piper Diagram

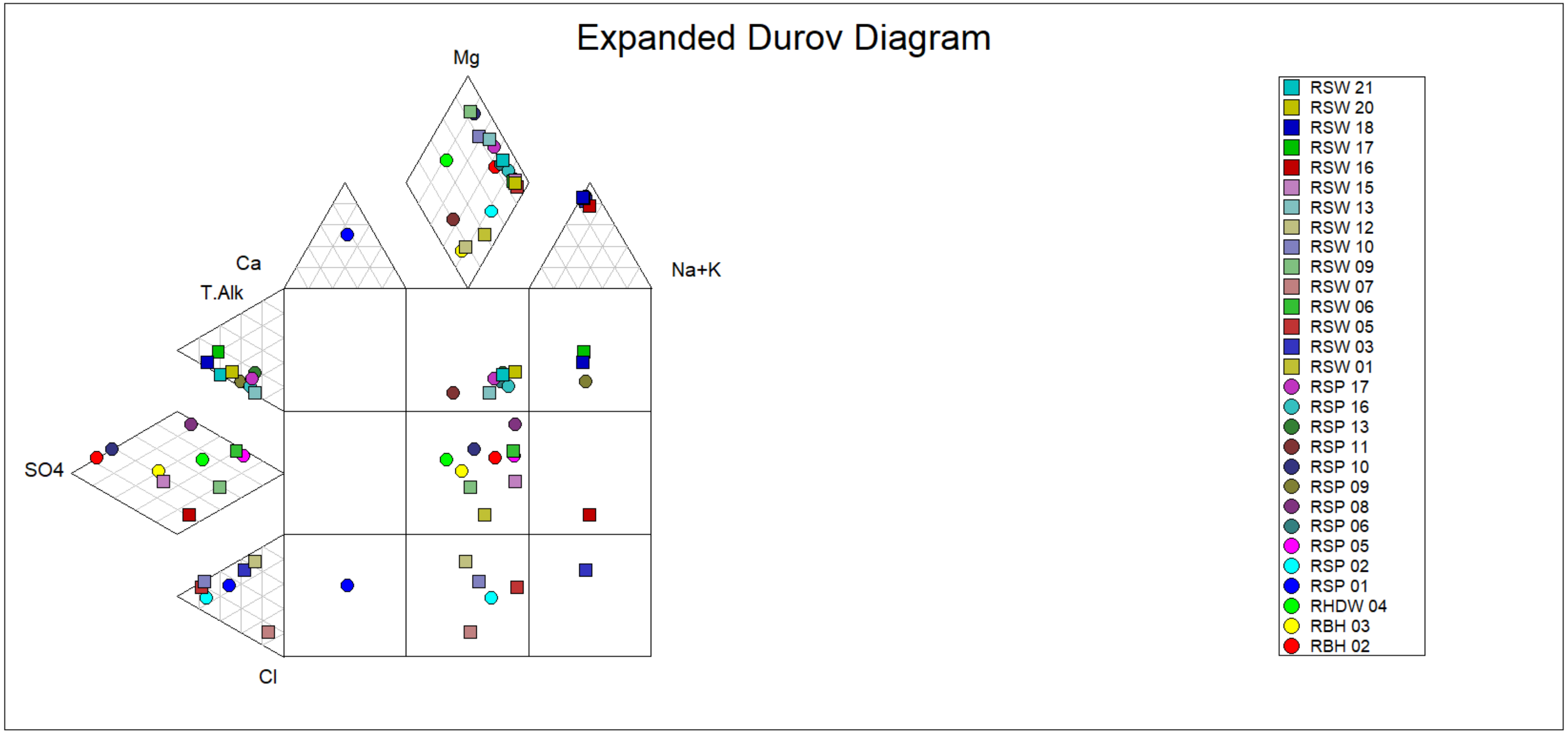


Figure 4-33: Hydrocensus Expanded Durov

Table 4-18: Hydrocensus Water Quality Results

Parameters	pH	Conductivity EC	Turbidity	Suspended matter (TSS)	Total dissolved solids (TDS)	Sodium Na	Sulphate SO_4	Chloride Cl	Magnesium Mg	Calcium Ca	Aluminium Al	Total Iron Fe	Zinc Zn	Arsenic As	Cadmium Cd
Units		**µS/cm**	**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Kenyan EAS12: 2014	**5.5-9.5**	**2500**	**25**	**Not detectable**	**1500**	**200**	**400**	**250**	**100**	**150**	**0.2**	**0.3**	**5**	**0.01**	**0.003**
WHO 2022						**50**								**0.01**	**0.003**
IFC 2007	**6.0-9.0**			**50**								**2**	**0.5**	**0.1**	**0.05**
RSW 01	7.78	250	6.51	5	160	15.3	4.1	3.51	10.5	22.7	<0.07	0.012	<0.01	<0.007	<0.002
RSW 03	7.7	130	255	159	85	8.15	4.61	9.23	4.63	10.9	<0.07	0.16	<0.01	<0.007	<0.002
RSW 05	7.89	150	65.8	37	92	8.36	4.31	4.7	5.15	11.8	<0.07	0.1	<0.01	<0.007	<0.002
RSW 06	7.97	140	59.9	42	88	7.82	4.19	4.11	5.03	11.3	<0.07	0.13	<0.01	<0.007	<0.002
RSW 07	7.76	190	1190	916	120	11.5	1.86	9.24	7.77	16.5	<0.07	0.026	<0.01	<0.007	<0.002
RSW 09	7.7	190	870	592	123	11.9	1.53	10	7.3	16.9	<0.07	0.02	<0.01	<0.007	<0.002
RSW 10	7.81	200	104	103	123	16.1	3.09	3.3	9.13	20.9	<0.07	0.066	<0.01	<0.007	<0.002
RSW 12	7.63	78	144	117	49	6.75	2.01	6.2	2.13	7.21	<0.07	0.17	<0.01	<0.007	<0.002
RSW 13	7.49	77	151	93	48	14.6	1.92	2.86	7.84	18.1	<0.07	<0.01	<0.01	<0.007	<0.002
RSW 15	7.58	190	1610	1820	122	8.68	3.51	1.88	6.72	15.4	<0.07	0.078	<0.01	<0.007	<0.002
RSW 16	7.82	150	22.4	20	95	9.22	4.55	3.09	4.9	12.4	<0.07	0.081	<0.01	<0.007	<0.002
RSW 17	7.72	140	248	260	88	8.75	4.46	10.5	4.87	12.4	<0.07	0.028	<0.01	<0.007	<0.002
RSW 18	7.9	130	313	292	85	9.75	4.67	10	4.65	12.5	<0.07	0.028	<0.01	<0.007	<0.002
RSW 20	7.95	130	28.3	14	79	8.09	3	2.29	5.41	11.1	<0.07	0.011	<0.01	<0.007	<0.002
RSW 21	7.67	150	23.4	33	94	7.74	4.82	2.39	7.25	14.8	<0.07	0.048	<0.01	<0.007	<0.002
RSP 01	7.11	340	43.1	25	212	16.6	3.95	5.06	11.5	41.9	<0.07	0.01	<0.01	<0.007	<0.002
RSP 02	6.97	220	32.2	49	137	14.1	6.11	7.21	10.9	16.4	<0.07	0.016	<0.01	<0.007	<0.002
RSP 05	7.07	140	16.9	8	89	9.15	3.83	4.25	6.34	10.5	<0.07	0.011	<0.01	<0.007	<0.002
RSP 06	6.93	130	29.6	15	81	5.04	3.39	3.06	5.35	12.6	<0.07	<0.01	<0.01	<0.007	<0.002
RSP 08	7.17	140	3.56	2	89	8.24	7.34	1.72	5.99	11.2	<0.07	0.016	<0.01	<0.007	<0.002
RSP 09	6.53	140	18.5	9	88	9.77	3.63	3.52	5.22	12.2	<0.07	<0.01	<0.01	<0.007	<0.002
RSP 10	7.03	210	21.2	21	130	13.2	4.01	0.65	8.97	19.2	<0.07	<0.01	<0.01	<0.007	<0.002
RSP 11	6.61	110	58.7	39	68	6.34	2.76	4.86	4.64	8.51	<0.07	<0.01	<0.01	<0.007	<0.002
RSP 13	6.38	160	12.6	10	101	7.15	2.85	3.46	7.73	14.3	<0.07	<0.01	<0.01	<0.007	<0.002
RSP 16	6.63	170	15.1	9	110	8.23	23.4	3.46	6.98	16.3	<0.07	0.033	<0.01	<0.007	<0.002
RSP 17	6.54	140	17.9	11	89	5.46	2.43	3.41	7.16	13.5	<0.07	<0.01	<0.01	<0.007	<0.002
RBH 02	7.02	200	1.09	<1	127	7.58	7.52	0.62	7.18	22.3	<0.07	<0.01	0.079	<0.007	<0.002
RBH 03	8.02	670	1	<1	421	7.23	8.3	22.4	28.2	80.2	<0.07	<0.01	<0.01	<0.007	<0.002
RHDW 04	7.55	500	3.37	2	318	25.4	23.5	10	9.91	72.2	<0.07	<0.01	<0.01	<0.007	<0.002
Legend															

Parameters	pH	Conductivity EC	Turbidity	Suspended matter (TSS)	Total dissolved solids (TDS)	Sodium Na	Sulphate SO_4	Chloride Cl	Magnesium Mg	Calcium Ca	Aluminium Al	Total Iron Fe	Zinc Zn	Arsenic As	Cadmium Cd
Units		µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Kenyan EAS12: 2014	5.5-9.5	2500	25	Not detectable	1500	200	400	250	100	150	0.2	0.3	5	0.01	0.003
WHO 2022						50								0.01	0.003
IFC 2007	6.0-9.0			50								2	0.5	0.1	0.05
	Meets or exceeds target metric														
<	Analyte is below detection														

Parameters	Lead Pb	Copper Cu	Mercury Hg	Manganese Mn	Selenium Se	Chromium Total Cr	Nickel Ni	Cyanide CN	Barium Ba	Nitrate NO_3	Boron Bo	Fluoride F	Nitrite NO_2	Molybdenum Mo	Phosphates PO_4
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Kenyan EAS12: 2014	0.01	1	0.001	0.1	0.01	0.05	0.02	0.01	0.7	45	2.4	1.5	0.003	0.07	2.2
WHO 2022	0.01		0.006	0.08	0.04	0.05	0.07			50	2.4	1.5	3		
IFC 2007	0.2		0.002			0.1	0.5	1							
RSW 01	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.045	4.83	<0.01	0.33	0.013	<0.01	0.19
RSW 03	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.034	6.51	<0.01	0.5	0.012	<0.01	0.046
RSW 05	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.068	4.34	<0.01	0.4	0.012	<0.01	<0.01
RSW 06	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.041	5.71	<0.01	0.33	0.012	<0.01	0.052
RSW 07	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.063	2.66	<0.01	0.68	0.015	<0.01	<0.01
RSW 09	<0.009	<0.01	<0.001	0.018	<0.01	<0.01	<0.003	<0.001	0.067	1.64	<0.01	0.61	0.017	<0.01	0.083
RSW 10	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.022	1.51	<0.01	0.49	0.014	<0.01	0.16
RSW 12	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.057	4.69	<0.01	0.24	0.012	<0.01	0.098
RSW 13	<0.009	<0.01	<0.001	0.096	<0.01	<0.01	<0.003	<0.001	0.033	2.97	<0.01	0.29	0.009	<0.01	0.095
RSW 15	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.053	1.55	<0.01	0.4	0.02	<0.01	0.037
RSW 16	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.062	2.39	<0.01	0.23	0.012	<0.01	<0.01
RSW 17	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.037	6.77	<0.01	0.37	0.015	<0.01	0.055
RSW 18	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.057	5.14	<0.01	0.45	0.013	<0.01	0.08
RSW 20	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.062	4.29	<0.01	0.19	0.012	<0.01	<0.01
RSW 21	<0.009	<0.01	<0.001	0.24	<0.01	<0.01	<0.003	<0.001	0.066	3.19	<0.01	0.19	0.015	<0.01	<0.01
RSP 01	<0.009	<0.01	<0.001	2.73	<0.01	<0.01	<0.003	<0.001	0.077	8.41	<0.01	<0.03	0.012	<0.01	<0.01
RSP 02	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.044	23.7	<0.01	<0.03	0.012	<0.01	0.13
RSP 05	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.036	14.3	<0.01	0.1	0.011	<0.01	0.037
RSP 06	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.06	12	<0.01	0.15	0.011	<0.01	<0.01
RSP 08	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.044	13.1	<0.01	0.18	0.014	<0.01	0.098

Parameters	Lead Pb	Copper Cu	Mercury Hg	Manganese Mn	Selenium Se	Chromium Total Cr	Nickel Ni	Cyanide CN	Barium Ba	Nitrate NO_3	Boron Bo	Fluoride F	Nitrite NO_2	Molybdenum Mo	Phosphates PO_4
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Kenyan EAS12: 2014	**0.01**	**1**	**0.001**	**0.1**	**0.01**	**0.05**	**0.02**	**0.01**	**0.7**	**45**	**2.4**	**1.5**	**0.003**	**0.07**	**2.2**
WHO 2022	**0.01**		**0.006**	**0.08**	**0.04**	**0.05**	**0.07**			**50**	**2.4**	**1.5**	**3**		
IFC 2007	**0.2**		**0.002**			**0.1**	**0.5**	**1**							
RSP 09	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.034	8.1	<0.01	0.25	0.012	<0.01	0.12
RSP 10	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.09	1.95	<0.01	0.28	0.011	<0.01	0.14
RSP 11	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.03	1.99	<0.01	0.41	0.013	<0.01	<0.01
RSP 13	<0.009	<0.01	<0.001	0.013	<0.01	<0.01	<0.003	<0.001	0.1	12.7	<0.01	0.14	0.009	<0.01	0.052
RSP 16	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.047	2.7	<0.01	0.23	0.009	<0.01	<0.01
RSP 17	<0.009	<0.01	<0.001	0.016	<0.01	<0.01	<0.003	<0.001	0.11	4.29	<0.01	0.22	0.01	<0.01	<0.01
RBH 02	<0.009	<0.01	<0.001	0.011	<0.01	<0.01	<0.003	<0.001	0.027	5.75	<0.01	0.033	0.013	<0.01	0.24
RBH 03	<0.009	<0.01	<0.001	0.038	<0.01	<0.01	<0.003	<0.001	0.078	21	<0.01	0.28	0.053	<0.01	<0.01
RHDW 04	<0.009	<0.01	<0.001	<0.01	<0.01	<0.01	<0.003	<0.001	0.01	7.39	0.011	0.2	0.011	<0.01	0.27

Legend

(pink shading)	Meets or exceeds target metric
<	Analyte is below detection

4.7.1.3.3. Groundwater Use

Groundwater use in the area is mainly by local communities, farmers (including aquaculture), and artisanal miners. The current depth of the artisanal mining is approximately 30 mbgl with estimated pumping rates of approximately 5 l/s based on observations made in the field and interactions with the artisanal miners during site visits.

Artisanal mining, though predominant in western Kenya, remains low in productivity but detrimental to groundwater due use of heavy metals such as mercury for extraction of gold from the ores.

4.7.1.4. Groundwater Monitoring Results

To comply with the issued environmental licenses, SGKL has been monitoring the groundwater quality where potential impacts could arise from exploration activities. Baseline groundwater qualities were assessed in 2021 for the Ramula-Mwibona Project (Table 4-19). Baseline results did not analyse for calcium, magnesium and potassium so the hydrochemistry for these results could not be defined. It is recommended that SGKL include major cations for calcium, magnesium and potassium as part of their monitoring requirements as these parameters, in conjunction with sodium, sulphate, chloride and alkalinity (which are included in the results) will allow for hydrochemistry characterization (with Piper, Expanded Durov and STIFF Diagrams).

The water quality results indicate the groundwater and surface water had a circumneutral pH with an average pH 6.8. The total dissolved solids range between 43 mg/l and 177 mg/l, with an average of 94 mg/l, indicating that the water quality is low in salts, which is confirmed with the electrical conductivity results which have an average of 191 µS/cm. Exceedances against the Kenyan Drinking Water Limits (KS EAS 12: 2014) are for:

- Turbidity – only two samples do not exceed the KS EAS 12:2014 limit of 25 NTU;
- Iron - one sample exceeds the KS EAS 12: 2014 limit of 0.3 mg/L;
- Lead – one sample exceeds the KS EAS 12: 2014 limit of 0.01 mg/L;
- Nitrite - all samples exceed the KS EAS 1: 2: 2014 limit for nitrate (0.003 mg/L), which is very stringent in comparison the WHO limit of 3 mg/L. All samples are within the WHO limits; and
- The Kenyan EAS12: 2014 limits are also more stringent than the IFC discharge limits with the exception of zinc. One sample exceeds the IFC limit (0.5 mg/L) for zinc.

Shanta Gold (Shanta Gold), 2022) indicated pit latrines as the main contaminating source to the shallow aquifer from the baseline results.

Time series graphs for pH and total dissolved solids for the sampling locations for which baseline as well as hydrocensus data is available are shown in Figure 4-35. A slightly increasing trend can be observed for pH and total dissolved solids, however, results are still compliant with the EAS 12: 2014 drinking water limits.

Table 4-19: Ramula- Mwibona Groundwater Baseline Monitoring Results

Parameters		pH	Conductivity EC	Turbidity	Suspended matter TSS	Total dissolved solids TDS	Sodium Na	Sulphate SO_4	Chloride Cl	Magnesium Mg	Calcium Ca	Aluminium Al	Total Iron Fe	Zinc Zn	Arsenic As	Cadmium Cd
Units			**µS/cm**	**NTU**		**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Kenyan EAS12: 2014		**5.5-9.5**	**2500**	**25**	**Not detectable**	**1500**	**200**	**400**	**250**	**100**	**150**	**0.2**	**0.3**	**5**	**0.01**	**0.003**
WHO 2022							**50**								**0.01**	**0.003**
IFC 2007		**6.0-9.0**			**50**								**2**	**0.5**	**0.1**	**0.05**
Sam	Well	6.81	200	71.5	-	98	0.286	5	2.3	-	-	-	0.08	0.014	ND	ND
Owino Owiti	Well	6.19	191.9	30.3	-	94	0.0465	9	13.1	-	-	-	0.06	0.013	ND	ND
Ramula HC	Borehole	6.13	167.4	43	-	82	0.864	4	4.32	-	-	-	6.37	0.001	ND	ND
Eddy's Tavern	Borehole	6.81	362	11.3	-	177	0.361	9	4.13	-	-	-	0.01	0.002	ND	ND
Munungo	Spring	6.55	206	58.4	-	101	0.734	0	5.42	-	-	-	0.12	0.134	ND	ND
Opere	Spring	6.08	161	68.5	-	79	2.41	7	9.9	-	-	-	0.04	0	ND	ND
Syayusi	Spring	7.05	323	1.56	-	158	0.603	0	3.58	-	-	-	0	0.073	ND	ND
Kotiende	Spring	6.59	126.6	99.6	-	62	0.708	5	5.94	-	-	-	0.12	0.069	ND	ND
Dhene	River	7.48	138.4	662	-	68	0.218	0	3.2	-	-	-	0.06	0.019	ND	ND
Awachi	River	7.56	137.3	303	-	67	0.174	0	5.03	-	-	-	0	-	ND	ND
Yala	River	7.47	87.4	69.5	-	43	0.0811	3	2.46	-	-	-	0.13	1.023	ND	ND

Legend

	Meets or exceeds target metric
-	Not analysed
ND	Not detected

Parameters	Lead Pb	Copper Cu	Mercury Hg	Manganese Mn	Selenium Se	Chromium Total Cr	Nickel Ni	Cyanide CN	Barium Ba	Nitrate NO_3	Boron Bo	Fluoride F	Nitrite NO_2	Molybdenum Mo	Phosphates PO_4
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Kenyan EAS12: 2014	**0.01**	**1**	**0.001**	**0.1**	**0.01**	**0.05**	**0.02**	**0.01**	**0.7**	**45**	**2.4**	**1.5**	**0.003**	**0.07**	**2.2**
WHO 2022	**0.01**		**0.006**	**0.08**	**0.04**	**0.05**	**0.07**			**50**	**2.4**	**1.5**	**3**		
IFC 2007	**0.2**		**0.002**			**0.1**	**0.5**	**1**							
Sam	0.1521	ND	ND	0.004	-	-	ND	-	-	2.7	-	0.0505	0.8	-	0.52
Owino Owiti	0.0023	ND	ND	0.001	-	-	ND	-	-	0.8	-	0.0154	0.7	-	0.01
Ramula HC	ND	0.003	ND	0.003	-	-	ND	-	-	0.6	-	0.0095	0.7	-	0
Eddy's Tavern	ND	0.001	ND	0.001	-	-	ND	-	-	1.9	-	0.372	0.6	-	0.21
Munungo	0.006	ND	ND	0	-	-	ND	-	-	0.9	-	0.0318	0.1	-	0.2
Opere	ND	ND	ND	0.0001	-	-	ND	-	-	1.6	-	0.0119	0.5	-	0.01
Syayusi	ND	ND	ND	0.0004	-	-	ND	-	-	2.5	-	0.0773	0.4	-	0.004
Kotiende	ND	ND	ND	0	-	-	ND	-	-	2.4	-	0.0352	0.4	-	0.22
Dhene	ND	ND	ND	0.002	-	-	ND	-	-	1.8	-	0.112	0.1	-	0.22
Awachi	ND	ND	ND	0	-	-	-	-	-	2.3	-	0.111	0.6	-	0.3
Yala	ND	ND	ND	0.027	-	-	ND	-	-	1.46	-	0.181	0.025	-	0.018

Legend

	Meets or exceeds target metric
-	Not analysed
ND	Not detected

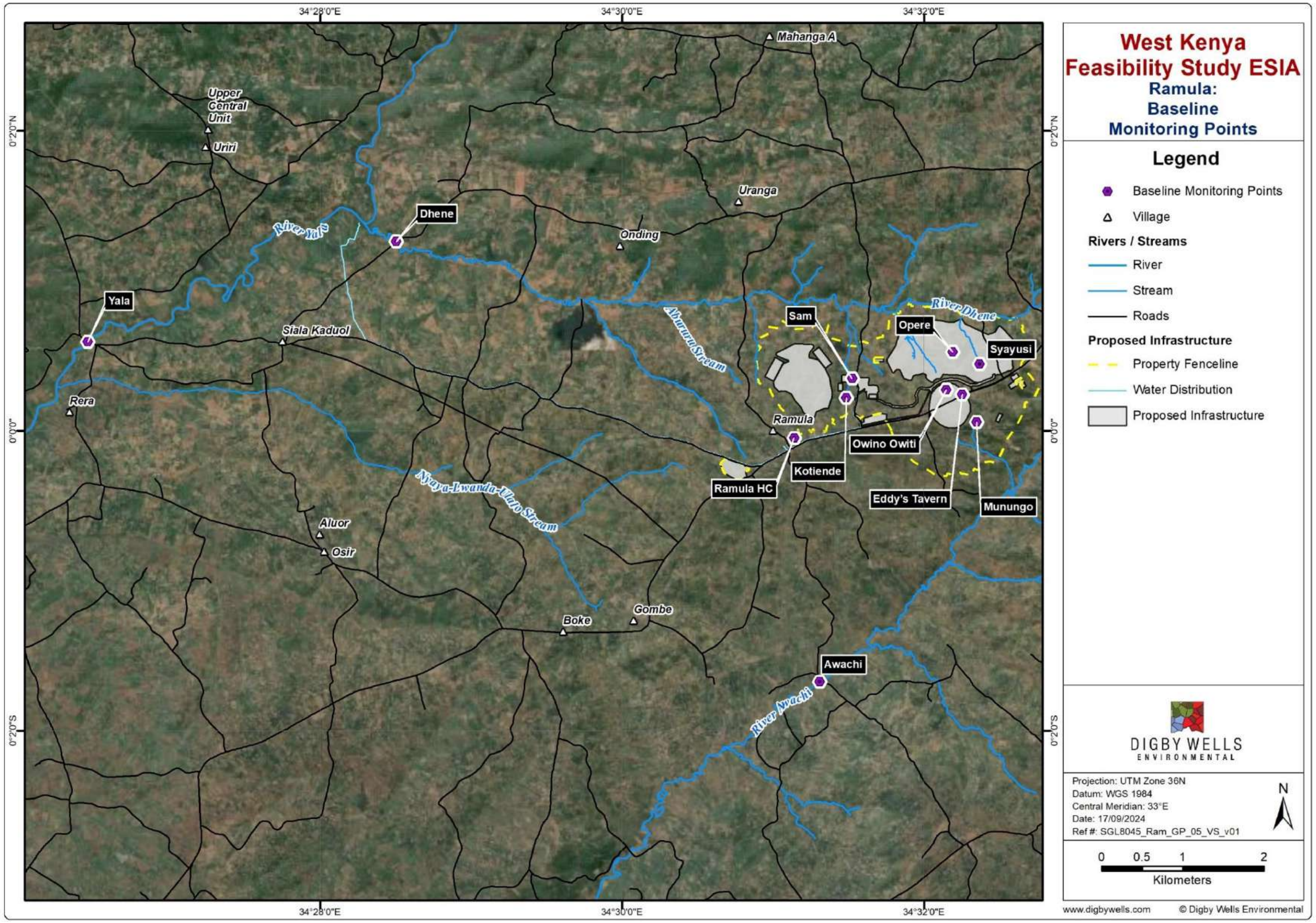


Figure 4-34: Ramula Mwibona Groundwater Monitoring Locations

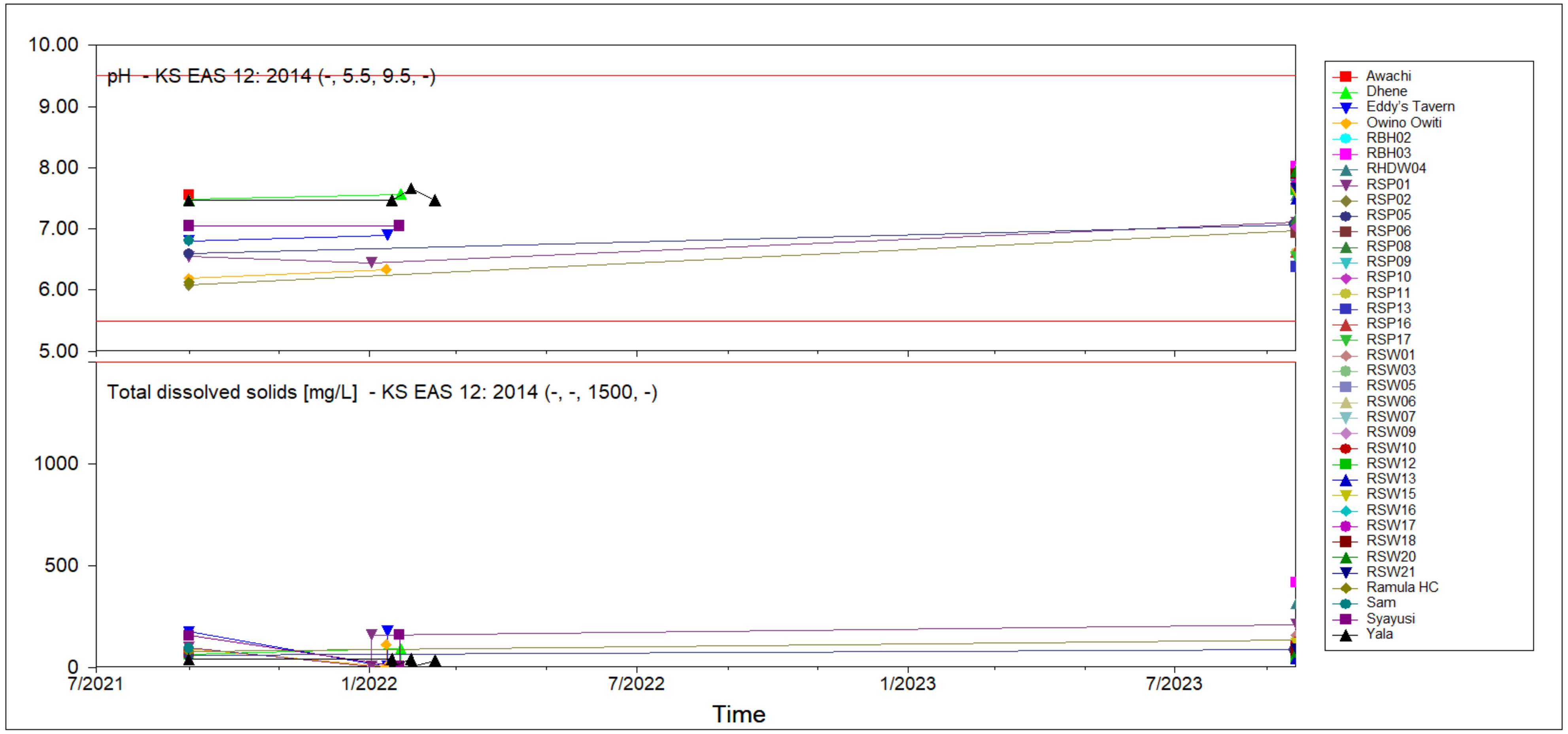


Figure 4-35: pH and Total Dissolved Solids Trends

The existing monitoring network in the Project area, is as shown and Table 4-20 below, include hand dug wells, drilled boreholes, springs, rivers, and streams.

Table 4-20: Monitoring Network

No	Name/Location	Code	Source Type	X-UTM	Y-UTM	Description
1	Owino Owiti	HDW01	Hand dug well	670910	501	Used for exploration for quarterly water quality monitoring
2	Eddy's Tavern Borehole	BH01	Drilled Borehole	671103	447	Used for exploration for quarterly water quality monitoring
3	Ramula Secondary school	BH02	Drilled Borehole	669040	-91	Used for exploration for quarterly water quality monitoring
4	Ramula market	BH03	Drilled Borehole	669916	124	Drilled in 2022, no sample was collected
5	Ochieng' Borehole	BH04	Drilled Borehole	669755	547	Borehole does not use, no sample collected
6	Munungo Spring	SPR01	Spring	671239	99	Used for exploration for quarterly water quality monitoring
7	Opere Spring	SPR02	Spring	671126	-234	Used for exploration for quarterly water quality monitoring
8	Joan spring	SPR03	Spring	670455	-298	No sampling done
9	Muhou springs	SPR04	spring	670556	-715	No sampling done
10	Kosato springs	SPR05	spring	669166	-475	No sampling done
11	Syayusi Spring	SPR06	Spring	671315	818	Used for exploration for quarterly water quality monitoring
12	Kodino spring A	SPR07	Spring	669666	794	No sampling done
13	Kodino spring B	SPR08	Spring	669652	781	No sampling done
14	Kotiende Spring A	SPR09	Spring	669691	360	No sampling done
15	Kotiende Spring B	SPR10	Spring	669675	401	Used for exploration for quarterly water quality monitoring
16	Soko spring	SPR11	Spring	669705	640	No sampling done
17	Hussein spring	SPR12	Spring	669737	621	No sampling done
18	Samson spring	SPR13	Spring	669752	642	No sampling done

No	Name/Location	Code	Source Type	X-UTM	Y-UTM	Description
19	Odado spring	SPR14	Spring	670509	887	No sampling done
20	Sam spring	SPR15	Spring	670440	1118	No sampling done
21	Ombeyi spring 1	SPR16	Spring	6668570	582	No sampling done
22	Ombeyi spring 1	SPR17	Spring	668575	580	No sampling done
23	Abururu spring	SPR18	Spring	668350	581	No sampling done
24	Kadero spring	SPR19	Spring	667871	918	No sampling done
25	Nyamemem spring	SPR20	Spring	688431	-310	No sampling done
26	Obado spring	SPR21	Spring	671233	-677	No sampling done
27	Madawo spring	SPR22	Spring	670126	687	No sampling done
28	Kotiende stream confluent	K01	stream	669701	1344	No sampling done
29	Munungo stream upstream	M01	stream	671296	-249	No sampling done
30	Munungo stream Awachi confluent	M02	stream	670496	-650	No sampling done
31	Muhou stream midpoint	MU01	stream	670565	-705	No sampling done
32	Auramena stream midstream	AM01	stream	670296	1319	No sampling done
33	Lwanda-Aluor stream Midstream (Dhene-Aluor Bridge)	LA01	River	664301	-500	No sampling done
34	R. Dhene Upstream (Emmuli-Elukala Bridge)		River	672973	2669	No sampling done
35	R. Dhene-Syayusi confluent	DH01	River	671056	1493	No sampling done
36	R. Dhene Midstream (Nyangulu-Onding' Bridge)	DH02	River	668418	1627	No sampling done
37	R. Dhene Downstream (Siala-Onding' Bridge)	DH03	River	664152	2323	Baseline sampling done in 2022
38	R. Awachi upstream	AW01	River	671999	-349	No sampling done
39	R. Awachi mistream	AW02	River	671681	-769	No sampling done
40	R. Awachi downstream	AW03	River	669353	-3085	Baseline sampling done in 2021

No	Name/Location	Code	Source Type	X-UTM	Y-UTM	Description
41	R. Yala Upstream		River	666748	6153	Baseline sampling done
42	R. Yala midstream (R. Dhene confluent)		River	663760	2537	No sampling done
43	R. Yala Downstream (Wagai-Rera Bridge)	Y01	River	660366	1092	Used for exploration quarterly water quality monitoring

(Rural Focus Ltd, 2023) mentions that the existing monitoring network comprises of 43 stations though some of the points have not been sampled yet, the hydrocensus points were mapped initially by SGKL in order to design a monitoring network.

The existing network covered the proposed Project area even though monitoring was restricted to less than a dozen water points for both surface and groundwater.

4.8. Geochemical Assessment

The Environmental Geochemistry Impact Assessment was conducted to identify and quantify the potential impacts on the surrounding environment as a result of the proposed development of the Project. For the purpose of the assessment, the Area of Influence (AoI) was defined as a 500 m area around the Project area to provide some regional context.

This section presents a summary of the geochemical characteristics of 16 waste rock samples (andesite, diorite, dolerite, intermediate intrusive rock, saprock and saprolite), four sulfide samples, two ore samples and one tailing sample. Laboratory certificates of analysis are presented in Appendix A in the Geochemistry Report attached as Appendix H.

4.8.1. Mineralogy

Table 4-21 indicates the summary of the mineralogical composition of the waste rock, sulfide, ore and tailing samples listed in order of decreasing weathering (reactivity) rates.

4.8.1.1. Waste Rock

The mineralogy of the waste rocks (n=16) can be described as follows:

- No minerals with acid-forming properties were detected in all lithologies;
- Acid-neutralising silicate minerals range from dissolving to slow weathering rates. The silicates are indicated per lithology as follows:
  - Andesite (n=4): dissolving dolomite (0.7%) and calcite (8.3 – 17%), intermediate actinolite (3.8%), chlorite (17 – 30%) and talc (0.6%), slow plagioclase (0.7 – 32%);

- Diorite (n=3): dissolving calcite (1.6 – 6.0%), intermediate epidote (4.8%), actinolite (6.3 – 12%), chlorite (16 – 20%) and smectite (2.3%), slow plagioclase (34 – 45%);
- Dolerite (n=1): dissolving calcite (3.0%), intermediate actinolite (1.4%), chlorite (19%), slow plagioclase (49%);
- Intermediate Intrusive Rock (n=1): dissolving calcite (8.9%), intermediate chlorite (23%) and smectite (0.7%), slow plagioclase (37%);
- Saprock (n=4): dissolving calcite (0.5 – 0.7%), intermediate actinolite (0.6 – 11%), chlorite (0.7%) and smectite (7.3 – 16%), slow plagioclase (22 – 48%) and kaolinite (0.9 – 25%);
- Saprolite (n=3): dissolving calcite (0.5 – 2.8%), intermediate chlorite (15%) and smectite (0.7%), slow plagioclase (7.5 – 49%) and kaolinite (27 – 42%);

- Resistant minerals such as quartz occur at abundant levels (20 – 50%); magnetite and hematite at trace levels (<3%) in all lithologies. These minerals contribute to no acid neutralisation.

4.8.1.2. Sulfide Samples

The mineralogy of sulfide-rich samples (n=4) can be described as follows:

- No minerals with acid-forming properties were detected in all lithologies especially the expected sulfide samples;
- Acid-neutralising silicate minerals range from dissolving to slow weathering rates. The silicates are indicated per lithology as follows:
  - Andesite (n=1): dissolving calcite (13%), intermediate chlorite (24%) and smectite (0.8%), slow plagioclase (37%); and
  - Diorite (n=3): dissolving calcite (2.5 – 8.3%), intermediate actinolite (2.1 – 11%), chlorite (14 – 29%) and smectite (0.1 – 1.5%), slow plagioclase (40 – 44%);
- Resistant minerals such as quartz occur in less abundant to abundant levels (10 – 50%); magnetite and hematite at trace levels (<3%) in all lithologies. These minerals contribute to no acid neutralisation.

4.8.1.3. Ore

The mineralogy of the ore samples (n=2) can be described as follows:

- No minerals with acid-forming properties were detected in all lithologies;
- Acid-neutralising silicate minerals range from dissolving to slow weathering rates. The minerals included dissolving dolomite (10%) and calcite (0.8 – 8.3%), intermediate chlorite (12 – 15%), slow weathering plagioclase (38 – 43%); and

- Resistant minerals such as quartz occur at less abundant levels (10 – 20%); magnetite and hematite at trace levels (<3%) in all lithologies. These minerals contribute to no acid neutralisation.

4.8.1.4. Tailings

The mineralogy of tailings sample can be described as follows:

- Acid forming mineral pyrite was detected at 1.3%; and
- Fast dissolving acid neutralising mineral calcite (4.6%) and dolomite (6.1%) were detected in minor concentrations.

Acid-neutralising silicate minerals range from fast (clinochlore), intermediate (epidote, actinolite, chlorite, smectite, illite and talc) to slow weathering rates (plagioclase and kaolinite). Very slow weathering rates (muscovite, microcline, apatite and goethite) were also detected but do not contribute to the acid neutralising capacity.In summary, the analysis revealed the absence of the acid-forming mineral pyrite in all lithologies (waste rock, ore and sulfide samples) while trace amounts were detected. The expected sulfide samples did not detect any sulfide minerals. Fast-dissolving acid-neutralising carbonate minerals, such as calcite were observed in all lithologies and tailings while dolomite was limited to andesite waste rock and tailings.

The silicates within the samples display varying degrees of weathering, ranging from intermediate (epidote, actinolite, chlorite, smectite and talc) to slow weathering (kaolinite, plagioclase, sepiolite). The silicates contribute to the neutralisation potential of samples but at a slower rate compared to the carbonates.

Table 4-21: Mineralogy of the Waste Rock, Ore and Sulfide Samples

Sample Code	Sample Type	Lithology	Acid Forming	Acid neutralizing minerals															Resistant (inert)				Total
				Dissolving			Fast	Intermediate					Slow		Very slow								
			Pyrite	Dolomite	Calcite	Epidote	Clinochlore	Actinolite	Chlorite	Smectite	Illite	Talc	Plagioclase	Kaolinite	Muscovite	Microcline	Apatite	Goethite	Magnetite	Quartz	Rutile	Hematite	
DDA103899	Waste Rock	Andesite			8.34				17				32		19					23		0.56	100
DDA103900	Waste Rock	Andesite		0.71	14				19				27		13					26		0.92	100
DDA103901	Waste Rock	Andesite			17				30			0.63	0.65		19					32		0.51	100
DDA103902	Waste Rock	Andesite			12			3.81	18				23		20	0.92				22		0.27	100
DDA103903	Waste Rock	Diorite			1.59	4.81		12	16	2.31			34		11	7.08				9.75			100
DDA103904	Waste Rock	Diorite			5.99			7.33	20				39		13	6.59				8.66			100
DDA103905	Waste Rock	Diorite			3.11			6.27	16				45		10	7.02				12			100
DDA103906	Waste Rock	Dolerite			2.95			1.41	19				49		5.25	1.66				21			100
DDA103907	Waste Rock	Intermediate Intrusive Rock			8.91				23	0.69			37		9.16	0.89				20			100
DDA103908	Waste Rock	Saprock			0.7				0.66	9.47			48		16	5				20			100
DDA103909	Waste Rock	Saprock			0.52			0.65		7.34			22	25	19	5.21				20			100
DDA103910	Waste Rock	Saprock			0.61					16			43	0.93	18	6.65				15			100
DDA103911	Waste Rock	Saprock			0.57			11		14			44	2.02	11	8.25				10			100
DDA103912	Waste Rock	Saprolite			2.81				15	0.73			49		11	8.15				13		0.05	100
DDA103913	Waste Rock	Saprolite			0.57								27	27	18	0.6				27			100
DDA103914	Waste Rock	Saprolite											7.45	42	13	4.8		1.05		31			100
DDA103915	Ore	Dioritoid (dioritic rock)		10	0.8				12				38		19	0.99				19		0.46	100
DDA103916	Ore	Dioritoid (dioritic rock)			8.33				15				43		10	1.23			5.81	16			100
DDA103917	Sulfide Samples	Andesite			13				24	0.81			37		10					14		0.83	100
DDA103918	Sulfide Samples	Diorite			8.3				29	1.15			40		8.27	1.36				11		0.46	100
DDA103919	Sulfide Samples	Diorite			2.51			11	14	1.53			43		12	9.74			0.81	5.17			100
DDA103920	Sulfide Samples	Diorite			3.66			2.07	18	0.95			44		9.21	9.4			1.25	11			100
VA24B3204-001_ -82 Combined TL	Tailings		1.3	6.1	4.6		11	1			18		34				0.4		0.6	22.5	0.9		100

Predominant	>50%	Dolomite	$CaMg(CO_3)_2$	Smectite	$\sim(Mg,Ca)_{0.3}(Mg,Fe,Al)_3(Si,Al)_4O_{10}(OH)_2$	Microcline	$KAlSi_3O_8$
Abundant	20-50%	Calcite	$CaCO_3$	Talc	$Mg_3Si_4O_{10}(OH)_2$	Goethite	FeOOH/α- FeO.OH
Less abundant	10-20%	Epidote	$Ca_2(Al,Fe)_3Si_3O_{12}(OH)$	Plagioclase	$(Na,Ca)(Al,Si)_4O_8$	Magnetite	Fe_3O_4
Minor	3-10%	Actinolite	$Ca2(Mg,Fe)_5Si_8O_{22}(OH)$	Kaolinite	$Al4(OH)_8(Si_4O_{10})/Al4(Si_4O_{10})(OH)_8$	Quartz	SiO_2
Trace	<3%	Chlorite	$(Mg,Fe)_5Al(AlSi_3O_{10})(OH)_8$	Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	Hematite	Fe_2O_3

4.8.2. Acid Generating Potential

Table 4-22 presents a summary of the ABA, Sulphur speciation, carbon speciation, and NAG results for the waste rock, ore, sulfide and tailing samples.

4.8.2.1. Waste Rock

The acid-generating and neutralising characteristics of the of the waste rock samples (n=16) are as follows:

- The paste pH ranges between neutral to alkaline in saprolite (pH 6.40 – 9.30), saprock (pH 7.50 – 8.30), andesite (pH 9.10 – 9.30), diorite (pH 9.30 – 9.40), intermediate intrusive rock (pH 9.30) and dolerite (pH 9.00);
- Total sulfur ranges from 0.009% in saprock and saprolite to 0.78% in andesite. The sulfide concentration ranges between 0.007% (saprock and saprolite) and 0.78% (in andesite). Sulfide sulfur contributes to 75% of the total sulfur while sulfate sulfur contributes 25%;
- The Sulfide Acid Potential (SAP) ranges from 0.2 kg $CaCO_3$/t in saprolite to 16 kg $CaCO_3$/t in andesite;
- The total carbon content ranges between 0.05% to 2.4%, with inorganic carbon concentration contributing 77%;
- The neutralisation potential (NP) ranges from 4.4 kg $CaCO_3$/t in saprolite to 202 kg $CaCO_3$/t in andesite;
- The assessment of the SAP and NP (Table 4-22 and Figure 4-36) indicates that 100 % of samples are Potentially Acid Neutralising (PAN);
- NAG pH levels are neutral ranging between a pH of 6.50 (saprolite and saprock) to pH 7.10 (diorite and saprolite). A NAG pH exceeding 4.5 indicates PAN capability and this is demonstrated with neutral to alkaline pH (Figure 4-37).

4.8.2.2. Sulfide Samples

The acid-generating and neutralising characteristics of the sulfide samples (n=4) are as follows:

- The paste pH is alkaline ranging between pH 9.0 and 9.40;
- Total sulfur ranges from 0.02% to 0.52%. The sulfide concentration ranges between 0.011% and 0.37%. There is no sulfide minerals identified in the mineralogy, but sulfide species especially sulfide sulfur contributing to 65% of the total sulfur while sulfate sulfur contributes 22% and 13% indicating other sulfur species. Based on visual representation results andesite demonstrated highest pyrite concentration and this was identified by the ABA results having 0.5% of sulfide sulfur;
- The SAP ranges from 0.3 kg $CaCO_3$/t to 12 kg $CaCO_3$/t;

- The total carbon content ranges between 0.5% to 16%, with inorganic carbon concentration contributing 97% to the total carbon;
- The NP ranges from 45 kg $CaCO_3$/t in saprolite to 138 kg $CaCO_3$/t;
- The assessment of the SAP and NP (Table 4-22 and Figure 4-36) indicates that 100 % of samples are PAN;
- NAG pH levels are neutral ranging between a pH of 6.7 to pH 7.10. A NAG pH exceeding 4.5 indicates PAN capability and this is demonstrated with alkaline pH (Figure 4-37).

4.8.2.3. Ore

The acid-generating and neutralising characteristics of the ore samples (n=2) are as follows:

- The paste pH is alkaline ranging between pH 9.30 – 9.50;
- Total sulfur ranges from 0.37% to 0.75% with the sulfide concentration is ranges between 0.3% to 0.6%. Sulfide sulfur contributes to 75% of the total sulfur while sulfate sulfur contributes 25%;
- The SAP ranges from 8.1 kg $CaCO_3$/t in saprolite to 19 kg $CaCO_3$/t;
- The total carbon content ranges between 1.3% to 1.7%, with inorganic carbon concentration contributing 100% to the total carbon;
- NP ranges from 113 kg $CaCO_3$/t to 129 kg $CaCO_3$/t;
- The assessment of the SAP and NP (Table 4-22 and Figure 4-37) indicates that 100 % of samples are PAN; and
- NAG pH levels are neutral ranging between a pH of 6.70 to 6.90 and this PAN capability (Figure 4-37).

4.8.2.4. Tailings

- The paste pH is alkaline ranging between pH 11.31;
- The total sulfur is 0.4% with the sulfide concentration contributing 100% to the total sulfur at 0.4%;
- The SAP is 13 kg $CaCO_3$/t;
- The total carbon content is 1.3%, similarly with sulfide sulfur the inorganic carbon contributes 100% to the total carbon;
- NP is 105 kg $CaCO_3$/t; and
- The assessment of the SAP and NP (Table 4-22 and Figure 4-36) indicates the tailing to be PAN.

In summary, the current pH of all samples demonstrates neutral to alkaline with all samples (waste rock, ore, sulfide and tailing) being PAN. No acid-forming minerals were identified in all lithologies. The ABA results demonstrated the ore to have relatively high sulfide with the sulfide sulfur highest concentrations at 0.6%. However, the high sulfide sulfur is countered by the high NP. Under the worst case scenario, the NAG pH is neutral, with NAG pH > 4.5 and NAG for all samples below the detection limit.

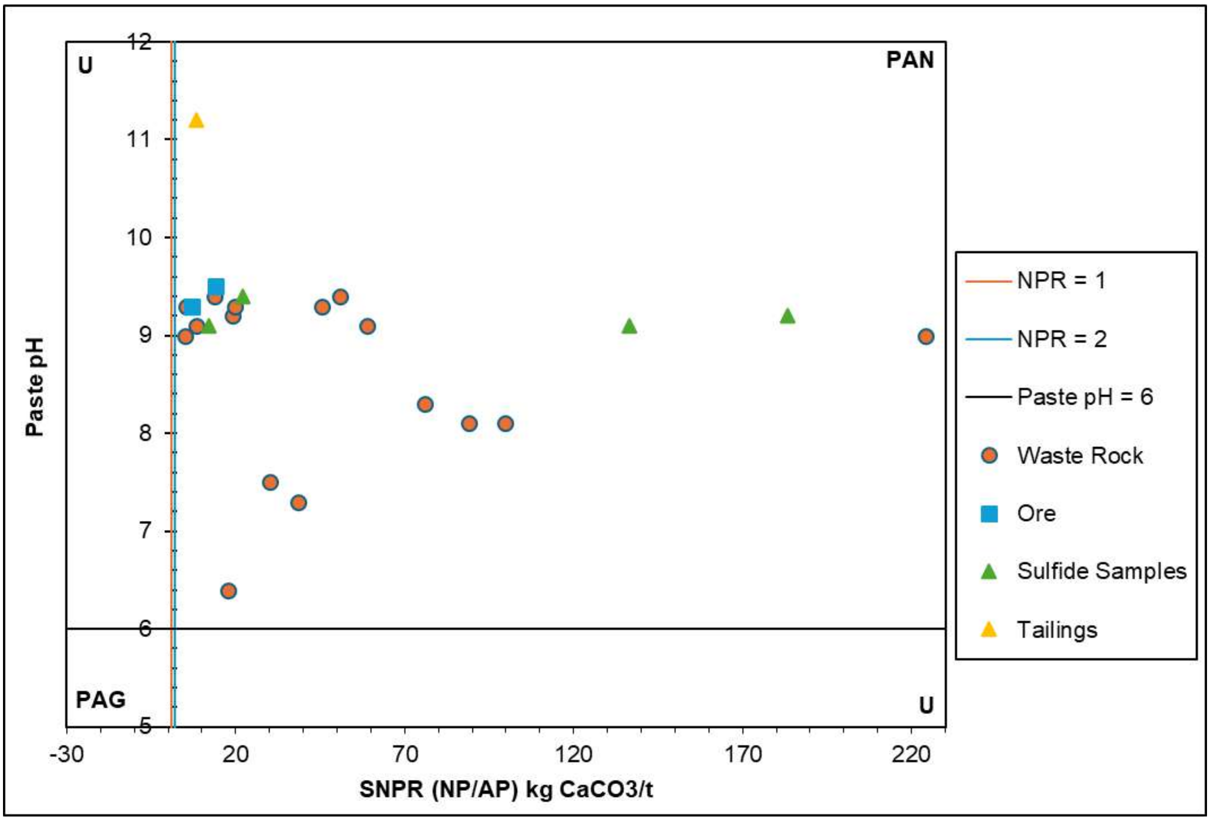


Figure 4-36: Paste pH versus SNPR for Waste Rock, Ore, Sulfide Samples and Tailings

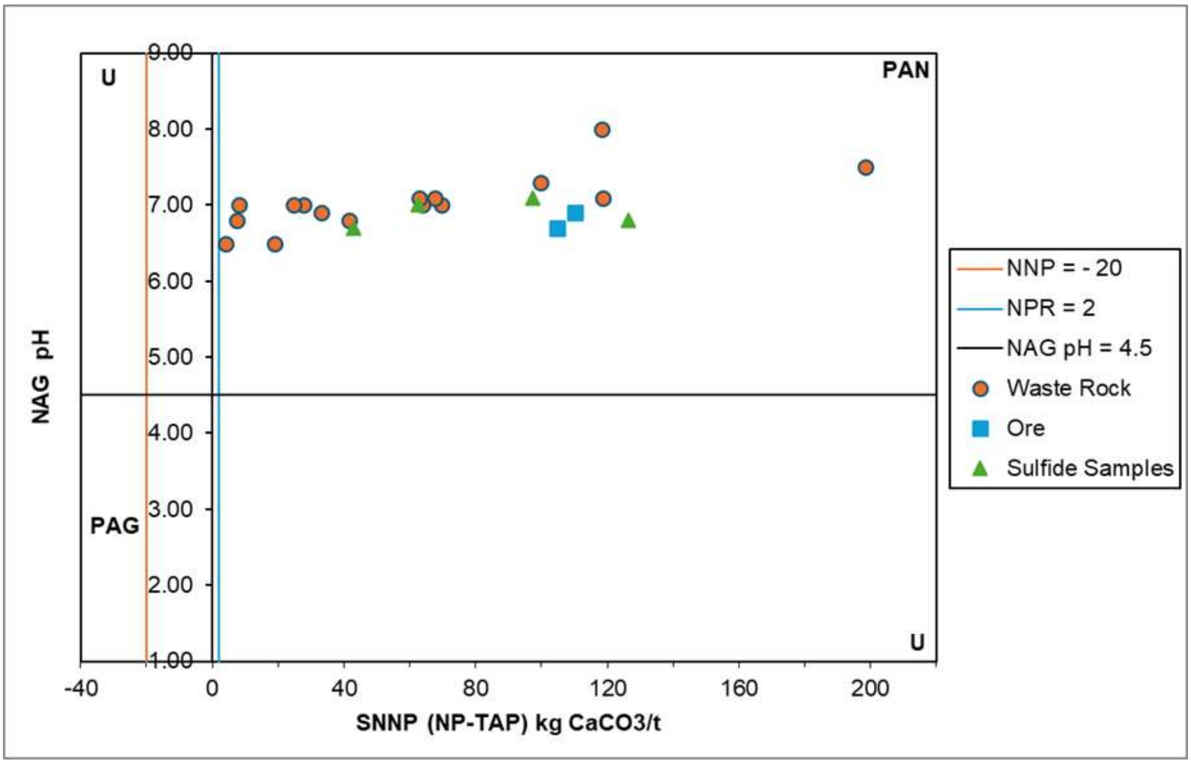


Figure 4-37: NAG pH versus SNNP for Waste Rock, Ore, Sulfide Samples and Tailings

Table 4-22: Acid-Base Accounting, Sulphur Speciation and NAG Test Results for the Ramula waste rock

Sample ID	lithology	Lithology code	Paste pH	Total sulfur as S	Sulfide as S	Sulfate as SO_4	Total carbon as C	Inorganic carbon as C	Organic carbon as C	SAP	TAP	NP	NP:AP ratio (SNPR)	NP:AP ratio (TNPR)	Net neutralising potential (SNNP)	Net neutralising potential (TNNP)	NAG	NAG pH	Classification (paste pH/NPR)	Classification (NAG pH/NNP)
			s.u	%	%	%	%	%	%	kg $CaCO_3$/T	kg $CaCO_3$/T	kg $CaCO_3$/T	No unit		kg CaCO3/T	kg CaCO3/T	kg H_2SO_4/T	-		
DDA103899	Andesite	Waste Rock	9.3	0.78	0.52	0.174	0.97	0.95	0.018	16.25	24.38	86	5.29	0.22	69.75	61.63	<0.5	7	PAN	PAN
DDA103900	Andesite		9.1	0.69	0.52	0.174	1.6	1.6	0.025	16.25	21.56	135	8.31	0.39	118.75	113.44	<0.5	7.1	PAN	PAN
DDA103901	Andesite		9.1	0.13	0.11	0.037	2.4	2.3	0.026	3.44	4.06	202	59	14	198.56	197.94	<0.5	7.5	PAN	PAN
DDA103902	Andesite		9.2	0.25	0.21	0.07	1.3	1.3	0.031	6.56	7.81	125	19	2	118.44	117.19	<0.5	8	PAN	PAN
DDA103903	Diorite		9.3	0.046	0.024	0.008	0.3	0.29	0.017	0.75	1.44	34	45	32	33.25	32.56	<0.5	6.9	PAN	PAN
DDA103904	Diorite		9.4	0.25	0.17	0.057	0.77	0.75	0.018	5.31	7.81	73	14	2	67.69	65.19	<0.5	7.1	PAN	PAN
DDA103905	Diorite		9.4	0.057	0.041	0.014	0.68	0.65	0.024	1.28	1.78	65	51	28	63.72	63.22	<0.5	7	PAN	PAN
DDA103906	Dolerite		9	0.49	0.34	0.114	0.59	0.51	0.082	10.63	15.31	52	4.89	0.32	41.38	36.69	<0.5	6.8	PAN	PAN
DDA103907	Intermediate Intrusive Rock		9.3	0.21	0.17	0.057	1.2	1.2	0.02	5.31	6.56	105	20	3	99.69	98.44	<0.5	7.3	PAN	PAN
DDA103908	Saprock		8.3	0.012	0.008	0.003	0.052	0.014	0.039	0.25	0.38	19	76	203	18.75	18.63	<0.5	6.5	PAN	PAN
DDA103909	Saprock		7.5	0.013	0.008	0.003	0.064	0.032	0.032	0.25	0.41	7.5	30	74	7.25	7.09	<0.5	6.8	PAN	PAN
DDA103910	Saprock		8.1	0.009	0.009	0.003	0.056	0.023	0.033	0.28	0.28	28	100	354	27.72	27.72	<0.5	7	PAN	PAN
DDA103911	Saprock		8.1	0.01	0.009	0.003	0.047	0.013	0.033	0.28	0.31	25	89	284	24.72	24.69	<0.5	7	PAN	PAN
DDA103912	Saprolite		9	0.011	0.009	0.003	0.64	0.62	0.012	0.28	0.34	63	224	652	62.72	62.66	<0.5	7.1	PAN	PAN
DDA103913	Saprolite		7.3	0.009	0.007	0.002	0.19	0.094	0.098	0.22	0.28	8.4	38	137	8.18	8.12	<0.5	7	PAN	PAN
DDA103914	Saprolite		6.4	0.012	0.008	0.003	0.27	0.17	0.096	0.25	0.38	4.4	18	47	4.15	4.03	<0.5	6.5	PAN	PAN
DDA103915	Dioritoid (dioritic rock)	Ore	9.3	0.75	0.6	0.2	1.7	1.7	0.032	18.75	23.44	129	6.88	0.29	110.25	105.56	<0.5	6.9	PAN	PAN
DDA103916	Dioritoid (dioritic rock)		9.5	0.37	0.26	0.09	1.3	1.3	0.016	8.13	11.56	113	14	1.2	104.88	101.44	<0.5	6.7	PAN	PAN
DDA103917	Andesite	Sulfide Samples	9.1	0.52	0.37	0.124	1.6	1.5	0.028	11.56	16.25	138	12	0.73	126.44	121.75	<0.5	6.8	PAN	PAN
DDA103918	Diorite		9.1	0.035	0.023	0.008	1	1	0.014	0.72	1.09	98	136	125	97.28	96.91	<0.5	7.1	PAN	PAN
DDA103919	Diorite		9.4	0.094	0.065	0.022	0.48	0.47	0.01	2.03	2.94	45	22	7.54	42.97	42.06	<0.5	6.7	PAN	PAN
DDA103920	Diorite		9.2	0.02	0.011	0.004	0.66	0.64	0.018	0.34	0.63	63	183	293	62.66	62.38	<0.5	7	PAN	PAN
BL1386-82 Combined TL	Tailings		11.2	0.41	0.4	0.01	1.33	1.32	0.01	12.5	12.81	105	8.4	0.66	92.5	92.19	<0.010		PAN	PAN

4.8.3. Elemental Enrichment

The total metal analysis was undertaken to identify elements enriched in the waste rock that may be of environmental concern relative to the average crustal abundance levels (Fortescue, 1992). The use of crustal abundance data is an industrially accepted approach to identifying enrichment and is commonly used in Environmental, Health, and Social-Economic Baseline Studies (EHSEBS).

The elemental concentrations and GAI values for the Yalea waste rocks are presented in Table 4-23. A GAI value of 0 indicates that the element is present at a concentration equal to or less than the crustal abundance. A GAI of six indicates approximately a 100-fold, or more, enrichment above crustal abundance. As a general guide, a GAI of three or above is significant in triggering environmental concerns.

Elements that are significantly enriched (GAI ≥3) in specific waste rock lithologies include the following:

- Waste Rock:
  - Saprock (n=4): tungsten (13 mg/kg); and
  - Saprolite (n=3): tungsten (16 mg/kg);
- Ore (n=2): aluminium (1.5 – 3.8 mg/kg); and
- Tailings: arsenic (21 mg/kg).

It must be noted that significant enrichment does not necessarily imply that the element represents an environmental risk although the enriched element in the waste rocks may leach into surface water and groundwater depending on site conditions. The risk that these enriched elements present is a function of the environmental mobility of the element, assessed by leach tests in the later sections of this report.

Table 4-23: Elemental Composition of Ramula Waste Rock, Ore, Sulfide and Tailing Samples

Elements	Average Elemental Composition of Ramula Pit	DDA103899	DDA103900	DDA103901	DDA103902	DDA103903	DDA103904	DDA103905	DDA103906	DDA103907	DDA103908	DDA103909	DDA103910	DDA103911	DDA103912	DDA103913	DDA103914	DDA103915	DDA103916	DDA103917	DDA103918	DDA103919	DDA103920	VA24B3204-001
		Andesite				Diorite			Dolerite	Intermediate Intrusive Rock	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite			Tailing
		Waste Rock																Ore		Sulfide Samples				
Ag	0.08	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.5	3.8	<0.2	<0.2	<0.2	<0.2	
Al	83600	17700	21500	37200	33200	21800	25500	18400	20000	35300	18600	26000	24100	16300	16900	28800	34700	15900	20300	31000	33400	16400	14400	72600
As	1.8	5.2	3.7	2.6	6.7	2.4	8.3	2.2	8.9	1.7	3.4	9.5	3	7.3	1.8	8.2	8.7	11	13	9.1	3	4.1	1.5	21
B	9	3.8	5.6	5.1	6.2	3.3	3.9	3.8	3	2.8	4	3.4	3.1	3.2	3.7	3.7	2.9	5.5	4.2	3.1	4.9	6.7	2.9	
Ba	390	77	45	61	58	362	99	154	143	36	197	308	198	175	172	324	461	128	390	76	106	121	51	520
Be	2	0.2	0.25	0.35	0.24	0.18	0.27	0.22	0.19	0.18	0.36	3.8	0.33	0.27	0.19	2.6	2.8	0.3	0.26	0.39	0.46	0.16	0.14	1.2
Bi	0.08	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<2
Ca	46600	30100	50200	75400	52800	19200	37200	29800	21800	38600	5360	2160	5970	8680	20800	1760	1640	38100	52200	68700	50700	16800	18400	39100
Cd	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5
Ce	66	33	39.2	40.1	45.3	72.9	70.1	69.2	59.2	39.7	69.5	93.9	70.8	72.9	65.8	104	236	66.9	65	67.1	66.9	70.4	67.3	
Co	29	19	19	24	25	18	18	16	20	23	17	25	20	20	16	22	43	18	16	21	23	16	13	21
Cr	122	62	50	162	102	56	57	63	52	43	98	88	92	61	75	103	75	69	59	49	64	53	62	207
Cu	68	37	33	30	48	42	46	51	44	23	23	48	24	39	12	34	63	27	23	62	43	38	60	49
Fe	62200	39200	42700	59700	54700	45500	52200	38600	42800	60400	40500	57400	48500	35700	33900	54800	81300	45800	43500	58600	63900	36700	28400	45400

Elements	Average Elemental Composition of Ramula Pit	DDA103899	DDA103900	DDA103901	DDA103902	DDA103903	DDA103904	DDA103905	DDA103906	DDA103907	DDA103908	DDA103909	DDA103910	DDA103911	DDA103912	DDA103913	DDA103914	DDA103915	DDA103916	DDA103917	DDA103918	DDA103919	DDA103920	VA24B3204-001
		Andesite				Diorite			Dolerite	Intermediate Intrusive Rock	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite			Tailing
		Waste Rock																Ore		Sulfide Samples				
Hg	0.09	12	12	12	13	12	13	12	17	12	10	15	13	13	13	19	32	15	22	12	12	14	12	
K	18400	2810	2010	3100	3700	1320	2090	2250	1400	831	3190	3640	2510	1920	2100	4140	2170	3350	2490	2270	2470	1330	816	16000
La	35	15.5	17.7	18.7	20.2	33.3	32	33.7	27.7	17.6	34.1	51.6	34	34.1	32.5	47.6	61.5	32.7	31.4	30.8	30.4	32.6	33.1	20
Mg	27640	13100	15400	29000	18400	17600	16500	14400	15400	17400	8980	8300	10400	9950	15100	6370	2140	16500	14700	19500	32800	12600	12900	18700
Mn	1060	709	932	1510	820	581	661	627	716	752	757	1270	814	723	730	1370	3850	848	765	875	878	515	563	830
Mo	1.2	4	3.5	0.9	3.7	2.9	3.4	3.5	3.7	1.9	5.7	3.5	4.3	2.8	4.1	5.3	4.3	4.9	3.6	2.2	3	2.6	3.9	9
Na	22700	706	663	250	837	879	970	883	982	658	812	488	881	807	756	568	363	731	571	582	682	780	610	25400
Ni	99	37	36	51	68	19	20	18	28	44	22	31	23	19	18	30	30	19	16	22	24	17	14	127
P	1120	961	936	1810	1370	2390	2530	1940	1710	1000	1890	613	1930	2080	1370	485	828	1810	1840	2400	2610	1830	1490	1300
Pb	13	6.1	6.6	6.2	6.8	9.5	11	6.2	6.7	<1.0	6.7	11	8.1	10	7.3	9	18	8.4	8.2	32	6.7	8.2	6.6	12
Sb	0.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<5
Sc	25	15	12.1	20	21.7	20.7	19	16.7	15.5	19.6	16.3	24.4	17.6	21.2	14.6	22.7	23.2	13.5	13.2	20.2	19.4	20.8	17.9	13
Se	0.05	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Sn	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Sr	384	43	38	121	82	86	84	97	33	46	52	52	92	73	78	39	23	151	211	151	89	71	64	464
Th	8.1	31	34	38	34	29	31	27	31	37	30	44	34	30	28	42	60	31	28	36	38	28	23	<20

Elements	Average Elemental Composition of Ramula Pit	DDA 103899	DDA 103900	DDA 103901	DDA 103902	DDA 103903	DDA 103904	DDA 103905	DDA 103906	DDA1 03907	DDA 103908	DDA 103909	DDA 103910	DDA 103911	DDA 103912	DDA 103913	DDA 103914	DDA 103915	DDA 103916	DDA 103917	DDA 103918	DDA 103919	DDA 103920	VA24B 3204-001
		Andesite				Diorite			Dolerite	Intermediate Intrusive Rock	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite			Tailing
		Waste Rock																Ore		Sulfide Samples				
Ti	6320	398	987	54	2290	2690	2430	1400	1500	27	187	764	550	1650	370	141	335	17	23	582	2110	2020	642	3600
Tl	0.72	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10
U	2.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10
V	136	48	62	64	60	82	83	73	64	75	80	130	91	79	76	115	126	49	57	98	110	76	52	123
W	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	13	<1.0	<1.0	16	6.5	<1.0	<1.0	<1.0	<1.0	<1.0	10
Y	31	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	13	<1.0	<1.0	16	6.5	<1.0	<1.0	<1.0	<1.0	<1.0	
Zn	76	58	71	97	83	64	70	61	96	59	103	106	154	105	59	197	306	63	62	79	115	56	54	98
Ag	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	0	0	0	0	0
Al	83600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	1.8	1	0	0	1	0	2	0	2		0	2	0	1	-1	2	2	2	2	2	0	1	-1	3
B	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ba	390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ca	46600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Elements	Average Elemental Composition of Ramula Pit	DDA 103899	DDA 103900	DDA 103901	DDA 103902	DDA 103903	DDA 103904	DDA 103905	DDA 103906	DDA103907	DDA 103908	DDA 103909	DDA 103910	DDA 103911	DDA 103912	DDA 103913	DDA 103914	DDA 103915	DDA 103916	DDA 103917	DDA 103918	DDA 103919	DDA 103920	VA24B 3204-001
		Andesite				**Diorite**			**Dolerite**	**Intermediate Intrusive Rock**	**Saprock**				**Saprolite**			**Dioritoid (dioritic rock)**		**Andesite**	**Diorite**			**Tailing**
		Waste Rock																**Ore**		**Sulfide Samples**				
Cd	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ce	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Co	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cu	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	62200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hg	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	18400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
La	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mg	27640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn	1060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mo	1.2	1	1	0	1	1	1	1	1	0	2	1	1	1	1	2	1	1	1	0	1	1	1	2
Na	22700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P	1120	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Pb	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Elements	Average Elemental Composition of Ramula Pit	DDA 103899	DDA 103900	DDA 103901	DDA 103902	DDA 103903	DDA 103904	DDA 103905	DDA 103906	DDA103907	DDA 103908	DDA 103909	DDA 103910	DDA 103911	DDA 103912	DDA 103913	DDA 103914	DDA 103915	DDA 103916	DDA 103917	DDA 103918	DDA 103919	DDA 103920	VA24B 3204-001
		Andesite				Diorite				Dolerite	Intermediate Intrusive Rock	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite			Tailing
		Waste Rock																Ore		Sulfide Samples				
S	340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sb	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sc	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sn	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr	384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Th	8.1	1	1	2	1	1	1	1	1	2	1	2	1	1	1	2	2	1	1	2	2	1	1	0
Ti	6320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl	0.72!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0
V	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	2	0	0	0	0	0	2
Y	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0

4.8.4. Leaching Potential

To determine the leaching characteristics, a short-term leach test ASTM, 1992; Mills, 2004d: Metal leaching test procedures where leaching water is ASTM D1987 water adjusted to pH 5.5 by carbonic acid, using a 4:1 liquid: solid ratio was conducted on 22 samples (16 waste rock, two ore and four sulfide sample). The solutions from these tests were analysed using multi-element ICP for cations and IC for anions. This analysis identified potential mobile chemical phases that are likely to be environmentally available due to their reactivity.

The Quality Control and Quality Assurance (QA/QC) included the method blanks for leachate analysis and the Ionic Charge Balance (ICB). The Method blanks were conducted for physicochemical, metal and/or metalloid parameters in the leachates. A method blank is an analyte media (usually deionised water) utilised by the laboratory to calibrate its instruments and to confirm the absence of interferences in the analytical signal. Acceptable method blank analytes should all be below the detection limit which is indicated in the laboratory certificates for both waste rock and tailings.

ICB was utilized to verify the accuracy and completeness of the analytical data. This assessment ensures that the sum of cations and anions in the chemical analysis is balanced, aligning with the principles of charge neutrality. The purpose of the ICB assessment is to identify any potential errors or inconsistencies in the data related to charge imbalances.

An imbalance exceeding ±20% was deemed unacceptable for solid samples, except samples exhibiting an EC lower than 20 mS/m. This threshold was established to account for potential variability in low-conductivity samples.

Out of the 22 waste rock samples, 86% of the samples displayed an imbalance below 20% while 14% were above 20%. By applying these criteria, the QA/QC process aimed to uphold data integrity and reliability, ensuring that analytical results met the required standards for precision and charge balance.

The leachate concentrations were evaluated against the Pakistan Effluent Guidelines 2006, IFC 2007, and background groundwater quality. The results are summarised in Table 4-24.

4.8.4.1. <u>Waste Rock</u>

The results for the waste rock samples (n=16) indicate the following:

- The pH of the leachate varies from neutral to alkaline, ranging between 6.60 and 9.40. The neutral pH is observed in the weathered zone saprolite and saprock. The leachate pH from andesite, diorites, dolerites and intermediate intrusive rock are above the maximum pH limit set by Kenyan effluent (pH 6.50 – 8.50) and IFC effluent (6.00 – 9.00) guidelines. All the lithologies are above the BGWQ (pH 6.63 – 7.11);
- The following parameters exceed Kenya's effluent guidelines:
  - Fluoride in saprolite is 2.5 mg/L, compared to guideline limit of 1.5 mg/L;

- Iron in saprock ranges between 26 – 57 mg/L is above the guideline limit of 10 mg/L; and
- Zinc in saprolite (1.3 mg/L) and saprock (1.0 – 1.7 mg/L) are above the guideline limit of 0.5 mg/L;

- The following parameters exceed IFC effluent guidelines:
  - Iron in saprolite (2.2 mg/L) and saprock (3.3 – 57 mg/L) are above the guideline limit of 10 mg/L; and
  - Zinc in saprolite (1.3 mg/L) and saprock (1.0 – 1.7 mg/L) are above the guideline limit of 0.5 mg/L; and
- Additionally, the following parameters exceed the BGWQ standards: high pH, electrical conductivity, sulphate, fluoride, nitrate-N, barium, iron, copper, magnesium, scandium, sodium and zinc.

4.8.4.2. Sulfide Samples

The results for the sulfide samples (n=4) indicate the following:

- The pH of the leachate is alkaline, ranging between 8.80 and 9.30. The leachate pH from andesite and diorites are above the maximum pH limit set by Kenyan effluent (pH 6.5 – 8.50), IFC effluent (6.00 – 9.00) guidelines and BGWQ (pH 6.63 – 7.11); and
- The following parameters exceed the BGWQ standards: high pH, electrical conductivity, sulphate, fluoride, barium and iron.

4.8.4.3. Ore

The results for the ore samples (n=2) indicate the following:

- The pH of the leachate is alkaline, ranging between 8.50 and 8.80. The leachate pH from andesite and diorites are above the maximum pH limit set by Kenyan effluent (pH 6.50 – 8.50), IFC effluent (6.00 – 9.00) guidelines and BGWQ (pH 6.63 – 7.11); and
- The following parameters exceed the BGWQ standards: high pH, electrical conductivity, sulphate, fluoride, barium and iron.

4.8.4.4. Tailings

The results for the waste rock samples indicate the following:

- The pH of the leachate is alkaline with a pH of 8.76. The leachate pH is above the maximum pH limit set by Kenyan effluent (pH 6.50 – 8.50) and BGWQ (pH 6.63 – 7.11);
- The following parameters exceed the Kenyan effluent guidelines:
  - Arsenic is 0.037 mg/L, compared to guideline limit of 0.02 mg/L;

  - Iron is 38 mg/L and above the guideline limit of 10 mg/L; and
  - Lead is 0.027 mg/L is above the guideline limit of 0.01 mg/L;
- The following parameters exceed IFC effluent guidelines:
  - Iron is 38 mg/L and above the guideline limit of 2 mg/L; and
- Additionally, the following parameters exceed the BGWQ standards: high pH, total dissolved solids, electrical conductivity, sulphate, fluoride, nitrate-N, arsenic, barium, chromium, copper, iron, lead, magnesium, nickel, sodium and zinc.

In summary, The pH of the waste rock leachate ranges from neutral to alkaline (6.60–9.40), while the pH of the sulfide samples, ore, and tailings are all alkaline, with values ranging between 8.80–9.30, 8.50–8.80, and 8.76, respectively. Fresh waste rock (andesite, diorite, dolerite, and intermediate intrusive rock), as well as sulfide samples and ore, have leachate pH levels that exceed the maximum limits set by the Kenyan effluent guidelines (pH 6.50–8.50) and BGWQ levels (pH 6.63–7.11). The sulfide samples leachate PH exceed the IFC effluent guidelines (6.00–9.00). The parameters that exceed the Kenyan effluent guideline limits include high pH, fluoride, iron and zinc. Iron exceeded IFC effluent guidelines for the weathered zone waste rock (saprolite and saprock). Additional parameters that exceed BGWQ levels include high pH, electrical conductivity, sulphate, fluoride, nitrate-N, barium, iron, copper, lead, magnesium, nickel, scandium, sodium and zinc. These parameters should be included in the water quality monitoring program of the site.

Table 4-24: ASTM D1987 Leachate Results for Ramula Waste Rock in 1:4 Solid-to-Liquid Ratio

Analytes	Units	Reporting Limit	Third Schedule: Kenya Effluent 2006	IFC Guidelines 2007	Background Groundwater Quality 2023		DDA1 03899	DDA1 03900	DDA1 03901	DDA1 03902	DDA1 03903	DDA1 03904	DDA1 03905	DDA1 03906	DDA1 03907	DDA1 03908	DDA1 03909	DDA1 03910	DDA1 03911	DDA1 03912	DDA1 03913	DDA1 03914	DDA1 03915	DDA1 03916	DDA1 03917	DDA1 03918	DDA1 03919	DDA1 03920
							Andesite				Diorite			Dolerite	IIR[12]	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite		
					Min	Max	Waste Rock																Ore		Sulphide			
Physiochemical Parameters																												
Final pH	-	0.1	6.5-8.5	6.0 - 9.0	6.63	7.11	8.8	8.9	9	9	9.4	9.2	9.3	9.1	9	7.7	7.2	7.2	6.9	8.3	7.3	6.6	8.5	8.8	8.8	8.9	9.1	9.3
Electrical Conductivity	mS/m	2			0.17	0.34	12	11	9	11	9	9	9	13	9	6	11	3	5	10	12	3	19	12	10	8	9	8
TDS	mg/l	21	1200		110	212	UTD	164	78	86	98	84	86	102	86	UTD	UTD	UTD	UTD	114	UTD	UTD	152	106	94	94	112	86
Total Alkalinity	mg/l	12					40	40	40	40	40	40	40	40	40	60	20	80	40	50	20	60	70	60	40	40	40	40
Chloride	mg/l	0.05	250		3.46	7.21	1.3	2.5	1.7	1.7	3.9	2.6	2.9	1.4	0.9	1.8	4.9	1.7	2	2.6	1.9	1.6	3.3	2.8	1.8	1.8	3.4	4.1
Sulphate	mg/l	0.05			3.95	23	13	10	2.5	14	7	5.2	5.2	28	4.4	6.7	7.1	3.3	3.7	5.9	7.8	6.9	24	10	6.3	6.4	5.1	2.3
Fluoride	mg/l	0.05	1.5		<0.03	0.23	0.28	0.25	0.31	0.27	0.29	0.29	0.33	0.24	0.21	1	1.2	0.96	0.92	0.4	0.62	2.5	0.38	0.3	0.33	0.38	0.13	0.22
Nitrite	mg/l	0.5			0.009	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrite as N	mg/l	0.2			0.003	0.004	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate	mg/l	0.1			2.7	24	1.8	1.8	0.9	5	0.3	1.5	1.9	1.8	1.8	14	39	4.4	6.7	4.2	44	6.9	4.9	0.6	1.4	1.4	0.4	0.1
Nitrate as N	mg/l	0.03			0.61	5.35	0.4	0.4	0.2	1.1	0.1	0.3	0.4	0.4	0.4	3.1	8.8	1	1.5	0.9	9.9	1.6	1.1	0.1	0.3	0.3	0.1	0
Ammonia	mg/l	0.1					<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ammonia as N	mg/l	0.012					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

12 Intermediate Intrusive Rock

Analytes	Units	Reporting Limit	Third Schedule: Kenya Effluent 2006	IFC Guidelines 2007	Background Groundwater Quality 2023		DDA1 03899	DDA1 03900	DDA1 03901	DDA1 03902	DDA1 03903	DDA1 03904	DDA1 03905	DDA1 03906	DDA1 03907	DDA1 03908	DDA1 03909	DDA1 03910	DDA1 03911	DDA1 03912	DDA1 03913	DDA1 03914	DDA1 03915	DDA1 03916	DDA1 03917	DDA1 03918	DDA1 03919	DDA1 03920
							Andesite				Diorite			Dolerite	IIR12	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite		
					Min	Max	Waste Rock																Ore		Sulphide			
Metals and Metalloids																												
Aluminium	mg/l	0.02					0.82	0.51	0.72	0.7	0.65	1.1	0.92	0.78	0.98	30	2.9	21	41	0.34	0.71	6.2	0.46	0.55	0.7	0.78	1.3	0.73
Antimony	mg/l	0.02					<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	mg/l	0.01	0.02	0.1		<0.007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	mg/l	0.002			0.044	0.08	0.022	0.003	0.003	0.004	0.21	0.035	0.096	0.068	0.004	1.1	0.16	0.76	1.2	0.047	0.1	0.29	0.039	0.17	0.005	0.014	0.13	0.021
Beryllium	mg/l	0.0001					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/l	0.03					<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Boron	mg/l	0.005	1			<0.01	0.019	0.025	0.024	0.028	0.025	0.024	0.02	0.02	0.019	0.13	0.11	0.15	0.093	0.02	0.028	0.26	0.029	0.025	0.022	0.023	0.025	0.021
Cadmium	mg/l	0.001	0.01	0.05		<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium	mg/l	0.5			16	42	9.9	11	9.1	11	6.2	7.4	6.8	13	7.9	17	9.5	14	31	9.6	6.6	11	14	7.2	7.7	6.8	6.8	5.9
Cerium	mg/l	0					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.152	0.152	0.238	0.181	<0.001	0.013	0.085	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Chromium	mg/l	0.002	2			<0.004	<0.002	<0.002	0.005	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	0.035	0.007	0.019	0.041	0.003	0.004	0.005	0.003	<0.002	<0.002	<0.002	0.004	0.003
Cobalt	mg/l	0.005					<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.048	0.007	0.038	0.074	<0.005	<0.005	0.017	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	mg/l	0.02	1	0.3		<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.02	0.04	0.1	<0.02	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hexavalent Chromium	mg/l	0.02	0.05	0.1		<0.01	<0.02	<0.02	<0.02l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analytes	Units	Reporting Limit	Third Schedule: Kenya Effluent 2006	IFC Guidelines 2007	Background Groundwater Quality 2023		DDA1 03899	DDA1 03900	DDA1 03901	DDA1 03902	DDA1 03903	DDA1 03904	DDA1 03905	DDA1 03906	DDA1 03907	DDA1 03908	DDA1 03909	DDA1 03910	DDA1 03911	DDA1 03912	DDA1 03913	DDA1 03914	DDA1 03915	DDA1 03916	DDA1 03917	DDA1 03918	DDA1 03919	DDA1 03920
							Andesite				Diorite			Dolerite	IIR12	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite		
					Min	Max	Waste Rock																Ore		Sulphide			
Iron	mg/l	0.05	10	2	0.01	0.03	0.58	0.06	0.39	0.53	0.53	0.92	0.62	0.47	0.46	40	3.3	26	57	0.28	0.79	2.2	0.23	0.15	0.22	0.53	1.3	0.35
Lanthanum	mg/l	0					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.103	0.172	0.179	0.075	<0.001	0.008	0.155	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	mg/l	0.01	0.01	0.2		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	mg/l	0.01			6.98	11.5	1.4	1.1	1.3	1.5	1.2	1.4	1.1	1.8	1.3	33	6.6	26	47	1.8	4.2	1.7	5.1	1.6	1.2	0.87	1.6	0.92
Manganese	mg/l	0.01	10			2.73	0.02	<0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	1.2	0.21	1.2	2.3	0.05	0.13	0.68	0.01	<0.01	<0.01	0.02	0.03	0.02
Mercury	µg/l	0.1		0.002		<0.001	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Molybdenum	mg/l	0.01				<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.005	<0.005	<0.005	<0.005
Neodymium	mg/l	0					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.09	0.211	0.184	0.07	<0.001	0.009	0.137	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/l	0.01	0.3	0.5		<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.043	0.005	0.032	0.053	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Phosphorus	mg/l	0.03					<0.03	<0.03	<0.03	<0.03	0.04	0.04	0.04	0.03	<0.03	0.83	0.15	0.75	0.84	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.07	<0.03
Potassium	mg/l	0.2					8.8	6	11	8.7	4.8	6.6	6.7	4.1	2.6	1.8	1.6	1.3	1.7	3.2	2.4	1.1	13	10	6.5	4.5	5.5	3.7
Scandium	mg/l	0	0.01			<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.033	0.014	0.044	0.047	<0.001	0.001	0.022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	mg/l	0.01					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silicon	mg/l	1					3	2	2	3	4	3	4	2	2	34	14	32	56	3	7	11	2	2	2	3	4	3
Silver	mg/l	0.002					<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Analytes	Units	Reporting Limit	Third Schedule: Kenya Effluent 2006	IFC Guidelines 2007	Background Groundwater Quality 2023		DDA103899	DDA103900	DDA103901	DDA103902	DDA103903	DDA103904	DDA103905	DDA103906	DDA103907	DDA103908	DDA103909	DDA103910	DDA103911	DDA103912	DDA103913	DDA103914	DDA103915	DDA103916	DDA103917	DDA103918	DDA103919	DDA103920
							Andesite				Diorite			Dolerite	IIR12	Saprock				Saprolite			Dioritoid (dioritic rock)		Andesite	Diorite		
					Min	Max	Waste Rock																Ore		Sulphide			
Sodium	mg/l	0.5			8.23	17	5.1	3.6	1.2	3.8	6.2	5.1	4.6	5.3	5.9	19	20	18	16	7.3	6.8	58	7.4	7	5.4	5.6	6.3	6.2
Strontium	mg/l	0.001					0.045	0.031	0.039	0.038	0.11	0.057	0.095	0.069	0.032	0.3	0.15	0.32	0.32	0.082	0.11	0.096	0.14	0.25	0.099	0.05	0.082	0.091
Sulphur	mg/l	0.07					13	14	1.3	9.2	2.8	2.7	2.1	17	3.5	2.2	3.2	0.96	1.2	2.5	2.9	2.8	16	6.6	7.3	1.2	2.2	1.1
Tellurium	mg/l	0.17					<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Thallium	mg/l	0.01					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	mg/l	0.04					<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	0.06	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Tin	mg/l	0.01					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Titanium	mg/l	0.01					0.009	<0.005	<0.005	0.014	0.034	0.04	0.029	0.018	<0.005	0.049	0.021	0.12	0.32	0.009	<0.005	0.008	<0.005	<0.005	<0.005	0.038	0.076	0.022
Tungsten	mg/l	0.01					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	0.05	0.05	0.05	0.06	0.06
Uranium	mg/l	0.01					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	mg/l	0					0.007	<0.001	<0.001	<0.001	0.015	0.011	0.018	0.007	0.007	0.15	0.036	0.1	0.13	0.009	0.008	0.06	<0.001	<0.001	<0.001	0.011	0.015	0.013
Yttrium	mg/l	0					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.047	0.062	0.069	0.036	<0.001	0.006	0.092	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/l	0.01	0.5	0.5		<0.01	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	1	0.13	1.4	1.7	0.02	0.1	1.3	0.02	0.02	0.02	0.03	0.02	0.03
Zirconium	mg/l	0.18					<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18
Ionic Balance							99	92	99	93	86	94	89	88	94	44	80	57	23	89	88	66	92	82	93	87	96	87

Table 4-25: ASTM D1987 Leachate Results for Ramula Tailings in 1:4 Solid-to-Liquid Ratio

Analytes	Units	Reporting Limit	Third Schedule: Kenya Effluent 2006	IFC Effluent Guidelines 2007	Background Groundwater Quality 2023		BL1386-82 Combined TL
							VA24B3204-001
					Min	Max	Tailings
Physiochemical Parameters							
Final pH	-	0.1	6.5-8.5	6.0 - 9.0	6.63	7.11	8.76
Electrical Conductivity	mS/m	2			0.17	0.34	50
TDS	mg/l	21	1200		110	212	596
Chloride	mg/l	0.05	250		3.46	7.21	1.92
Sulphate	mg/l	0.05			3.95	23	89
Fluoride	mg/l	0.05	1.5		<0.03	0.23	0.35
Nitrite as N	mg/l	0.2			0.003	0.004	0.008
Nitrate as N	mg/l	0.03			0.61	5.35	0.06
Metals and Metalloids							
Aluminum	mg/l	0.0050					43
Antimony	mg/l	0.00010					0.005
Arsenic	mg/l	0.0010	0.02	0.1		<0.007	0.037
Barium	mg/l	0.0010			0.044	0.077	0.85
Beryllium	mg/l	0.00050					<0.00250
Bismuth	mg/l	0.00050					<0.00250
Boron	mg/l	0.010	1			<0.01	<0.050
Cadmium	mg/l	0.000050	0.01	0.05		<0.002	<0.000250
Calcium	mg/l	0.10			16	42	16
Chromium	mg/l	0.00050	2			<0.004	0.071
Cobalt	mg/l	0.00010					0.026
Copper	mg/l	0.0010	1.0	0.3		<0.01	0.16
Iron	mg/l	0.030	10	2.0	0.01	0.033	38
Lead	mg/l	0.00010	0.01	0.2		<0.01	0.027
Lithium	mg/l	0.0050					<0.0250
Magnesium	mg/l	0.050			6.98	11.5	13
Manganese	mg/l	0.00050				2.73	0.57
Mercury	mg/l	0.000050		0.002		<0.001	<0.000050
Molybdenum	mg/l	0.00010					0.022
Nickel	mg/l	0.00050	0.3	0.5		<0.003	0.031
Phosphorus	µg/l	0.30					<1.50
Potassium	mg/l	0.050					26
Selenium	mg/l	0.00050					<0.00250
Silicon	mg/l	0.050					72
Silver	mg/l	0.000050					0.001
Sodium	mg/l	0.050			8.23	17	91
Strontium	mg/l	0.00050					0.21

Analytes	Units	Reporting Limit	Third Schedule: Kenya Effluent 2006	IFC Effluent Guidelines 2007	Background Groundwater Quality 2023		BL1386-82 Combined TL
							VA24B3204-001
					Min	Max	Tailings
Sulfur	mg/l	0.50					41
Thallium	mg/l	0.00010					<0.00050
Tin	mg/l	0.00050					<0.00250
Titanium	mg/l	0.010					0.57
Uranium	mg/l	0.000010					0.001
Vanadium	mg/l	0.0010					0.11
Zinc	mg/l	0.010	0.5	0.5		<0.01	0.09

4.9. Aquatic Biodiversity

An Aquatic Assessment was conducted as part of this EIA process and is included as Appendix I. To establish baseline conditions, the aquatic study comprised of two field surveys conducted across two different seasons to ensure the Project captured the variable conditions associated with the hydrological cycle. The initial survey was conducted from the 14 to the 17 March 2024 to record dry/winter season conditions during the lower water levels, while the second survey was conducted from the 17 to the 18 July 2024 during the wet/summer season when the watercourses had somewhat higher water levels. The assessment of both the low and high-water levels, allows for improved likelihood of recording the representative diversity of aquatic biota that utilize the watercourses based on their biological needs (foraging, spawning and refugia). This would include the potential of recording Species of Conservation Concern (SCC).

4.9.1. Water Quality

Due to the highly dynamic nature of lotic (or flowing) systems, water quality conditions have been shown to vary substantially on a temporal scale (e.g. seasonality) and along the longitudinal profile of a watercourse (Dallas and Day, 2004). Despite these variations, the assessment of *in situ* water quality is important in understanding potential stressors on aquatic organisms within their environment. *In-situ* water quality parameters essentially provide a snapshot of the general conditions observed at a site at the time of the survey, which aids in the interpretation of biological findings. Findings gathered during the study (Table 4-26) were compared against the applicable guidelines. These guidelines stem from global sources and serve to highlight physio-chemical stresses that may be present within the assessed aquatic environments.

- Kenya's discharge limits for pH guidelines (Environmental Management and Coordination, (Water Quality) Regulations. 2006);
- Conductivity guideline value of 500 µS/cm stipulated in U.S. Environmental Protection Agency (2010);

- Dissolved oxygen concentration guideline of > 5.0 mg/l for macroinvertebrates (Nebeker et al., 1996); and
- Dissolved oxygen saturation of between 80% and 120% and water temperatures of between 5 and 30°C for aquatic biota from Department of Water Affairs and Forestry (1996) (South Africa).

Table 4-26: *In-situ* water quality parameters recorded during the study period

Site	Time	Temperature (°C)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
Guideline Values		**5-30**	**6.5-8.5**	**<500**	**>5**	**80-120**
March 2024 dry season survey						
Northern Drainage Systems						
Camp 1	10:55	24.5	7.8	161	6.2	80
Dhene 1	09:30	22.5	7.2	148	4.4	49.5
Auromena 1	14:10	27	7.5	196	5.8	68
ROM 1	12:08	29	7.2	143	5.2	71
TSF trib1	11:18	25	7.3	110	6.0	72
Dhene 2	10:54	25	8.2	166	5.5	75.5
Yala 1	11:10	26	7.5	87	7.5	88
Southern Drainage Systems						
Awachi 1	09:30	22.0	7.0	128	5.21	60.3
Munungo Pit 20	13:20	28	7.5	228	6.02	64.2
Awachi-NTrib	12:05	26.5	7.0	159	6.06	77.8
Awachi 2	10:00	22.0	7.9	138	6.5	70.6
July 2024 wet season survey						
Northern Drainage Systems						
Camp 1	Excluded as no longer being considered.					
Dhene 1	10:10	22.1	7.19	180	4.75	53.8
Auromena 1	14:40	25.1	7.05	216	4.70	58.3
ROM 1	16:30	25.4	6.96	137	4.00	44.0
TSF trib1	17:00	24.2	6.60	106	5.08	53.5
Dhene 2	14:22	26.3	6.88	186	5.04	63.1
Yala 1	Not sampled due to time lost to country strikes.					
Southern Drainage Systems						
Awachi 1	No Access – Social unrest.					
Munungo Pit 20	No Access – Social unrest.					
Awachi-NTrib	15:24	24.8	7.01	162	5.20	60.1
Awachi 2	10:15	25.5	7.40	155	5.52	65.0
Red values indicate water quality constituents that exceed the recommended guideline values						

During both surveys, most of the recorded *in situ* water quality parameters complied with guideline values. However, the Dissolved Oxygen (DO) saturation percentages were consistently below the guideline of 80% (DWAF, 1996) during the March 2024 dry season, with concentrations decreasing further below the guideline lower limit during the July 2024 wet season survey. This was notable for the tributary systems that were largely subjected to ASM activities with majority of the water flowing in these systems stemming from the pumping of groundwater which typically holds a lower dissolved oxygen value compared to surface water. The lower DO in groundwater is related to the water being shielded from atmospheric exchange and where in aquifers, microbial respiration, oxidation of minerals, and the absence of photosynthetic activity often result in oxygen depletion (Heath, 1983; Chapelle, 2001). According to USGS (2018), groundwater DO levels can range from 0 to 10 mg/L, with many groundwater sources having levels near or below 2 mg/L, which is considered hypoxic. When groundwater is pumped into streams as a result of activities such as ASM, the lower DO can affect stream water quality, negatively impacting aquatic life which requires higher oxygen levels. Additionally, the lower DO was expected given the slow flowing wetland nature of the sites in the upper reaches of the Dhene River (Figure 4-38).

Conductivity values were found to be low and of near natural levels, however some level of modification was noted when average values (160 µS/cm across both systems and seasons) were compared to the partially flooding Yalla River downstream of the project area (i.e. Yalla 1 at 84 µS/cm in March 2024). These modified values are likely affected by groundwater discharge together with rural use of the rivers for clothes washing and bathing activities.

Visual observations made during the study period noted high turbidity levels at majority of the sites, with levels increasing towards the afternoon. This is related to ASM activities, which included panning activities, with intensities increasing from midday onwards as more people were mining. According to various sources [Ogola et al. (2002); Ogendi & Ong'ang'a (2007); Nyakundi et al. (2010)], artisanal mining in Kenya causes increased turbidity and pollution, leading to habitat loss (physical removal and smothering from sedimentation), reduced biodiversity, and the contamination of aquatic ecosystems. These changes disrupt food chains (loss of primary production from blocked sunlight and lowered visibility for predatory species), harm fish populations (physiological stress/ laboured respiration from high turbidity), and decrease water quality.

Overall, the water quality was deemed sufficient to sustain general aquatic life, however the low DO values compounded by the high turbidity levels were expected to limit the diversity and abundance of sensitive aquatic biota in both the Dhene and Awachi Rivers.

Figure 4-38: Dhene 1 presenting wetland characteristics taken during the March 2024 survey

4.9.2. Sediment Analysis

A total of nine sediment samples were collected from each of the monitoring sites across the Dhene and Awachi rivers and their tributaries. The Yala River was not included due to its distant location and Camp 1 as no mining is proposed in that system. Samples were kept cool and sent to SGS Kenya Limited Laboratory Services for analysis. The results from the March 2024 dry season survey are presented in Table 4-30. The March 2024 results are presented with low confidence due to delays in analysis and loss of two samples (Awachi 1 and Awachi 2) at the laboratory. Due to social unrest during the July 2024 survey, the Awachi 1 and Awachi 2 sites were not recollected, limiting baseline knowledge in these areas. These samples will be recollected by SGKL.

These value present baseline conditions with some indication of potential contaminants in the sediments. This was indicated by higher Nickel, Arsenic, Cadmium, Chromium, Lead, Selenium and Zinc values present in the TSF and to some degree at ROM 1 when compared to the rest of the monitoring data. Interestingly the tests did not detect Mercury, despite local artisanal miners admitting to using liquid Mercury to separate the gold.

Values were compared against the Probable Effect Concentrations (PEC) at which sediments are likely to be toxic to sediment-dwelling organisms (MacDonald et al., 2000). The majority of the contaminants were not considered toxic with some falling below detection levels; however, several parameters do not have listed PEC.

Table 4-27: Aquatic sediment data collected during the March 2024 dry season survey

TESTS	pH	Electrical Conductivity	Total Cyanide	Nickel as Ni	Arsenic as As	Cadmium as Cd	Chromium as Cr	Copper as Cu	Lead as Pb	Selenium as Se	Zinc as Zn	Mercury as Hg	Volatile Organic Compounds in Soil			
													Benzene	Toluene	Ethylbenzene	Xylenes (sum)
UNITS		mmhos/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg
MacDonald et al (2000) PEC	-	-	-	48.6	33	4.98	111	149	128	-	459	1.06	-	-	-	-
Northern Drainage Systems																
Dhene 1	6.35	0.03	<0.001	8.57	1.50	0.14	21.98	6.70	2.22	<0.00	14.38	Not detected	<10	<10	<10	<20
Auromena 1	6.11	0.04	<0.001	10.22	1.43	0.17	22.16	7.73	2.23	<0.00	14.08	Not detected	<10	<10	<10	<20
ROM 1	6.23	0.03	<0.001	14.14	3.38	0.19	39.86	12.14	4.63	<0.00	16.60	Not detected	<10	<10	<10	<20
TSF trib1	6.06	0.04	<0.001	17.62	4.36	0.25	37.87	13.63	4.81	0.17	29.18	Not detected	<10	<10	<10	<20
Dhene 2	6.16	0.03	<0.001	13.76	2.04	0.15	28.70	9.58	5.01	<0.00	16.16	Not detected	<10	<10	<10	<20
Southern Drainage Systems																
Awachi 1	Misplaced sample															
Munungo Pit 20	6.82	0.10	<0.001	7.99	1.24	0.16	7.75	7.56	2.69	<0.00	22.04	Not detected	<10	<10	<10	<20
Awachi-NTrib	6.80	0.08	<0.001	14.09	3.97	0.21	30.10	10.65	2.23	0.00	29.50	Not detected	<10	<10	<10	<20
Awachi 2	Misplaced sample															
Within Probable Effect Concentrations – Green Shaded; Exceeding Probable Effect Concentrations – Red Shaded																

4.9.3. Aquatic Biota

Macroinvertebrate and fish assemblages were utilised as key biological indicators as part of the study. Sampling took place at all sampling sites with sufficient water levels and habitat availability. This excluded the tributaries of the Dhene and Awachi Rivers which drain the project area. The biological findings from the two seasonal surveys are presented in the respective sections below.

4.9.3.1. Macroinvertebrate Assessment

According to the known distribution ranges of selected groups of extant and probably extant aquatic macroinvertebrates, the Lake Victoria basin supports an exceptionally high diversity and endemism, including approximately 219 species of Odonata (Dragonflies and Damselflies), 50 different types of mollusc (i.e. Gastropoda and Pelecypoda) and 16 different decapods species (i.e. Potamanautidae, Atyide, and Paleomonidae, Sayer et al., 2018). However, it is unlikely that all these species will be present within the study area, with marginally lower numbers expected, and some probability of endemic species being present.

4.9.3.2. Instream Biotope Suitability and Habitat Descriptions

The instream biotope suitability for aquatic macroinvertebrates was described using an adapted version of the IHAS, Version 2 (McMillan, 1998). The assessment index describes the quantity, quality and diversity of available macroinvertebrate habitat relative to an “ideal” diversity of available habitat.

Macroinvertebrate habitat availability was observed to range from Adequate to Excellent during the study period with minor variation in water levels and instream habitat condition (Table 4-28). Photographic examples of habitat presence across the Project area is presented in Figure 4-39. Most sites exhibited an abundance of cobbled sections within a diversity of flow rates. These type of course biotopes (i.e. habitat types) are preferred by sensitive taxa which tend to be flow and oxygen dependent. Most of the sites, bar Camp1 were negatively influenced by artisanal mining through the smothering of the course substrates by sediment through washing soil for gold instream, lowering IHAS scores and habitat integrity and availability for macroinvertebrates. This coincided with turbidity levels that fluctuated throughout the day and were considered to be moderate to high limiting light penetration through the water column and photosynthesis potential for primary producers (Figure 4-40). Extreme levels of habitat disturbance occurred in July 2024 at Dhene 2, whereby large portions of the cobble from the riffle sections was removed from the watercourse for mining, and was not returned following the mining, with complete changes to flow velocities changing the habitat from diverse riffles to uniform fast runs, unsuited to support high biotic diversity (Figure 4-41).

Dhene 1

Dhene 2

Awachi

Camp 1

Yalla 1

Figure 4-39: Photographs of habitat differences across the Project area

Table 4-28: Instream Biotope Suitability for the study period

Site	Adapted IHAS Value (%)		Description
	March 2024 dry season	July 2024 wet season	
Northern Drainage Systems			
Dhene 1	66	67	Good yet portions of banks are eroded and modified for farming and mining practices. Good water clarity (low turbidity) in March 2024 deteriorating to Poor water clarity (high turbidity) in July 2024.
Dhene 2	82	64	Excellent in March 2024 yet mining related sedimentation smothered gravel. This deteriorated to Adequate in July 2024 from intensive ASM and removal of many cobble areas. Poor water clarity (high turbidity) both seasons.
Camp 1	65	Excluded	Good yet banks are deeply incised, eroded and bare, with patches of vegetation present. Good water clarity (low turbidity) both seasons.

Site	Adapted IHAS Value (%)		Description
	March 2024 dry season	July 2024 wet season	
Yala 1	75	Not sampled	Excellent yet mining related sedimentation small portions of smothering gravel. Poor water clarity (moderate turbidity).
Southern Drainage Systems			
Awachi 1	78	Not sampled	Excellent yet mining related sedimentation smothering moderate portions of gravel. Poor water clarity (moderate turbidity).
Awachi 2	69	70	Good yet mining related sedimentation smothering moderate portions of gravel. Limited vegetation. Poor water clarity (moderate turbidity) both seasons.
>75 - Excellent; 65-74 - Good; 55-64 - Adequate/Fair; <55 - Poor			

Figure 4-40: Photographs of water clarity differences at Dhene 1 (left) March 2024 (right) July 2024

Figure 4-41: Photographs of ASM related cobble removal and channel alterations at Dhene 2 (left) March 2024 (right) July 2024

When describing these watercourses as per IFC PS6 definitions, the habitat condition within the Project area is dominated by Modified Habitat where agricultural (crop and livestock), ASM practices and poorly designed river crossing structures have modified the upper Dhene reach wetlands. The ASM activities have altered all of the assessed watercourses with instream sedimentation present across the Project area varying in intensity. The riverbanks have been denuded with unmitigated pits dug out for gold washing.

Despite portions of the larger watercourses such as the Dhene and Awachi Rivers and downstream Yala River consisting of large sections of habitat, that appears generally unmodified, these systems are lined with anthropogenic activities as listed above, with resource harvesting (reeds) and clearing for agriculture and alien Eucalyptus plantations a common occurrence, negatively affecting the habitat and flow drivers. The tributaries visited were all deeply incised from continuous groundwater pumping. The extensive ASM and groundwater pumping has impacted on the water quality driver with associated limitations to sensitive aquatic biota. As a result, no *Natural* watercourses were recorded during the study, which all watercourses considered *Modified* with the ecological functioning modified from natural/ reference conditions.

4.9.3.3. Benthic Community Composition

The TARISS, Version 1 (Kaaya et al., 2015). was used as the standard aquatic macro-invertebrate collection and scoring method for all the sites throughout the Project area. The use of assemblage-based methods, such as TARISS and SASS, provides significant information for evaluating cumulative ecological effects since it encompasses a wide range of pollution tolerances and trophic levels (Palmer & Taylor, 2004). For the purposes of this study, the thresholds proposed by Chutter (1998) were deemed sufficient to determine a perceived ecological category (Table 4-29).

Table 4-29: Suggested thresholds/ranges for interpreting SASS metrics

SASS Score	ASPT	Suggested Interpretation	Ecological category
> 100	> 6	Water quality natural, habitat diversity high (A)	A
< 100	> 6	Water quality natural, habitat diversity reduced	B
> 100	< 6	Borderline case between water quality natural and some deterioration in water quality	C
50 - 100	< 6	Some deterioration in water quality	D
< 50	Variable	Major deterioration in water quality	E

The dominant sampling biotopes were fine-grained sediments (i.e. sand and mud) between patches of gravel and cobble. The marginal vegetation biotope was rather patchy due to the ASM disturbance at most sites with the upper Dhene presenting diverse and abundant vegetation. This meant that the macroinvertebrates that were sampled showed a strong bias toward those that prefer the GSM and cobble biotopes. Relatively poor oxygenation of the water throughout the survey area together with high turbidity and sedimentation impacts were considered a limiting factor to the abundance and diversity of aquatic macroinvertebrates, which resulted in relatively poor invertebrate scores throughout the study area considering the diversity of habitat across a wide diversity of depth-flow velocities, ranging from slow flowing pools to fast flowing riffles, rapids and runs.

A total of 37 aquatic macroinvertebrate families, ranging from 14 taxa at Yala 1 to 27 at Dhene 1, were collected within the watercourses across the study period (Table 4-30). This indicates a low to moderate diversity of macroinvertebrates. The corresponding TARISS scores (total sensitivity) ranged from a low of 102 at Yala 1 to a moderately high score of 161 at Dhene 1, while the Average Score per Taxon (ASPT – average sensitivity) values ranged from 5.59 at Dhene 2 to 7.29 at Yala 1. The Ephemeroptera, Plecoptera, and Trichoptera taxa (%EPT) metric as applied in Barbour et al. (1999), Chutter (1998), and Dallas (2007) refers to the percentage of the macroinvertebrate community that is made up of organisms from the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These taxa are often used in bioassessment studies because they are sensitive to water quality and pollution. A higher %EPT typically indicates better water quality and healthier stream ecosystems. Ranges for %EPT can vary depending on the specific water body, pollution levels, and regional benchmarks, but in general the following ranges were applied:

- High %EPT (>40-50%) indicates good water quality and low pollution levels.
- Moderate %EPT (20-40%) suggests intermediate water quality with moderate pollution.
- Low %EPT (<20%) suggests poor water quality with significant pollution or habitat degradation.

Based on the study findings, the %EPT was considered to be moderate throughout the assessed sites, ranging from 22% at Dhene 1 to 43% at Yala 1 where the stones-in-current habitat was present. However, it is worth noting that the %EPT is influenced by habitat availability and condition, i.e., the majority of EPT taxa tend to prefer coarse substrates, which was generally present however negatively impacted due to ASM activities within the assessed watercourses, with several key and commonly sampled EPT taxa absent from the samples. Additionally, the macroinvertebrate families, such as Odonata (Dragonflies and Damselflies), Hemiptera (Bugs), Coleoptera (Beetles) and Diptera (Flies), with an affiliation to the vegetation biotope were found to be depauperate due to ASM impacts, limiting the overall community diversity.

Table 4-30: Aquatic macroinvertebrate data collected during the study period

Site	Season	TARISS Score	No. of Taxa	ASPT*	%EPT	IHAS (%)	Ecological Band	Community Comment
Northern Drainage Systems								
Dhene 1	March Dry	139	24	5.79	29	66	C	Low flow diversity in pool-run type habitat supporting a diverse community including 3 moderately- and 2 sensitive taxa sampled.
	July Wet	161	27	5.96	22	67	C	Improved community diversity with 3 moderately- and 4 sensitive taxa sampled.
Dhene 2	March Dry	123	22	5.59	27	82	C	Moderate flow diversity in riffle-run-pool type habitat supporting a diverse community including 3 moderately- and 2 sensitive taxa.
	July Wet	104	18	5.78	33	64	C	Lowered community diversity with a single moderately- and 2 sensitive taxa sampled.
Camp 1	March Dry	106	16	6.63	31	65	B	Low flow diversity in riffle-run-pool type habitat supporting a low macroinvertebrate diversity 2 moderately- and 3 sensitive taxa sampled.
	July Wet	Excluded as no longer being considered.						
Yala 1	March Dry	102	14	7.29	43	75	A	Flooding/high flow with high habitat diversity comprising riffle-rapid-run. 2 moderately- and 3 sensitive taxa sampled. Interpret with caution due to likely flood related flushing effect of inverts.
	July Wet	Not sampled due to time lost to country strikes. In higher flood conditions, limiting analysis.						
Southern Drainage Systems								
Awachi 1	March Dry	127	22	5.77	32	78	C	Moderate flow diversity in diverse riffle-run-pool type habitat supporting a diverse community including 3 moderately- and 1 sensitive taxa.
	July Wet	No Access – Social unrest.						
Awachi 2	March Dry	141	23	6.13	30	69	A	High flow diversity in diverse riffle-rapid-run-pool type habitat supporting a diverse community including 4 moderately- and 2 sensitive taxa.
	July Wet	148	25	5.92	28	70	C	Lowered community diversity with a 5 moderately- and 1 sensitive taxa sampled.

ASPT* = Average Score per Taxon

4.9.3.3.1. Indicators of functional integrity

The ASPT scores indicated that the watercourses comprised a diversity of tolerant macroinvertebrates (Intolerance score: 1 – 5). A total of 7 moderately sensitive (Intolerance score: 8 – 10) macroinvertebrate families were recorded during the study, while 7 sensitive (Intolerance score: 11 – 15) macroinvertebrate families were collected across the project area. Sensitive (moderate and high) taxa included **Plecoptera** (Stoneflies) – namely Perlidae (Stoneflies – limited to Camp1 and Yala1); **Ephemeroptera** (Mayfly) families – namely Baetidae >2 spp (Maylfies), Prosopistomatidae (Water specs – Yala only), Heptageniidae, (Flat-headed mayfly), Leptophlebiidae (Prongills) and Trichorythidae (Stout Crawlers); **Odonata** (Dragonflies and Damselflies) –namely Calopterygidae (Broad-winged damselflies), Chlorocyphidae (Jewel Damselflies), Platycnemidae (Brook damselflies) and Aeshnidae (Emperors and Hawkers), as well as **Coleoptera** (Beetles) such as Elmidae (Riffle Beetles) and **Lepidoptera** - Crambidae (Aquatic Caterpillar) (Figure 4-42).

A

B

C

D

Figure 4-42: Photographs of some of the moderately sensitive taxa sampled within the study area including A: Leptophlebiidae; B: Trichorythidae; C: Chlorocyphidae; and D: Corduliidae (Specimens not from project area)

The presence of these sensitive macroinvertebrate families across all sampled sites indicates a moderate to high level of ecological functioning within the sampled watercourses, despite current levels of habitat disturbance.

A B C

Figure 4-43: Highly sensitive A: Heptageniidae; B: Prosopistomatidae; and C: Perlidae individuals sampled within the project area (Specimens not from project area)

4.9.3.4. Ichthyofaunal / Fish Assessment

Based on distribution ranges of extant and possibly extant species within the central region of Africa, approximately 56 indigenous species of fish exhibited a potential to occur within the greater Lake Victoria catchment area (Darwall et al., 2011). However, it is anticipated that a large number of specimens inhabit the Lake Victoria itself, so the probability of have these species moving up into the Yala, Awachi and Dhene rivers may be slightly limited. This was highlighted by Achieng et al. (2020) with 25 species recorded in the Yala River catchment. The presence of species is largely based on habitat suitability, with depth and flow class and biotope diversity being drivers of species diversity, with the smaller tributaries not expected to support as much fish diversity as the larger watercourses with greater water depth and volume.

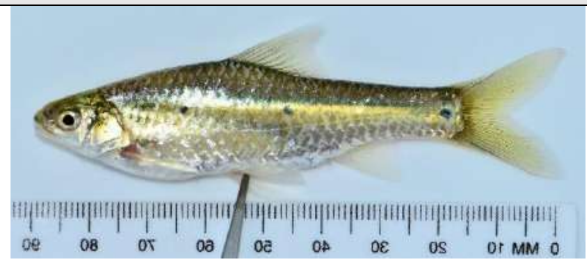
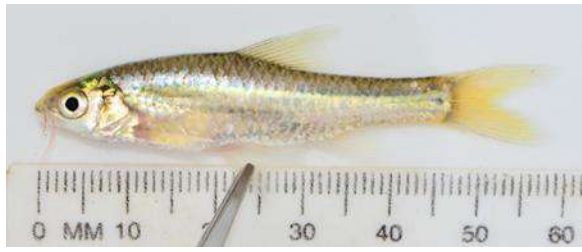
During the March 2024 dry season a total of five fish families comprising 11 species, totalling 463 individual specimens were collected, while the July 2024 wet season a total of three fish families comprising eight species, totalling 175 individual specimens were collected (Table 4-31). A total of 13 species were cumulatively sampled across the Project area, ranging from two to seven species per site across the two seasonal surveys, with the Dhene and Yala rivers presenting the highest diversity. The cumulative impact site on the Yala River was only sampled in March 2024, resulting in fewer species sampled in July 2024. The most abundant and common species were *Enteromius neumayeri* (57% of all specimens; n=361), followed by *Enteromius kerstenii* (16%; n=102) and *Clarias gariepinus* (7%; n=44).

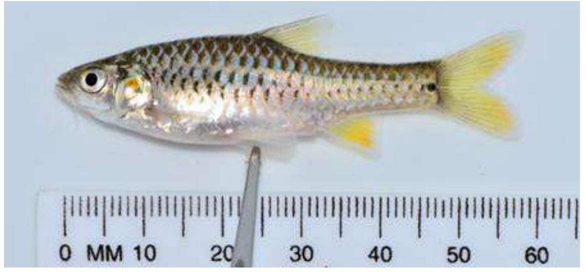
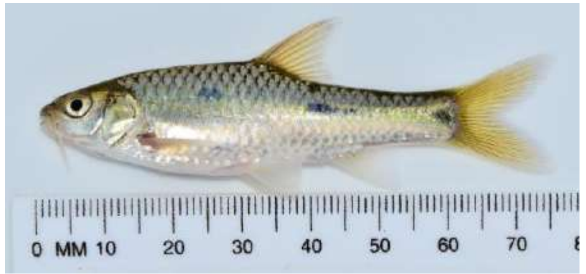
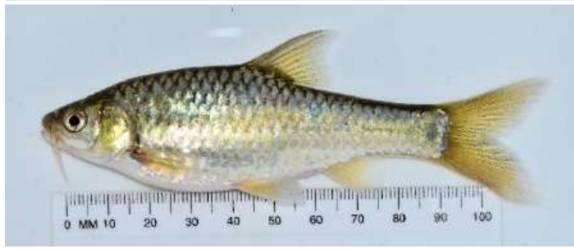
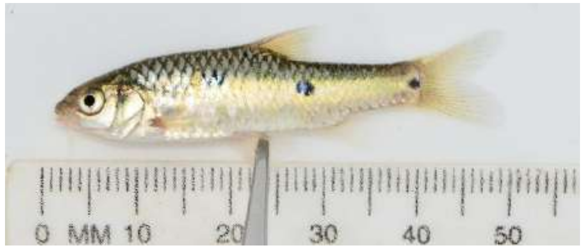
At the time of writing this report the fish identifications were considered accurate, while unknown species were in discussion with leading Ichthyologists from the South African Institute for Aquatic Biodiversity as well as Dickens Odeny a fish specialist based in Kenya. Of the 13 species, the two unknown *Enteromius* species could not be positively identified past genus level due to the gaps in information available on fish assemblages within the Yala River catchment and capturing of only single specimens of each species. A precautionary approach should be taken regarding the biodiversity risk management of these two fish species, and the species should be considered as both novel and SCC due to their Not Evaluated IUCN Red List Threat Status (IUCN, 2024). The remaining species are listed as Least Concern, while the *Poecilia reticulata* (Guppy) sampled in the Dhene River, although listed as LC, is both exotic and invasive both globally and locally in Kenya (Mugo et al., 2015; Nyangena & Ogada, 2004). Despite the aforementioned impacts, the sampled watercourses offer refugia for these species, assisting in maintaining their LC status, highlighting the need to limit impacts to the watercourses within the AOI. It is recommended that museum samples be collected to refine identifications beyond those that are presented in this report. This would require the client to send fish specimens for both taxonomic and genetic (fin clippings) analysis at either the South African Institute for Aquatic Biodiversity or to the National Museum of Kenya in Nairobi via Dickens Odeny locally.

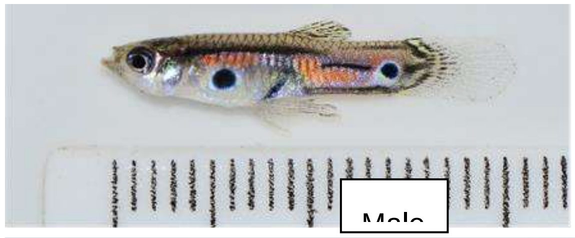
The tolerance levels of Kenya's fish to environmental perturbation (water quality and river health) as presented in Achieng et al., (2021), indicated that the fish recorded during this study ranged from tolerant (*Labeo victorianus* and *Clarias gariepinus*) to moderately tolerant (*Amphilius jacksonii* and *Enteromius cf neumayeri*). No intolerant species were recorded (*Clarias theodorae*). Furthermore, in the specialist's opinion, the species sampled are generally hardy, widespread species that tolerate disturbed ecosystems, however the high abundance of fish sampled indicates that despite disturbance and likely fishing pressure from local people, the sampled fish species are surviving in the project area. The presence of rheophilic (flow-loving) and migratory species such as *Labeo* and *Labeobarbus* in the Yala and Awachi river reaches. This indicates that these fish are likely migrating across the AOI between the larger Yala River and smaller watercourse utilising the tributary network based on water levels and the presence of suitable flow velocities required for spawning. This highlights the need to cater for fish migration for the proposed project in terms of physical (road crossing upgrades) and chemical barriers (water quality impacts such as Acid mine Drainage). This is important as the extensive drainage network is serving as important nursery areas for both migrants and non-migratory species. This was corroborated by the presence of numerous juveniles across the sampled species assemblage. This highlights that fish distribution patterns are a guideline rather than authoritative check lists, especially within poorly studied catchments such as the Yala and Awachi. In light of this, the AOI is expected to support a greater diversity of fish, with migratory and potentially novel species reflecting the high dispersal and potential presence of a large portion of the expected fish species within the AOI. This includes threatened species such as *Oreochromis variabilis* (Near Threatened) that have been recorded by Achieng et al. (2020) in the Yala River, and likely its tributaries.

Table 4-31: Fish species collection record during the study period

Scientific Name	Common Name	*IUCN Status	Photograph	Site (Total: n=X)	
				March	July
Family Amphiliidae					
Amphilius jacksonii	Marbled Mountain Catfish	LC		Camp 1 (n=1); Yala (n=8)	n=0
Family Bagridae					
Bagrus docmak	Sudan Catfish	LC		Yala (n=2)	n=0
Family Clariidae					
Clarias gariepinus	African Sharptooth Catfish	LC		Awachi 1 (n=10); Dhene 1 (n=3); Dhene 2 (n=9)	Awachi 2 (n=3); Dhene 1 (n=10); Dhene 2 (n=9)
Clarias liocephalus	Smoothhead Catfish	LC		n=0	Dhene 1 (n=8)
Family Cyprinidae					

Scientific Name	Common Name	*IUCN Status	Photograph	Site (Total: n=X)	
				March	July
Enteromius alberti	Luambwa Barb	LC	 	Awachi 1 (n=2); Dhene 2 (n=1)	Dhene 1 (n=4); Dhene 2 (n=1)
Enteromius sp 1 (2 spot)	-	Unknown		Yala (n=1)	n=0
Enteromius sp 2 (faint stripe)	-	Unknown		n=0	Dhene 2 (n=1)

Scientific Name	Common Name	*IUCN Status	Photograph	Site (Total: n=X)	
				March	July
Enteromius kerstenii	Redspot Barb	LC	 	Yala (n=13); Dhene 1 (n=12)	Dhene 1 (n=77)
Enteromius neumayeri	Neumayer's Barb	LC	  	Camp 1 (n=>300); Dhene 2 (n=15)	Dhene 1 (n=42); Dhene 2 (n=4)
Enteromius cf paludinosus	Straightfin barb	LC		Yala (n=2)	n=0

Scientific Name	Common Name	*IUCN Status	Photograph	Site (Total: n=X)	
				March	July
Labeo victorianus	Ningu	LC		Yala (n=27)	n=0
Labeobarbus altianalis	Ripon Barbel	LC	 	Awachi 2 (n=5); Yala (n=2)	Awachi 2 (n=3)
Family Poecilidae					
Poecilia reticulata	Guppy	LC (Exotic and invasive)	 	Camp 1 (n=7); Dhene 1 (n=6)	Dhene 1 (n=13)
Number of species				**Total – 11;** Yala – 7 Camp 1 – 3; Dhene – 5; Awachi – 3.	**Total – 8;** Yala – Not assessed Camp 1 – Not assessed; Dhene – 7; Awachi – 2.
Total Catch (Number of Individuals)				**463**	**175**

Scientific Name	Common Name	*IUCN Status	Photograph	Site (Total: n=X)	
				March	July
LC – Least Concern. Table presents variations within a species.					

4.10. Terrestrial Biodiversity

A Terrestrial Flora and Fauna Assessment was conducted as part of this EIA process and is included as Appendix J. Terrestrial biodiversity in terms of flora and fauna applicable to the Project area were identified at a desktop-level and verified during site surveys. The identified habitat types within the Project area were used in the flora and fauna baseline surveys. In addition, the site observation and surrounding land use activities were considered for interpretation and determination of the potential impacts on site.

The following section describes in detail the results from the bi-annual field assessments undertaken in 2024.

4.10.1. Flora

The Project area is situated within the Victoria Basin Forest-Savanna ecoregion which is classified as Protection 8 based on the Global Safety Net (Martin & Burgess, 2024) and previously classified as Critical/Endangered (WWF, 2024). Only about 14% of the ecoregion is protected, including national parks and forest reserves. Positioned north and 24 km west of Lake Victoria, the Project area is 16 km from the Southern Acacia-Commiphora bushlands and thickets ecoregion (Kurrent Technologies Ltd and Digby Wells Environmental, 2024).

The site is characterized by a landscape of steep, undulating hills intersected by drainage lines that form riparian drainage systems. The predominant landscape in the Project area consists of transformed properties, with subsistence agriculture dominating the land use, along with numerous holdings and community centres. Exotic tree plantations are widespread, providing timber and building materials for local communities.

Subsistence agriculture in the area includes crops such as maize, sweet potatoes, sugar cane, groundnuts, and a variety of other vegetables. Additionally, the landscape is dotted with numerous fruit trees, including mango, citrus, avocado, nut trees, and loquats, which are abundant across the holdings and play a significant role in sustaining the local population. Guava trees are also prevalent, serving as a vital food source for both the local inhabitants and the native fauna.

The site has undergone considerable transformation from its original vegetation cover, which now exists only in small pockets. Indigenous trees are scattered throughout the developed areas, often mixed with exotic species. Many roads and pathways are lined with groves of both exotic and indigenous trees, contributing to the area's altered landscape.

The floral assessment conducted on-site identified a total of 144 plant species, of which 41 are exotic and alien. Based on the field survey, three broadly defined vegetation and habitat communities were identified: riverine, mixed woodland, and transformed habitats. These communities are discussed in more detail in the following section. A vegetation map illustrating these habitat communities is provided below (see Figure 4-44).

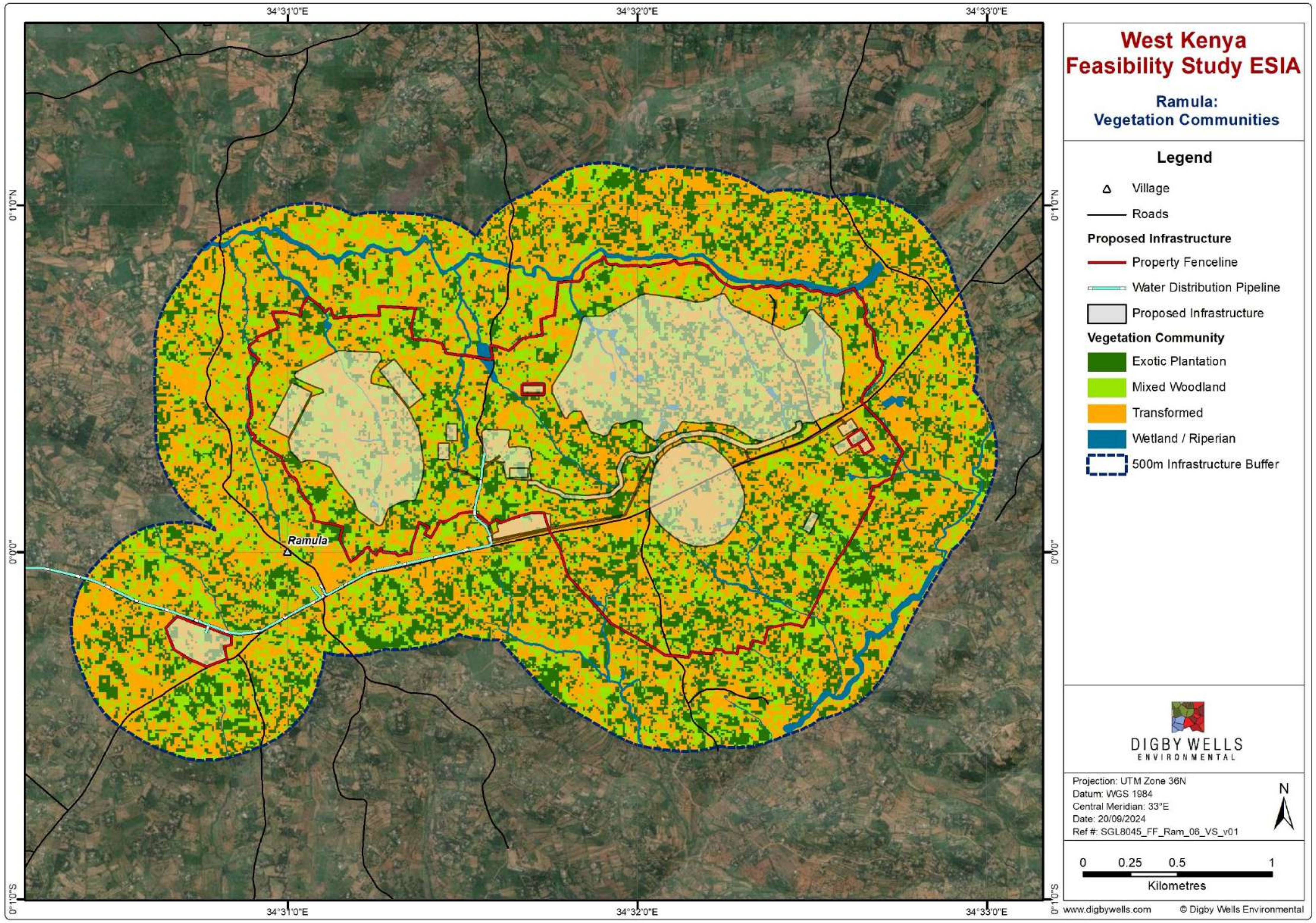


Figure 4-44: Vegetation Communities

4.10.1.1. Riverine Habitat

This habitat community is primarily associated with the lower-lying areas and drainage systems that form the watercourses (wetlands) and waterways (riparian) within the Project area. These lowland zones are characterized by hydrophilic vegetation, including species such as *Typha capensis, Phragmites australis, Cyperus distans, Maranta arundinacea*, and *Megathyrsus maximus* (see Figure 4-45 and Figure 4-46).

In areas where water flows through these drainage systems, riverine and riparian trees are prevalent, with notable species including *Bridelia micrantha,Ficus amadiensis, F. asperifolia, F. sur, Harungana madagascariensis*, and *Kigelia africana*. However, many of these systems have been significantly impacted by human activities, particularly through cultivation and artisanal and small-scale mining (ASM) operations.

The ASM activities have led to the widespread removal of essential riverbed vegetation, which plays a crucial role in stabilizing riverbanks and filtering pollutants from the water. As a result, there is a marked increase in water turbidity due to gold panning, which in turn heightens sedimentation levels. Additionally, the continual erosion of the riverbanks is encroaching further into the vegetated areas, threatening the remaining natural habitats.

Historically mined areas have undergone significant alterations, transforming into different habitat types than those that existed prior to the onset of ASM activities. These changes have resulted in a loss of biodiversity and have disrupted the ecological balance within these riverine systems.

Figure 4-45: *Cyperus distans* in the low lying areas within the AOI

Figure 4-46: Representative example of Riverine Vegetation within the AOI

4.10.1.2. Mixed Woodland

The mixed woodland habitat community was observed in very isolated patches, with some encroachment into the surrounding transformed areas. These woodlands are indicative of the regional indigenous vegetation, specifically the Moist Combretum Wooded Grassland. Unlike forests, woodlands are characterized by a significant density of trees but with a more open canopy, allowing for an understory of shrubs or herbaceous plants to thrive (see Figure 4-47). This structural composition is crucial for biodiversity, as woodlands provide essential habitats for a variety of birds, mammals, insects, and fungi. The diverse vertical structure of these woodlands supports species with differing ecological requirements, offering niches for both ground-dwelling and arboreal organisms.

Within this community, a high diversity of woody species was recorded, including *Acacia macrothrysa, Combretum molle, Cussonia arborea, Dombeya rotundifolia, Heteromorpha trifoliata,* and *Keetia gueinzii*. These species are emblematic of the native flora and play a crucial role in maintaining the ecological balance of the area.

Of particular significance is the presence of *Entandophragma angolense*, a tree species classified as Near Threatened by the IUCN. The recording of this species within the mixed woodland underscores the conservation value of these isolated patches, as they provide refuge for threatened and rare species amidst a largely transformed landscape. The continued survival of such species within these woodlands highlights the importance of preserving and managing these habitats, not only for their intrinsic biodiversity but also for their role in supporting species at risk of extinction.

Figure 4-47: Mixed Woodland Habitat within the AOI

4.10.1.3. Transformed and Cultivated Areas

The majority of the Project area is dominated by transformed habitats, where local communities have established their livelihoods. These areas have been heavily modified from their natural state, primarily to support subsistence and cash crop agriculture. Within individual homesteads, there are extensive plantations of various crops such as maize, sugar cane, sweet potatoes, and guava, which are integral to the local economy and sustenance.

Adjacent to many villages are extensive stands of exotic tree plantations, including species like *Eucalyptus, Grevillea robusta, Pinus patula, and Hesperocyparis lusitanica*. These trees are cultivated by locals for timber, building materials, and commercial purposes. The widespread planting of these exotics has led to the significant displacement of indigenous vegetation, with much of the original flora having been cleared to make way for these plantations.

The proliferation of exotic and alien species is a notable feature of the landscape, with *Psidium guajava* (guava) and *Lantana camara* being particularly prevalent. These species have spread extensively and are encroaching into all habitat communities, altering the ecological balance and outcompeting native species. Additionally, many ornamental plants, such as *Plumeria rubra,Nerium oleander, Jacaranda mimosifolia, Aleurites moluccanus, and Delonix elata*, are commonly found in gardens, hedges, and groves around the homesteads. These ornamentals are often cultivated and sold by informal nurseries scattered throughout the region, contributing to the further introduction of non-native species.

Within the homesteads, a variety of fruiting trees, including *Carica papaya* (papaya), *Musa* spp. (banana), *Persea americana* (avocado), and *Mangifera indica* (mango), are abundant and play a crucial role in sustaining the local population. These fruit trees not only provide a source of food but also contribute to the local economy through small-scale trading. The transformation of these habitats reflects the deep integration of agriculture and plantation forestry into the daily lives of the local communities, shaping the landscape and influencing the ecological dynamics of the area.

Figure 4-48 and Figure 4-49 depict the various cultivated and transformed landscapes within the Project area. All Alien Invasive Plants that were recorded within the AOI are listed in the Appendix A.

Figure 4-48: Cleared fields for cultivation surrounded by exotic tree plantations

Figure 4-49: Transformed and cleared areas

4.10.2. Fauna

The habitat within the Project area and its AOI is predominantly characterized by undulating hills, which are densely populated by local villagers and communities. This region is marked by extensive exotic tree plantations and large tracts of land that have been cleared for cultivation. Consequently, only small fragments of natural vegetation remain, as most of the original regional vegetation has been converted into agricultural land. This leaves limited natural habitat remaining for faunal species within the AOI.

Despite these significant alterations to the landscape, indigenous faunal communities have not been entirely driven away. On the contrary, some synanthropic species—those that can adapt to and even thrive in human-altered environments—have found ways to persist. The numerous guava plantations and fruit trees scattered throughout the area serve as important foraging grounds for various frugivorous bird and bat species. Additionally, the vast plantations of exotic species such as pine, eucalyptus, and grevillea provide essential roosting and nesting habitats for larger birds of prey, as well as feeding opportunities for nectar-feeding birds and insects.

As a result of these environmental changes, the local biodiversity has undergone a transformation, leading to the emergence of a unique ecosystem that reflects the interplay between human activity and natural processes in this specific area.

4.10.2.1. Mammals

The biannual survey results revealed a significant presence of mammals in the Project area and its AOI. During the first survey in March, 27 mammal species were recorded, and an additional 13 species were documented in July 2024, bringing the total to 40 species recorded within the AOI.

Among the most diverse and abundant were species within the Chiroptera order (bats), with five different families and 15 species observed. Notably, one bat species of conservation concern, the African Straw-coloured Fruit Bat (*Eidolon helvum*), was found in large roost colonies, with over 200 individuals roosting near the Itumbu School.

Eidolon helvum is listed under Appendix I of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), granting it international protection. Although widespread across Africa, this species is patchily distributed. The Ramula Project site is located less than 10 km from two major roosts: one at Itumbu School (GPS Coordinates: 0.03171471367, 34.57975993) and another within the KEFRI campus (GPS Coordinates: 0.0074399061002, 34.60428965), which has been monitored for 15 years and is confirmed to have interesting migratory and viral dynamics. Activities such as the clearing of fruiting trees, particularly fig and guava, could negatively impact *Eidolon helvum* by reducing its food sources. Additionally, powerlines pose a risk of electrocution to this species, as observed in Luanda town (see Figure 4-50). However, these risks can be mitigated by establishing feeding woodlots and designing powerlines to be more bat-friendly.

All species recorded during the two surveys are listed in Table 4-32 and Table 4-33

Table 4-32: Recorded mammal species at Ramula

Family	Species	Common name	Sites	Wet	Dry	IUCN/ CITES/CMS	Locally protected
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet monkey	A		X	LC	-
Lepuridae	*Lepus saxatilis*	Scrub hare	F	X	X	LC	No
Soricidae	*Crocidura turba*	White-toothed shrew	B	X		LC	No
	C. olivieri	Olivier's shrew	A, D	X	X	LC	No
	C. viaria	Savana Path shrew	D	X	X	LC	No
	C. luna	White-tooth shrew	B	X		LC	No
Pteropodidae	*Eidolon helvum*	Straw-coloured fruit bat	A	X	X	NT	No
	Epomophorus wahlbergi	Egyptian epaulette fruit bat	B, D	X		LC	No
	E. lobiatus	Ethiopian epaulette fruit bat	C	X	X	LC	No
Nycteridae	*Nycteris hispida*	Hairy slit-faced bat	E, F	X		LC	No
	Nycteris thebaica	Cape long eared bat	E, F		X		
Molossidae	*Chaerephon pumila*	Little free tailed bat	A, C, D	X	X	LC	No
	Tadarida aegyptiaca	Egyptian free-tailed bat	A, C, D	X	X		

Family	Species	Common name	Sites	Wet	Dry	IUCN/ CITES/CMS	Locally protected
Verspertilionidae	*Myotis bocagii*	Hairy bat	E	X	X	LC.	No
	Scotophillus nigrita	Schrebers yellow bats	B, D	X	X	LC.	No
	Neoromicia nana	Banana bat	A,C,D	X	X	LC.	No
	Neoromicia capensis	Cape serotine	A, C	X		LC.	No
	Pipistrellus rueppellii	Rueppel's pipistrel	B, C	X		LC.	No
	Scotoecus hirundo	Dark-winged lesser house bat	A	X		LC	-
Hipposideridae	*Hipposideros ruber*	Leaf nosed bat	B	X		LC.	No
	Lavia frons	Yellow winged bat	F	X		LC.	No
(Carnivora) Mustellidae	*Aonyx capensis*	Cape Clawless Otter	F	X		LC.	No
Nandinidae	*Nandinia bionotata*	Palm civet	F	X		LC.	No
Herpestidae	*Genetta servalina*	Servaline genet	F	X		LC.	No
	Atilax paludinosus	Marsh mongoose	B, F	X		LC.	No
	Ichneumia albicauda	White tailed mongoose	E,F	X		LC.	No
	Herpestes ichneomon	Ichneumon mongoose	F	X		LC.	No

Family	Species	Common name	Sites	Wet	Dry	IUCN/ CITES/CMS	Locally protected
	Bdeogale crassicauda	Bush tailed mongoose	B, F	X		LC.	No
Hystricidae	*Hystrix cristata*	Crested porcupine	-		X	LC	
(Rodentia); Muridae	*Lemniscomys striatus*	Zebra mouse	A,	X	X	LC.	No
	Mastomys natalensis	Multimammate rat	B, C, E	X	X	LC.	No
	Mus triton	Common mouse	A, C, F	X	X	LC.	No
	Mus minutoides	Dwarf mouse	A, E	X	X	LC.	No
	Aethomys kaiseri	Rock rat	F	X		LC.	No
	Lophuromys zena	Brush furred rat	B	X		LC.	No
	Arvicanthis niloticus	Unstriped grass rat	E,F	X		LC.	No
Spalacidae	*Tachyoryctes splendens*	Orange-toothed rat	C,F	X	X	LC.	No
Nesomyidae	*Cricetomys ansorgei*	Giant pouched rat	A,F	X		LC.	No
LC=Least Concern, NT=Near Threatened, VU=Vulnerable							

Figure 4-50: *Eidolon helvum* electrocuted on powerline in Luanda (photo: Agwanada 16.07.24)

Table 4-33: Images of the recorded mammal species on site

			
Zebra mouse (*Lemniscomys striatus*)	**Common mouse (*Mus munitoides*)**	**Multimummate rat (*Mastomys natalensis*)**	**White-toothed shrew (*Crocidura turba*)**
			
Epauletted fruit bat (*Epomophorus wahlbergi*)	**African civet (*Civettictis civetta*) track**	**Marsh mongoose (*Atilax palidunosus*)**	**Hippopotamus (*Hippopotamus amphibius*)**

4.10.2.2. Birds

Compared to the March 2024 survey, the July 2024 bird survey recorded a greater diversity of species, coinciding with the end of the wet season. A total of 115 species were recorded across both seasons, with 100 species documented during the wet season and 73 during the dry season. The wet season accounted for approximately 87% of the total species recorded, while the dry season accounted for about 63%. The lush vegetation during the wet season provided essential food and shelter, supporting a thriving bird population. Notably, species absent in previous surveys, particularly those from the Weaver family, were observed, including widowbirds in brooding plumage. Nests of the African Blue Flycatcher were also documented, along with signs of breeding, such as courtship behaviours and the feeding of young birds. These findings confirm that the sites serve as important breeding grounds for local resident birds. Images of recorded bird species are listed in Table 4-34.

Despite most habitats in the area being converted into farmlands, these areas continue to attract birds, especially during the crop harvesting season. The riverine habitats and natural areas within the farms seem to support a greater variety of bird species, particularly in Ramula. The avian community was dominated by Common Bulbuls, African Thrushes, Arrow-marked Babblers, and various species of weavers, largely due to the abundance of food resources, particularly fruit-bearing plants. However, the significant transformation of the landscape due to intensive farming and high human population density has reduced the likelihood of encountering threatened species, as suitable habitats are now scarce.

The site is part of a significant ecosystem and is located near important bird areas, such as the Yala Important Bird Area (IBA). Conducting a cumulative impact assessment is crucial to understanding the broader impacts on these ecosystems.

Table 4-34: Images of recorded birds in Ramula

			
Black Kite	**African Harrier Hawk**	**Olive Sunbird**	**Spectacled Weaver**
			
Violet-backed Starling	**Long-crested Eagle**	**African Firefinch**	**Black-headed Gonolek**

4.10.2.3. Herpetofauna

The biannual assessments conducted over the study period identified a total of nine reptile species and nine amphibian species within the Project area. This moderate diversity is notably lower compared to other taxa, as detailed in Table 4-35 and Table 4-36. The relatively low numbers of reptile and amphibian species can likely be attributed to the extensive land transformation due to agricultural activities and the high human population density in the region. These factors have contributed to habitat fragmentation and degradation, limiting the availability of suitable environments for these species.

Herpetofauna species inventory for Ramula conducted between the 14th and 27th of July 2024, though comparable to the previous survey in March 2024 (billed as dry season), registered fewer species among both reptiles and amphibians. The most productive habitats for herpetofauna in Ramula were riverine habitats and clear waters especially the small section of a streams at the confluence with Dhene and another in Naya B and A.

Of particular note, two reptile species observed during the assessments are listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). These species are the Nile monitor (*Varanus niloticus*) and Elliot's groove-throated chameleon (*Trioceros ellioti*). Appendix II of CITES includes species that are not necessarily threatened with extinction but may become so unless their trade is closely controlled. The inclusion of these species in Appendix II highlights the importance of monitoring and managing their populations to ensure that they do not move closer to a threatened status.

The riverine and drainage features within the Project area are naturally well-suited to support a diverse range of amphibian species, providing critical resources such as breeding grounds, shelter, and abundant food sources. Under normal circumstances, these habitats would likely host a rich and varied amphibian community. However, the ongoing ASM activities have significantly degraded these habitats, leading to a decline in both species diversity and population abundance.

The ASM activities have led to the widespread removal of essential riverbed vegetation, which plays a crucial role in stabilizing the riverbanks, filtering pollutants, and providing cover for amphibians from predators. The destruction of this vegetation disrupts the delicate ecological balance, reducing the availability of habitat niches that different amphibian species rely on for survival.

Moreover, the process of gold panning has introduced substantial quantities of sediment into the waterways, turning the once clear waters into turbid, murky environments. This increased turbidity severely limits the ability of amphibians to forage effectively, as their primary food sources, such as insects and other small invertebrates, become harder to detect. Additionally, the murky water can interfere with the breeding activities of certain amphibian species, which often rely on clear water to locate mates and lay eggs.

The cumulative impact of these environmental disturbances is compounded by the high density of human activity in the area. The presence of a large human population increases the likelihood of further habitat disturbance, pollution, and competition for resources, all of which exert additional stress on the amphibian community.

As a result, the amphibian population in the Project area is not as robust or diverse as it could be under more pristine conditions. The combination of habitat degradation, water quality deterioration, and human encroachment has created an environment where amphibian species struggle to thrive, leading to a noticeable decline in their numbers and diversity. This situation highlights the urgent need for conservation measures to protect and restore these critical habitats, ensuring the long-term survival of the amphibian species that depend on them.

Further details on the specific findings and implications for conservation and management strategies are provided in the subsequent sections of this report.

Table 4-35: Recorded reptiles

Family	Common name	Species	IUCN	CITES	Wet	Dry
Agamidae	Eastern Blue-headed Tree Agama	*Acanthocercus minutus*	Least Concern	-		x
Agamidae	Red headed rock Agama	*Agama lionotus*	Least Concern	-	X	
Alapidae	Brown forest cobra	*Naja subfulva*	Least concern	-		x
Chamaeleonidae	Elliot's groove-throated Chameleon	*Trioceros ellioti*	Least Concern	Appendix II	X	x
Colubridae	Spotted green snake	*Philothamnus sevariagatus*	Least Concern	-	X	
Gekkonidae	Tropical House gecko	*Hemidactylus mabouia*	Least concern	-	X	x
Lacertidae	Boulenger's Scrub Lizard	*Nucras boulengeri*	Least concern	-	X	x
Pelomedusidae	Williams' mud Terrapin	*Pelusios williamsi*	Least concern	-	X	x
Scincidae	Speckle-lipped skink	*Trachylepis cf maculilabris*	Least concern	-		x
Scincidae	Stripped skink	*Trachylepis striata*	Least Concern		X	
Scincidae	Five-lined skink	*Trachylepis quinquetaeniata*	Least Concern		X	

Family	Common name	Species	IUCN	CITES	Wet	Dry
Varanidae	Nile monitor lizard	*Varanus niloticus*	Least concern	Appendix II	X	x
Viperidae	Puff adder	*Bitis arietans*	Least concern	-		x

Table 4-36: Recorded amphibians

Family	Common name	*Species*	IUCN	CITES	Wet	Dry
Bufonidae	Kisolo toad	*Sclerophrys kisoloensis*	Least concern	-		x
Bufonidae	Flat backed toad	*Sclerophrys pusilla*	Least Concern	-	X	
Bufonidae	Lesser cross-marked Toad	*Sclerophrys maculutus*	Least Concern	-	X	x
Dicroglossidae	African groove-crowned Bullfrog	*Hoplobatrachus occipitalis*	Least concern	-		x
Hyperoliidae	Common Reed Frog	*Hyperolius viridiflavus*	Least Concern	-		X
Hyperoliidae	Peters' Reed Frog	*Hyperolius glandicolor*	Least Concern	-		x
Pipidae	Northern clawed frog	*Xenopus borealis*	Least concern	-		x
Pipidea	Lake Victoria Clawed frog	*Xenopus victorianus*	Least concern	-	X	
Ptychadenidae	Nile Reed frog	*Ptychadena nilotica*	Least concern	-	X	X
Ptychadenidae	Rocket frog	*Ptychadena spp.*	-	-		x
Ptychadenidae	Ancheta's ridged frog	*Ptychadena anchietae*				
Pyxicephalidae	Nutt's River frog	*Amietia nutti*	Least concern	-	X	x

Table 4-37: Images of recorded herpetofauna

			
Elliot's groove-throated chameleon	**Eastern blue-headed tree agama**	**Tropical house gecko**	**Speckle-lipped skink**
			
Boulenger's scrub lizard	**Williams' mud terrapin**	**Kisolo toad**	**Nutt's river frog**
			
African groove-crowned bullfrog	**Nile ridged frog**	**Common reed frog**	**Peters' reed frog**

4.11. Wetlands

A Wetland Assessment was conducted as part of this EIA process and is included as Appendix K. A two-season site assessment was conducted from the 14 to the 17 March 2024 (dry season) and again from the 01 to the 02 August 2024 (wet season). The objective of the second site assessment was to determine any seasonal changes to the extent of delineated watercourses as well as the functionality and integrity thereof (where potential land uses and disturbance units might have changed or overlooked during the dry season).

4.11.1. Wetland Identification and Classification

In the absence of Kenyan wetland methodology, the South African methodology (Kotze & Marneweck, 1999) was adopted for wetland identification and classification which considers four wetland indicators, namely Soil Wetness Indicator (SWI), Soil Form Indicator (SFI), Vegetation and Terrain. These are explained in the subsections below. Little to no changes were identified from the first to the second site survey, emphasising the fact that seasonality has very little effect on the wetland drivers. A similar volume of surface water was noticed from one season to the next, although cultivation land uses were more prolific in the wet season.

4.11.1.1. Terrain Unit Indicators

Terrain Unit Indictor (TUI) is used to identify areas in the landscape where wetlands are more likely to occur. These areas were identified through desktop analysis and include the following aspects:

- 5 m contours;
- Digital Elevation Models (DEM);
- Channel network (by means of the System for Automated Geoscientific Analyses (SAGA) model); and
- Slope percentage.

Except for seeps, wetlands are more likely to form on gentle slopes and/or concave topographical features defined by a concentrated preferential flow path.

4.11.1.2. Vegetation Indicators

Delineated wetlands are characterised by hydrophilic vegetation which predominantly includes species such as *Typha capensis, Phragmites australis, Cyperus distans, Maranta arundinacea*, and *Megathyrsus maximus* (see Figure 4-45).

River and riparian trees are prevalent, with notable species including *Bridelia micrantha, Ficus amadiensis, F. asperifolia, F. sur, Harungana madagascariensis*, and *Kigelia africana*. It is however worth noting that the diversity of vegetation species has been severely affected.

ASM activities have led to the widespread removal of essential riverbed vegetation (in rivers) which plays a crucial role in stabilizing riverbanks and filtering pollutants from the water. As a result, there is a marked increase in turbidity, which in turn heightens sedimentation levels. Additionally, the continual erosion of the riverbanks is encroaching further into the vegetated areas, threatening the remaining natural habitats.

Figure 4-51: *Cyperus distans* Located Within Wetland System

4.11.1.3. Soil Indicators

Soil indicators, including SFI and SWI were used to identify and confirm wetland boundaries. The delineated wetlands' saturation level ranges from seasonal to permanent, dependent on their position in the landscape. The seepage areas all classify as seasonal together with most Unchannelled Valley Bottom (UVB) systems. One UVB wetland (HGM 26) was classified as permanent considering the presence of a Gley horizon. A Gley horizon is a soil horizon associated with prolonged, permanent saturation and ensures high assimilation abilities.

The SFI refers to the soil forms (hydromorphic soils), which are associated with prolonged and fluctuating saturation levels. These includes Fluvisols and Gleysols. The SWI refers to the morphological "signatures" developed in the soil profile, which includes mottling and an unspecified consolidated material with signs of wetness within the topsoil and subsoil respectively. The permanent systems are characterised by a gley horizon within the subsoil (between 40 and 50 cm). The river systems and alluvial tributaries are all characterised by alluvial sediments, and therefore do not constitute wetland conditions. The hydromorphic soils throughout the AoI are uniform and don't include a wide range of hydromorphic properties and soil forms. Examples of hydromorphic properties identified are illustrated in Figure 4-52.

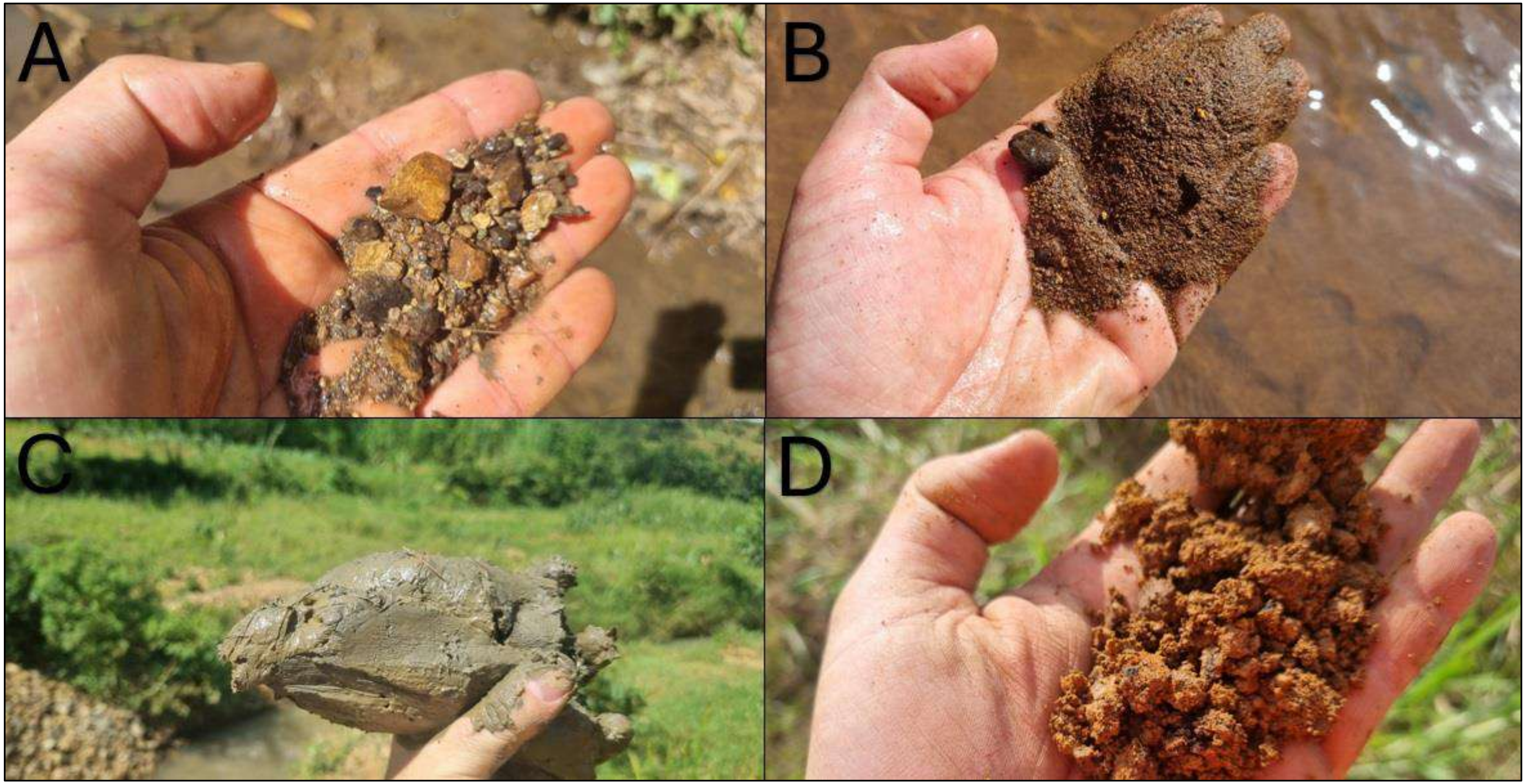


Figure 4-52: Soil Indicators. A) Rocky Alluvial Material. B) Fine Alluvial Sediments. C) Gley Horizon from Permanent Wetland System. D) Iron/Magnesium Concretion

4.11.1.4. Classification

Various HGM types were classified throughout the AoI, including UVB wetlands, artificial wetlands (human-induced wetlands), seeps, alluvial tributaries and three river systems. The delineated watercourses cover 57.55 ha of the total AoI (the latter being 1 217.92 ha in size). Watercourses therefore account for approximately 4.72% of the AoI. It is worth noting that a wetland, according to EMCA (2021) is defined as; *areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.* Therefore, even though the methodologies and approaches used to calculate the health of wetlands do not make provision for alluvial/riparian systems, all watercourses will be referred to as wetlands.

The low coverage of wetlands demonstrates the narrow extent of wetlands delineated throughout the AoI. Figure 4-55 below depicts the delineated wetlands. Examples of delineated wetlands are illustrated in Figure 4-54. Scattered seeps were identified throughout the AoI. These systems are located alongside other valley bottom systems (UVB wetlands and alluvial tributaries) and are favourable for cultivation considering the diffuse and evenly spread flows. To some extent these systems are responsible for feeding the valley bottom wetlands and provide a different habitat from that associated with UVB wetlands and alluvial tributaries.

UVB wetlands were identified in geomorphologically more stable areas, where erosion hasn't resulted in deep incising. These systems are characterised by seasonal hydromorphic conditions with scattered patches of dense hydrophytic vegetation. One UVB (HGM 26) stands out from the other UVB wetlands due to the gentle slope, the complete coverage of vegetation and little physical disturbances. This system also fringes on the northern river system which favours habitat integration for riverine faunal species. Considering the permanent inundation of the system, no cultivation takes place.

The alluvial tributaries are characterised by alluvial sediments, and deeply incised flow paths (in some cases up to 10 m deep). Surface flows are therefore confined to the incised channel and completely covered in alluvial sediments. Similarly, drainage lines were identified throughout the AoI, where surface flows are absent outside of rainfall events. These systems do not classify as wetland habitats (due to the lack of hydromorphic soils and hydrophytic vegetation) but classify as watercourses nonetheless.

Two large river systems were identified to the north and south of the AoI, namely the Dhene and Awachi Rivers respectively with another joining in from the east, flowing south into the Awachi. These systems have been assessed in detail in the Aquatic Baseline and Impact Assessment (Digby Wells, 2024a) considering the classification of these systems are riverine systems.

Table 4-38: Classification of Delineated Watercourses

Classification/System	Total Area (ha)	Percentage of Total Wetland Coverage
Artificial Wetlands	1.78	3.10
Seeps	1.77	3.07
UVB	2.13	3.71
Rivers	34	59.08
Alluvial Tributary	16.89	29.35
Drainage Lines	0.97	1.69
Total	**57.55**	**100**

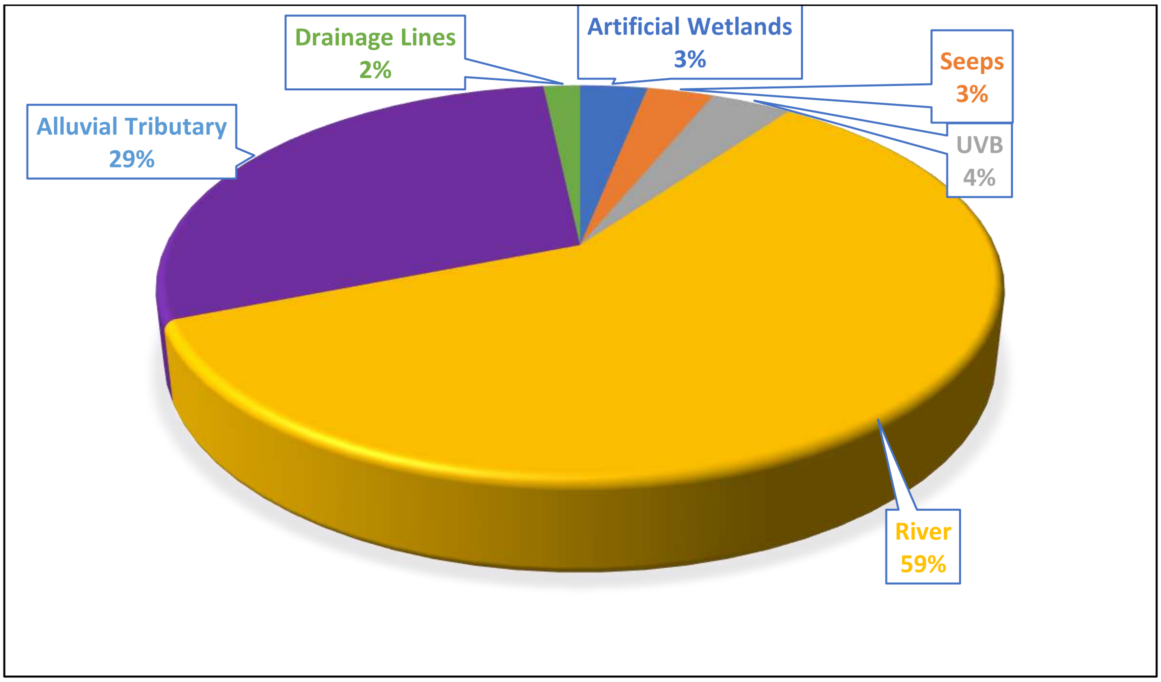


Figure 4-53: Proportion of Watercourse Types within the AoI

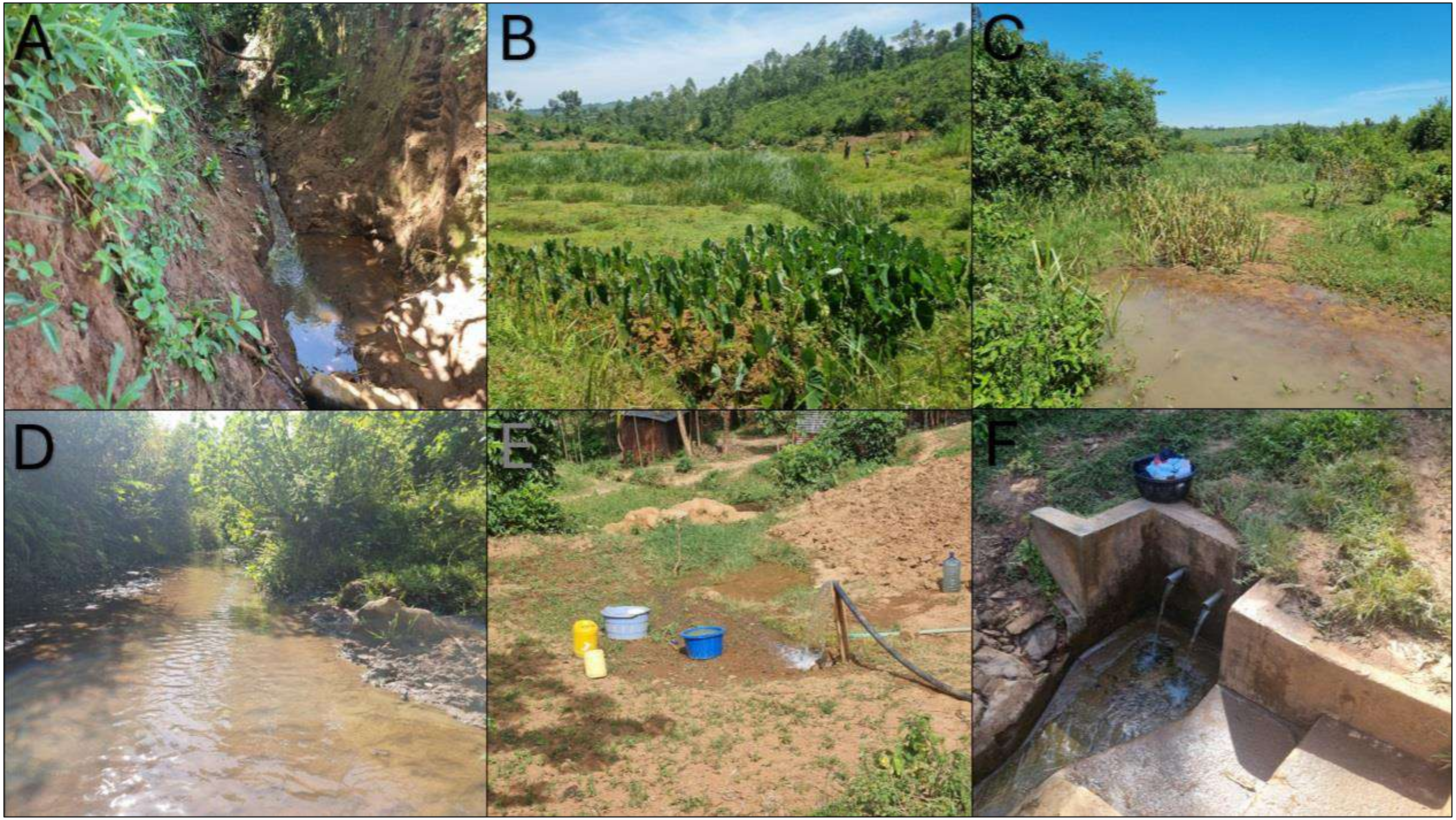


Figure 4-54: Examples of Wetlands Delineated. A) Alluvial Tributary. B) Seep. C) UVB. D) River System. E) Artificial Wetland (From ASM Activities). F) Artificially Modified Spring Feeding UVB Wetland

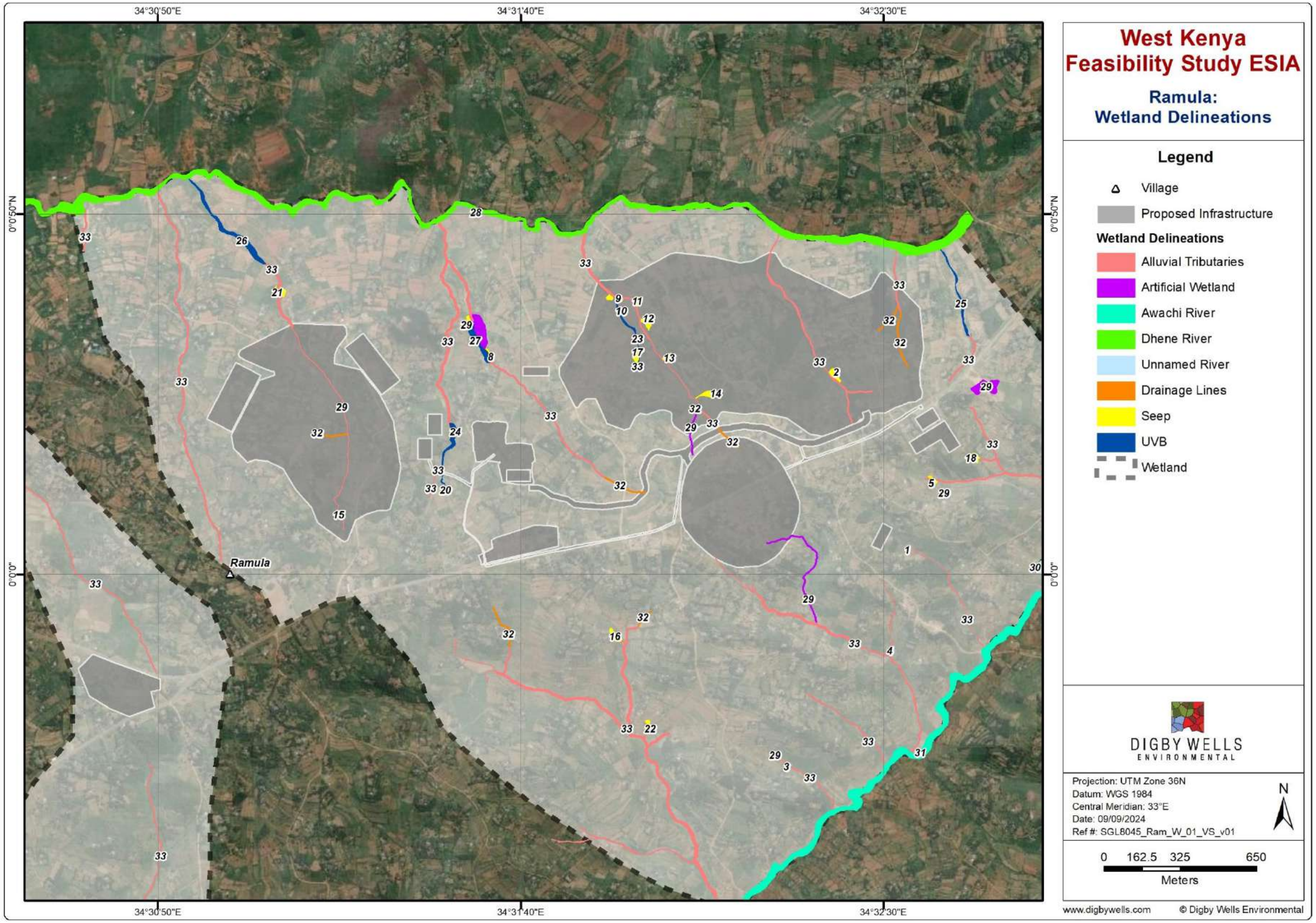


Figure 4-55: Wetland Delineation

4.11.2. Wetland Health and Functionality

The Wet-Health Version 2 (Level 1A) (Macfarlane, Ollis, & Kotze, 2020) was used to determine the health/PES of the wetland systems. The Wet-Health Version 2 consists of three different levels (levels 1A, 1B and 2), which differ from one another regarding the amount of detail required. The level of detail depend on the size of the AoI as well as the number of wetland HGM units identified. Table 4-39 describes the detail and selection process associated with each of the versions.

Twenty-seven (27) HGM units were identified within the AoI. The level 1A approach considers tens to thousands of systems with the 1B approach having capped at a maximum of 100 systems. The Wet-Health 1A calculation sheet was used for practicality considering the combination of various systems into one sheet as opposed to an individual sheet per HGM unit. It is however acknowledged that aspects of the 1B approach do provide a higher accuracy due to certain components being included (i.e. individual catchments and landcover delineations).

Table 4-39: Details Surrounding the Wet-Health 2 Levels

	Level 1A (Applicable)	Level 1B (Not Applicable)	Level 2 (Not Applicable)
Resolution/Detail of the Assessment	Very low	Low	Moderate to high
Number of Wetlands Typically Assessed	Tens to thousands of systems	A maximum of 100 systems	A maximum of 20, usually between one and five
Amendments of Desktop Land Cover Data	None	Some amendments to be made	Extensive amendments to be made
Identification of Point-Source Pollution Inputs	No	Optional	Required
Field Verification	None	Limited to a sub-set of wetlands assessed	Extensive field verification of each wetland assessed
Mapping of Inflowing and Outflowing Streams	None	Required	Required
Delineating Assessment Units	Not required	Required	Required
Delineating External Areas of Influence	Not required	Required	Required
Delineating Catchments	No delineation required, pseudo-catchments in the form of sub-quaternary catchments can be used	Catchments to be delineated	Catchments to be delineated
Delineations of Wetland Disturbance Units	None required, broader landcover to be used	None required, broader landcover to be used (although amendments to be made in landcover data)	Delineations of disturbance units required

The dominant land cover categories affecting the health of the delineated wetlands in the AoI and downstream systems include:

- Selected areas of subsistence cultivation;
- Moderate to heavily degraded land (a combination of sporadic deforestation, clearance of vegetation and overgrazing). The modification category was adjusted within the calculation sheet to account for a range of impacts to suit the conditions of the surrounding areas;
- Erosion;
- Local and haul roads;
- ASM;
- Alien invasive tree species (Eucalyptus sp.);
- Built-up areas (commercial areas); and
- Informal residential areas.

4.11.2.1. Wetland Ecological Health Assessment

PES is calculated considering the reference condition of a wetland (prior to land uses affecting wetland health). The PES of the delineated wetlands range from “Largely Modified (D)” to “Seriously Modified (E)”. It is worth noting that the artificial wetlands were not scored considering the fact that these systems are man-made and do not present a reference condition. The river systems and alluvial tributaries were also not assessed as part of the Wet-Health analysis due to the fact that the methodology and approach adopted is developed solely for wetlands. A more comprehensive representation of baseline conditions is presented in the Aquatic Baseline and Impact Assessment (Digby Wells, 2024a) for non-wetland systems. Detail pertaining to modification components include:

- The hydrological component of all wetlands was scored “Seriously Modified (E)”;
- The geomorphological component of all wetlands was scored “Largely Modified (D)”. The uniform land can explain the uniformity of the geomorphological and hydrological modification scores across all wetlands uses across all wetland sub-catchments;
- The water quality modification scores range from “Moderately Modified (C)” (where less informal residential areas are located) to “Largely Modified (D)”. Soils from wetlands affected by ASM activities were analysed to determine the concentration of heavy metals to ultimately inform current contamination findings. No conclusive evidence was found to indicate contamination from ASM activities (more details in the Soil, Land Capability and Land Use Assessment (Digby Wells, 2024b); and
- The vegetation modification score ranged from “Seriously Modified (E)” to “Critically Modified (F)” depending on the coverage of Eucalyptus, erosion and cultivation within

wetlands. A breakdown of the Wet-Health Version 2 Level 1A calculations and results is illustrated in Appendix B.

The total area of wetlands (excluding rivers, drainage lines and alluvial tributaries) characterised by "Largely Modified" overall PES scores is calculated at 24.8% with the remainder of the wetland systems all characterised by "Seriously Modified" conditions (see Figure 4-56 and Figure 4-58).

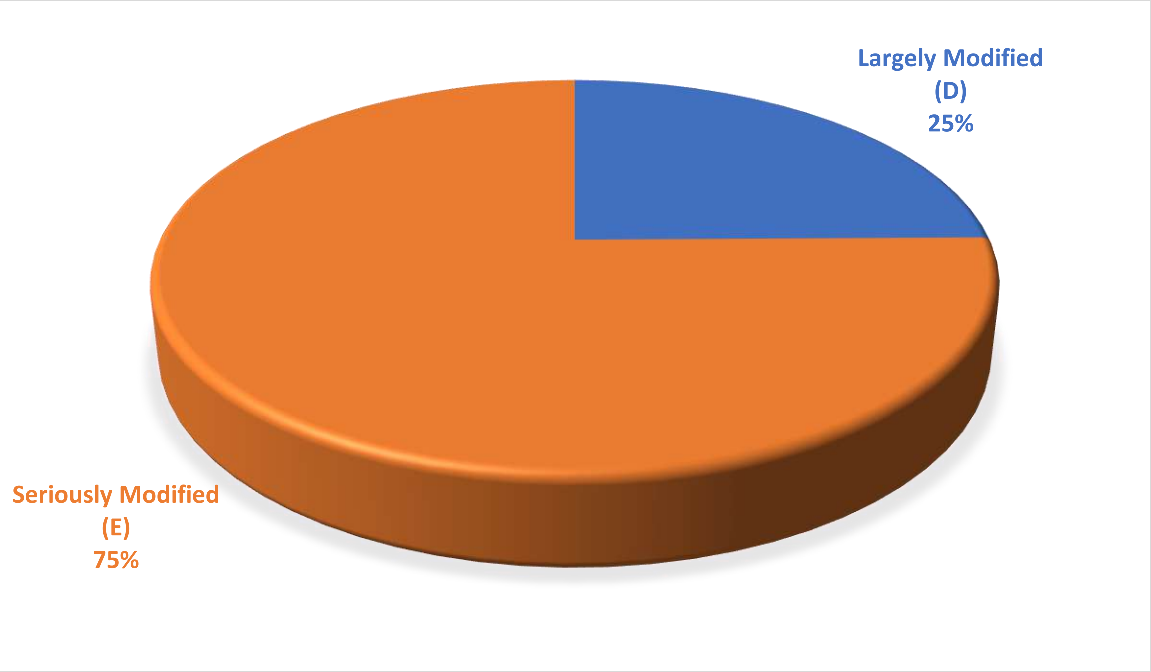


Figure 4-56: Overall Proportion of PES/Health of Wetlands within AoI (Area of Respective PES Scores)

The Wet Health Version 2 Level 1A approach considers landcover, which have been ground-truthed. The overall PES is therefore dependent on the coverage of various land uses. For example, a system characterised by high coverage of *Eucalyptus* will be associated with high modifications to the natural hydrology and vegetation. Accordingly, the following is noteworthy, with photographical evidence illustrated in Figure 4-57.

- Large portions of the terrestrial area outside of the wetlands are characterised by a combination of deforestation, compacted areas and overgrazing. A landcover unit was developed within the Level 1A approach to account for this modification score to represent the impacts thereof on wetlands. Deforestation and overgrazing will lead to a loss of vegetation and exposure to topsoil. This will result in modifications to the vegetation and hydrology aspects of wetlands affected by this landcover;
- Heavily modified areas were identified in some portions within the AoI, considering existing impacts in the form of general degradation associated with clearance of vegetation and excavations for soil material (not ASM related);

- Cultivation takes place throughout the AoI, regardless of the soil's land capability. All of the delineated wetlands are characterised by cultivation alongside the edge of the systems or directly within the systems;
- Erosion was identified predominantly within the UVB systems (except for HGM 26). This affects the geomorphological and hydrological components of the system significantly, which in turn affects the functionality;
- Local and haul roads have accounted for impacts associated with altered surface flow dynamics and sedimentation into wetland systems; and
- Informal residential areas are located near wetlands. This has resulted in increased overland flow, which affects the hydrology of delineated wetlands as well as the water quality aspects due to informal ablutions.

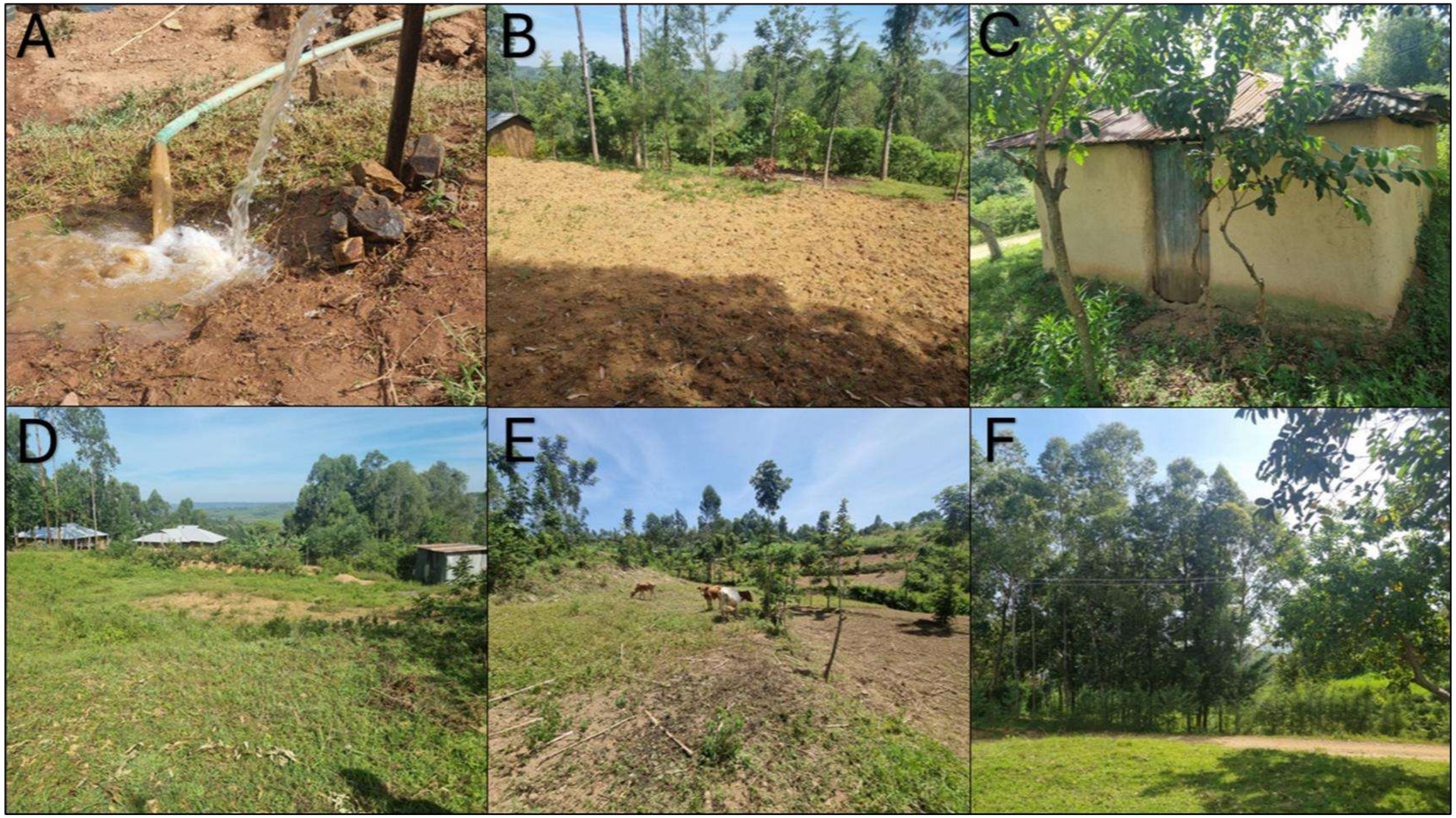


Figure 4-57: Common Impacts Identified on-Site. A) Washing of Excavated Material (ASM Activities). B) Areas Cleared for Cultivation. C) Informal Residential Housing. D) Excavation for Soil and Building Material. E) Signs of Overgrazing. F) Dense *Eucalyptus* Stands.

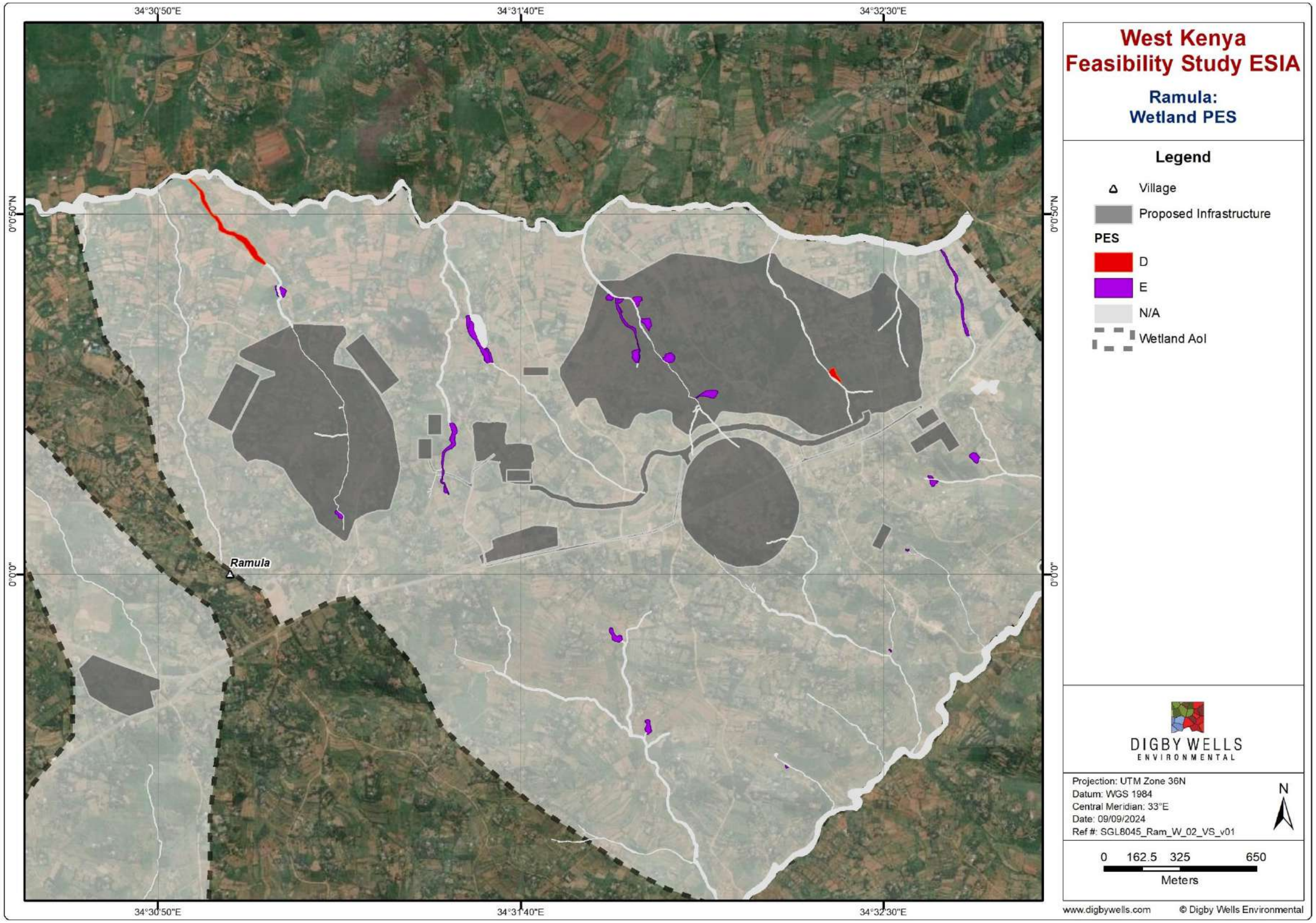


Figure 4-58: Wetland Ecological Health Assessment Scores

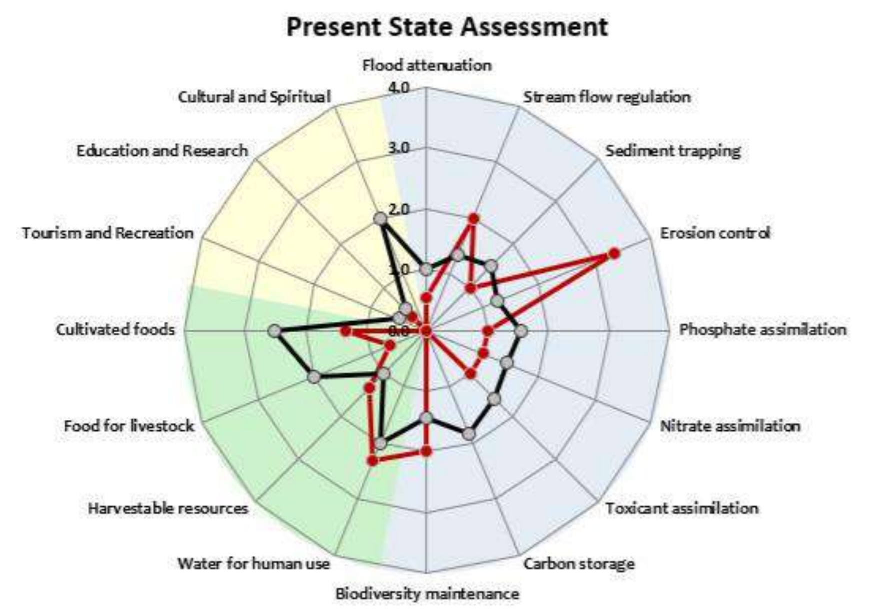
4.11.2.2. Wetland Ecosystem Services (WET-EcoServices)

The identified watercourses (including drainage lines) were grouped into seven different Ecosystem Groups. These include the river systems, the artificial wetlands and alluvial tributaries, as the latest EcoService methodology allows for the assessment of non-wetland systems (besides the "streamflow regulation" service (Kotze, Macfarlane, & Edwards, 2020)). Wetlands were grouped according to surrounding land uses within the respective catchments, the type of wetland as well as the general characteristics of wetlands (seasonality, vegetation characteristics, volume of water/soil moisture etc.). The main summary of the grouping is included in Table 4-40 together with the radial plots indicating the level of each ecosystem service.

The majority of EcoService Groups were rated as "Very Low" (groups A, E, F and G), with only two groups rated as "Moderate" (groups C and D). The latter mentioned groups are characterised by the highest average EcoService scores. Group C (HGM 26 only) is characterised by diffuse flows within a flat topography. This system is characterised by dense vegetation growth which ensures high indirect benefits related to sediment trapping, erosion control and assimilation of contaminants. This system is additionally associated with seasonally saturated soils, and as such, provides higher functionality in respect to the indirect benefits mentioned. Group D (the river systems) are characterised by high direct benefits. These systems are characterised by perennial flows which have resulted in a high reliance of the surrounding communities on water for human use and cattle, harvestable resources (most prominently *Phragmites sp.* growing in river banks) and cultivation. Water is often abstracted from the river by means of buckets and carried to crop fields for irrigation purposes (primarily during the dry season).

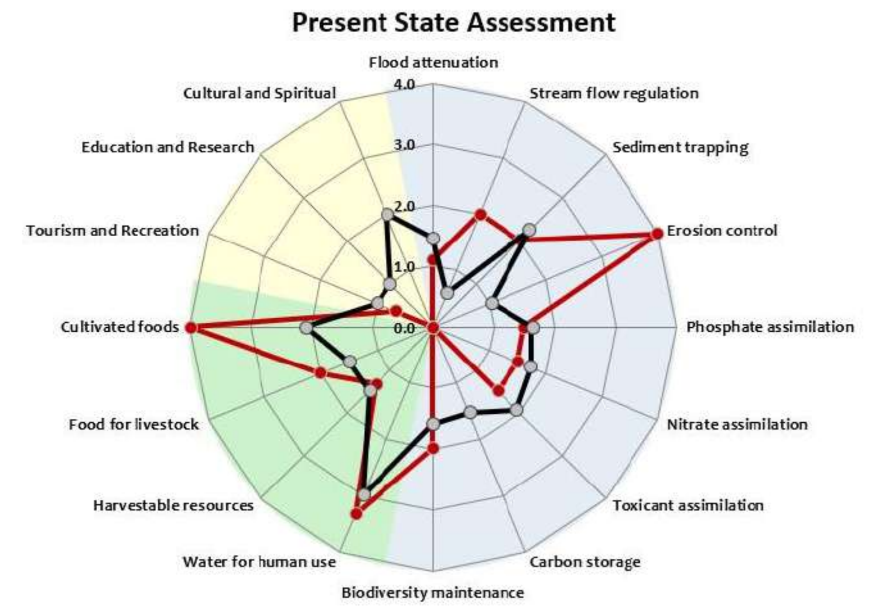
Table 4-40: Wetland Ecological Services Radial Plots

Group A- Seeps



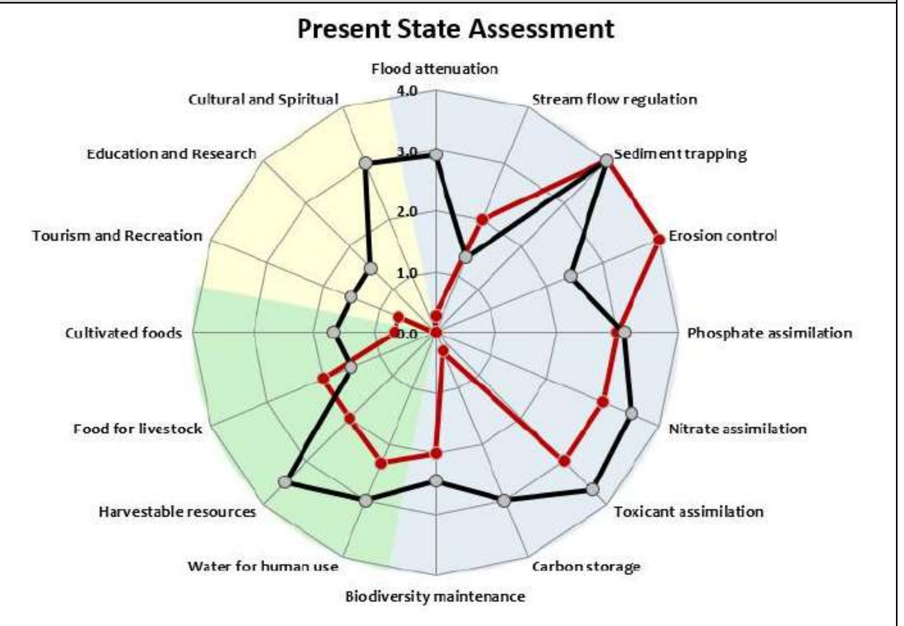
Group B- UVB (HGM 23, 24, 25 and 27)

Seasonal UVB wetlands are characterised by erosion and sporadic vegetation cover. These systems are utilised for cultivation

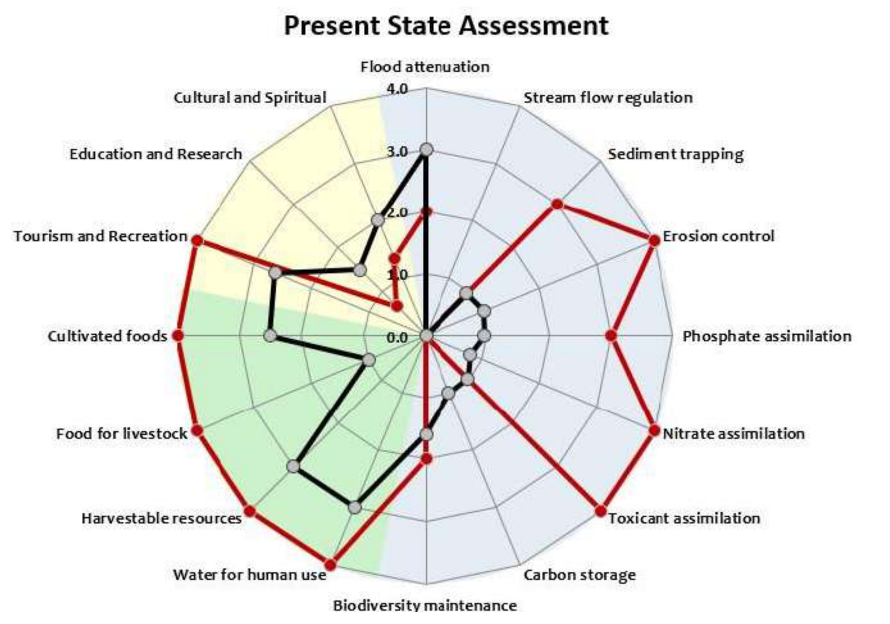


Group C- UVB (HGM 26)

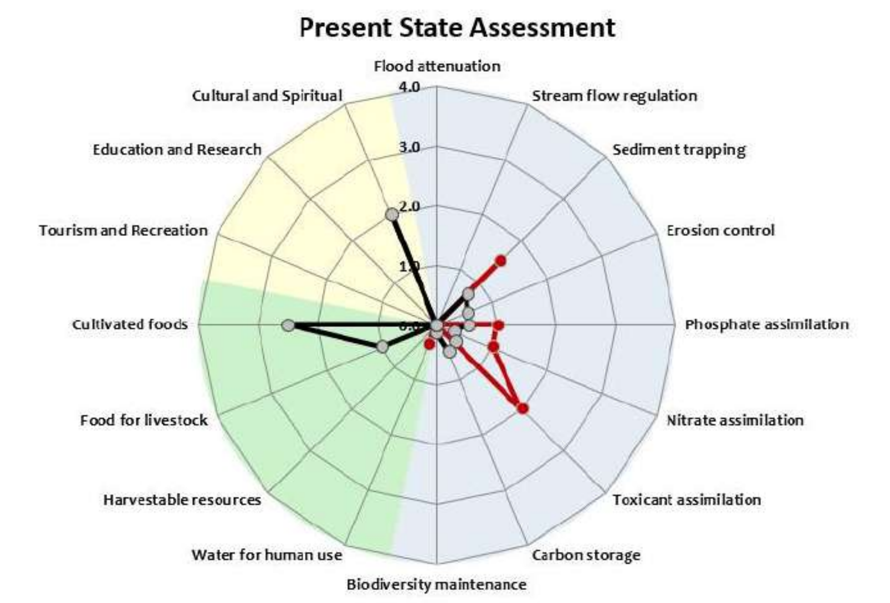
Permanent UVB is characterised by a more stable geomorphology and dense vegetation cover. This system is not utilised for cultivation



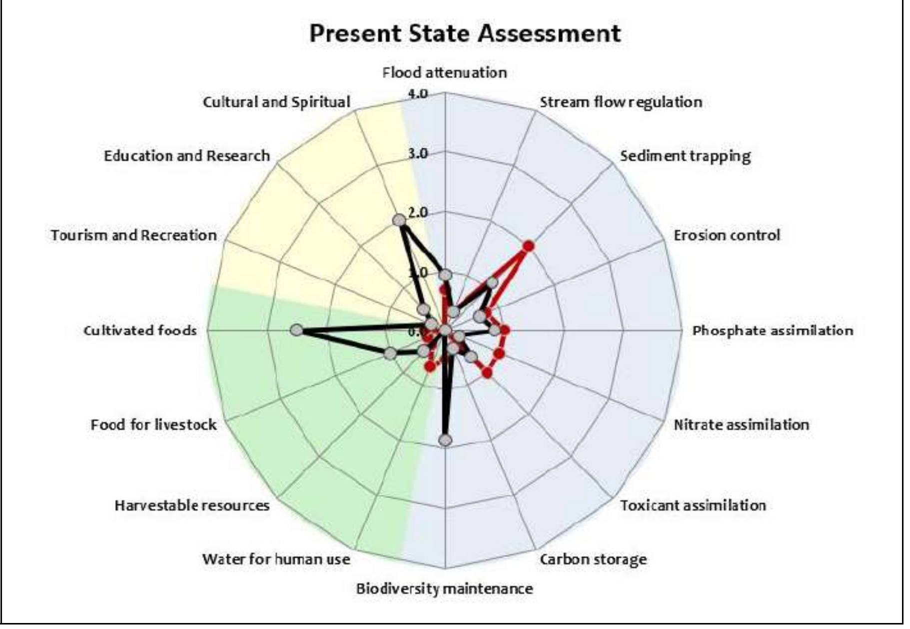
Group D- Rivers



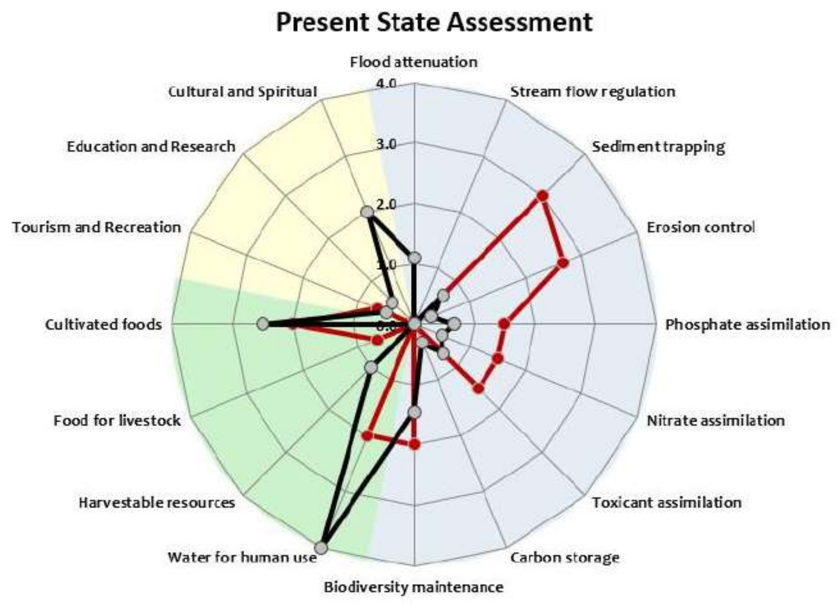
Group E- Artificial Wetlands



Group F- Drainage Lines



Group G- Alluvial Tributaries



Demand Supply

Table 4-41: Wetland Ecosystem Services Scores (Group A to D)

		Group A- Seeps		Group B- UVB (HGM 23, 24, 25 and 27) Seasonal UVB wetlands characterised by erosion and sporadic vegetation cover. These systems are utilised for cultivation		Group C- UVB (HGM 26) Permanent UVB characterised by a more stable geomorphology and dense vegetation cover. This system is not utilised for cultivation)		Group D- Rivers	
ECOSYSTEM SERVICE		Importance Score	Importance	Importance Score	Importance	Importance Score	Importance	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.0	Very Low	0.5	Very Low	1.6	Moderately Low	2.5	Moderately High
	Stream flow regulation	0.8	Low	0.1	Very Low	0.8	Low	N/A	N/A
	Sediment trapping	0.5	Very Low	1.8	Moderate	4.0	Very High	1.0	Low
	Erosion control	1.4	Moderately Low	1.5	Moderately Low	2.9	High	1.5	Moderately Low
	Phosphate assimilation	0.6	Very Low	0.9	Low	3.1	High	1.0	Low
	Nitrate assimilation	0.4	Very Low	1.0	Low	3.5	Very High	1.3	Low
	Toxicant assimilation	0.6	Very Low	1.2	Low	3.7	Very High	1.5	Moderately Low
	Carbon storage	0.3	Very Low	0.0	Very Low	1.7	Moderately Low	0.0	Very Low
	Biodiversity maintenance	1.0	Low	1.1	Low	2.0	Moderate	1.1	Low
PROVISIONING SERVICES	Water for human use	1.7	Moderately Low	3.2	High	2.7	Moderately High	3.5	Very High
	Harvestable resources	0.2	Very Low	0.7	Very Low	3.0	High	3.5	Very High
	Food for livestock	0.8	Low	1.0	Low	1.0	Low	1.5	Moderately Low
	Cultivated foods	1.5	Moderately Low	2.6	Moderately High	0.5	Very Low	3.0	High
CULTURAL SERVICES	Tourism and Recreation	0.0	Very Low	0.0	Very Low	0.3	Very Low	3.1	High
	Education and Research	0.0	Very Low	0.0	Very Low	0.0	Very Low	0.3	Very Low
	Cultural and Spiritual	0.5	Very Low	0.5	Very Low	1.5	Moderately Low	1.2	Low
Average Ecological Service Provision		**0.7**	**Very Low**	**1.0**	**Low**	**2.0**	**Moderate**	**1.7**	**Moderate**

Table 4-42: Wetland Ecosystem Services Scores (Group E to G)

		Group E- Artificial Wetlands		Group F- Drainage Lines		Group G- Alluvial Tributaries	
ECOSYSTEM SERVICE		Importance Score	Importance	Importance Score	Importance	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Stream flow regulation	0.0	Very Low	N/A	N/A	N/A	N/A
	Sediment trapping	0.0	Very Low	0.6	Very Low	0.7	Very Low
	Erosion control	0.0	Very Low	0.0	Very Low	0.1	Very Low
	Phosphate assimilation	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Nitrate assimilation	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Toxicant assimilation	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Carbon storage	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Biodiversity maintenance	0.0	Very Low	0.6	Very Low	1.2	Low
PROVISIONING SERVICES	Water for human use	0.0	Very Low	0.0	Very Low	3.5	Very High
	Harvestable resources	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Food for livestock	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Cultivated foods	1.0	Low	1.2	Low	2.0	Moderate
CULTURAL SERVICES	Tourism and Recreation	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Education and Research	0.0	Very Low	0.0	Very Low	0.0	Very Low
	Cultural and Spiritual	0.5	Very Low	0.0	Very Low	0.5	Very Low
Average Ecological Service Provision		**0.1**	**Very Low**	**0.3**	**Very Low**	**0.5**	**Very Low**

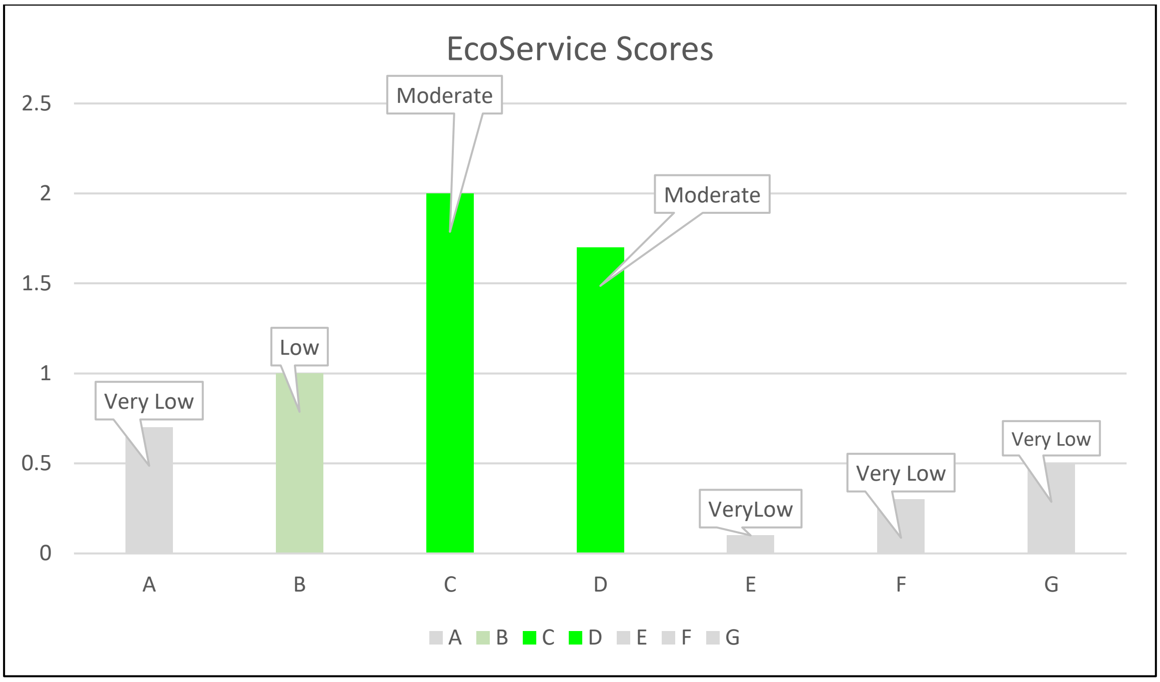


Figure 4-59: Average EcoService Scores

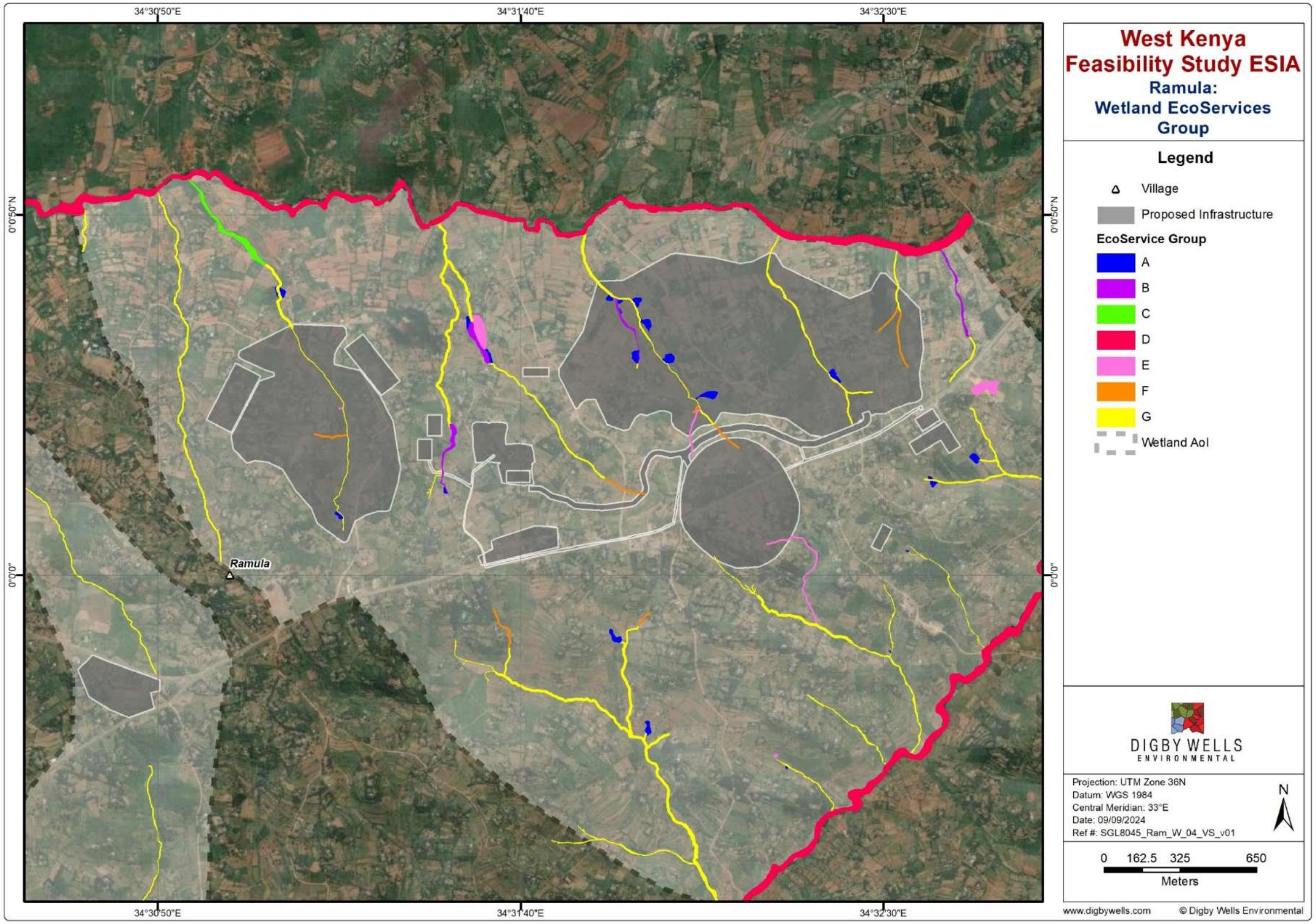


Figure 4-60: Wetland EcoService Groups

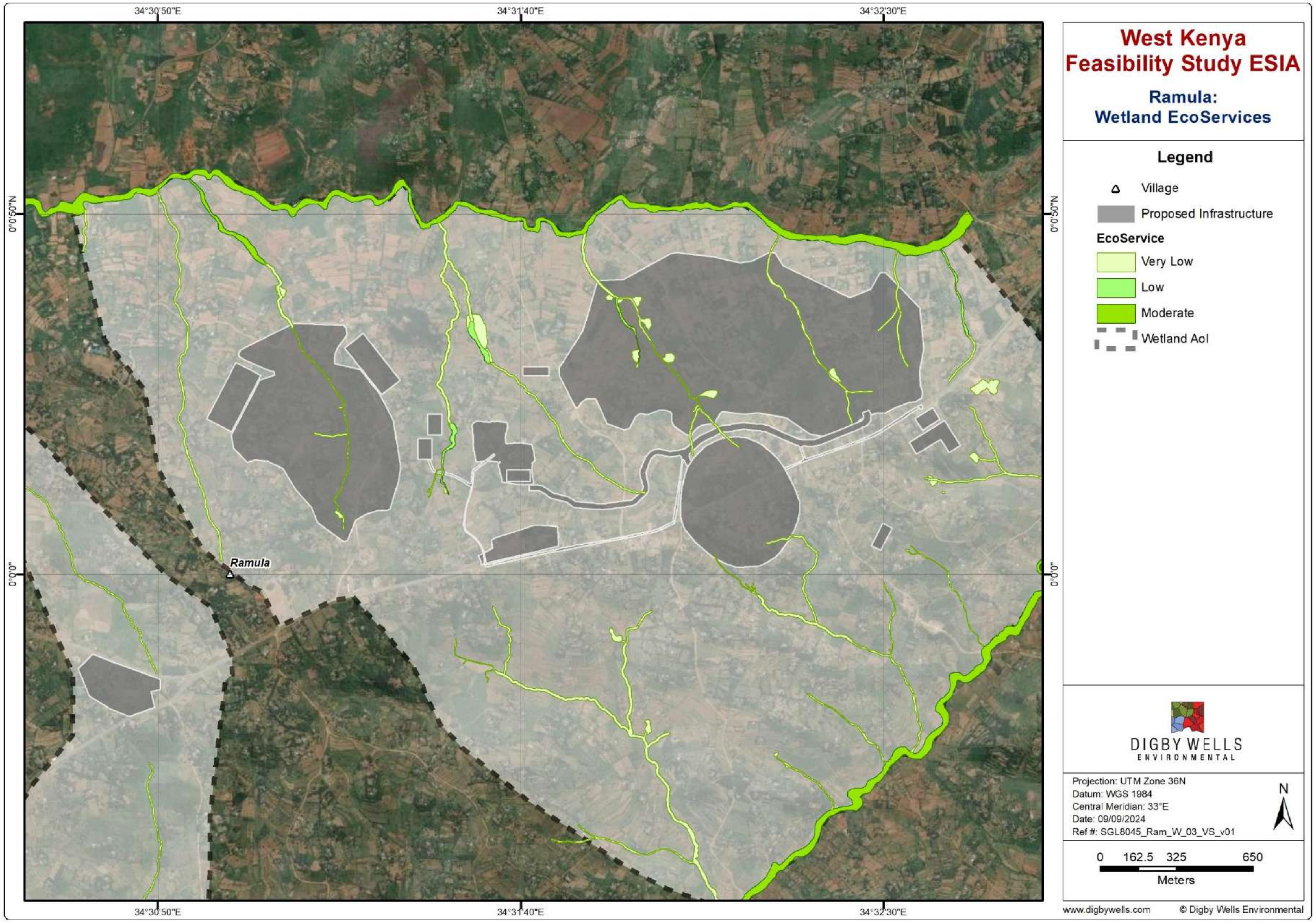


Figure 4-61: Wetland Ecosystem Services

4.11.2.3. Sensitivity Analysis

A sensitivity analysis was conducted to determine the sensitivity of each system to provide insight on valuable attributes provided by the relevant HGM units. The sensitivities ranged from “Moderately Low“ to “Moderate” (Figure 4-63). All of the HGM units are characterised by “Moderately Low” sensitivities except for HGM 2, 26, 27, 28 , 30 and 31. These systems scored a higher sensitivity due to the higher biodiversity maintenance score (HGM 27), better health (HGM 2 and 26) and a higher average EcoService score (HGM 26, 28 and 30). The sensitivity analysis approach was developed by Digby Wells, and considers the maximum score of the following parameters:

- The EcoService score;
- The overall PES/health score;
- Biodiversity maintenance of a system; and
- The protection level (i.e. protected through conservation or recognised by Ramsar).

Even though only a number of wetlands are characterised by a “Moderate” sensitivity, these systems are large in extent in comparison to other systems. Therefore the “Moderate” sensitivity wetlands make up 61% of all watercourses. This breakdown is depicted in Figure 4-62. Considering the fact that the highest calculated sensitivity is “Moderate”, it is evident that the sensitivity of wetlands within the area do not justify sensitive enough environments to restrict any of the proposed activities. It’s worth noting that these sensitivities only consider wetland dynamics, and as such, should not be considered solely. The Terrestrial (Digby Wells, 2024c) and Aquatic (Digby Wells, 2024a) Baseline and Impact Assessments should additionally be considered when determining the final sensitivities.

Wetland offsets should be considered for wetland habitats characterised by “High” sensitivity or natural/near natural conditions. None of the wetlands within the AoI meet this criteria and therefore no offsets will be required.

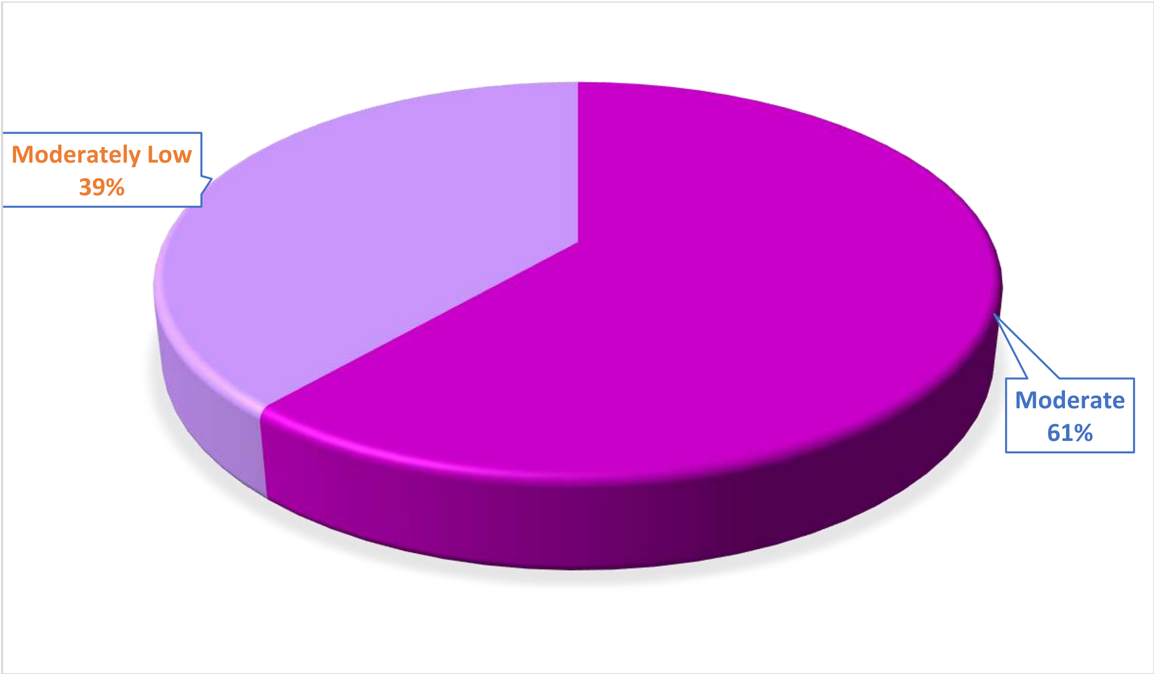


Figure 4-62: Overall Sensitivity of Wetlands within AoI

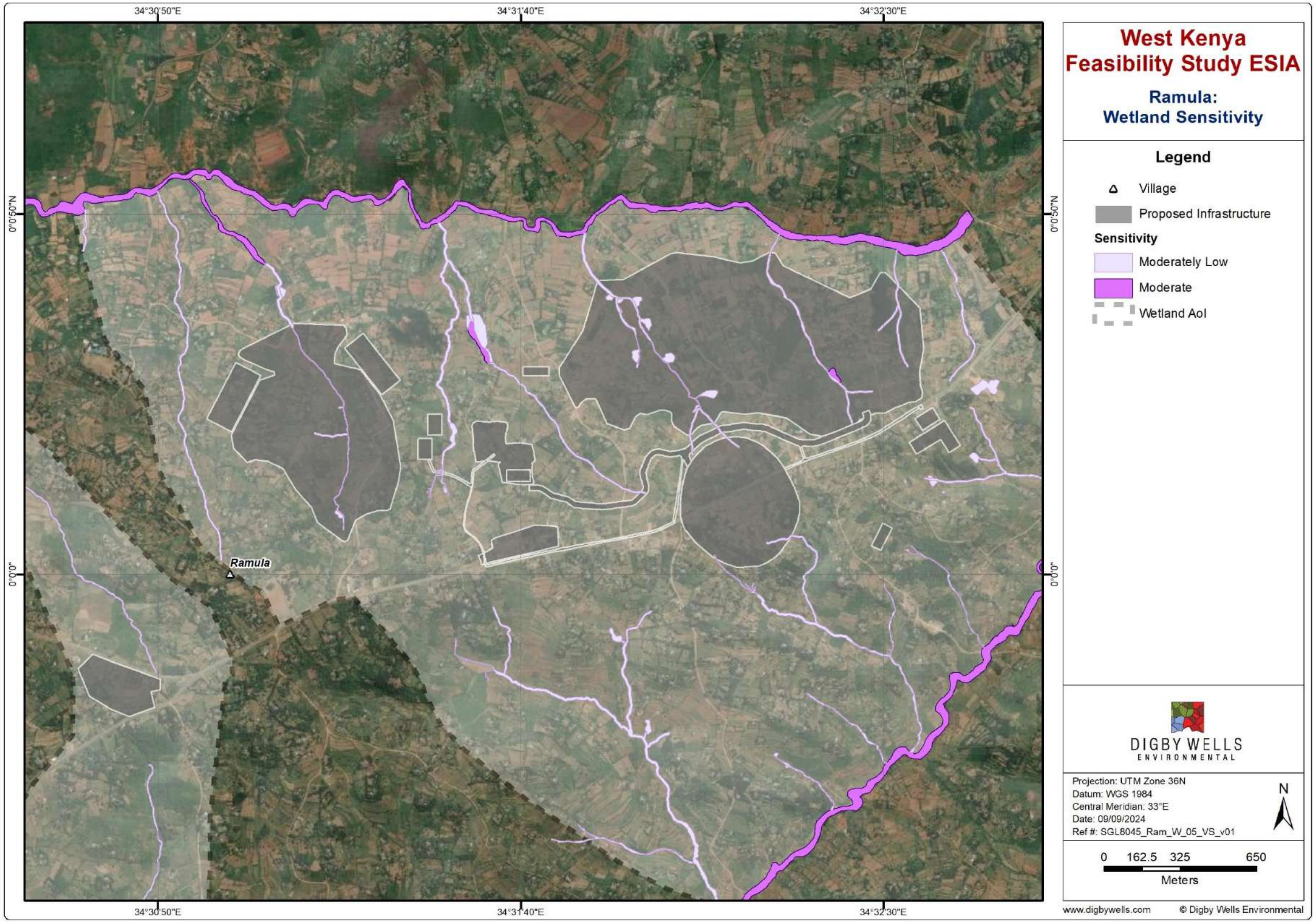


Figure 4-63: Wetland Sensitivity within the AOI

4.11.3. Wetland Buffers

Wetland buffers aim to inform adjustments to layouts to subsequently avoid direct impacts to watercourses. Only three components impede delineated watercourses (including drainage lines), including the Ramula Open Pit, the TSF and WRD. None of these components can practically be moved and adjustments required to avoid watercourses are too significant to be considered feasible. Considering that adjustments cannot be made, wetland buffers will not be practical for this assessment. Various roads will cross through wetland systems. It is worth noting that this crossing is inevitable and adjustments cannot be made to drive around wetlands. A 15 m buffer zone should be implemented throughout the construction phase for road crossings to restrict laydown areas, topsoil stockpiles and any associated activities besides the direct construction of crossings.

4.12. Ambient Air Quality

A baseline Air Quality Assessment was conducted as part of this EIA process and report is included as Appendix L.

A desktop survey of the Project area and surroundings on Google Earth® imagery was conducted and it shows that the Project is located in an area classified as a semi-urban area (Figure 4-64). Based on the imagery, there are numerous residential developments in all compass directions from the Project fence line, i.e. dwellings scattered across the landscape. Each of these households represents a sensitive receptor (Table 4-43), likely to be impacted. *Sensitive receptors* (SR) *are locations where the occupants are more susceptible to airborne pollutants, including places, such as hospitals, schools, daycare facilities, elderly housing, and convalescent facilities* (United States Environmental Protection Agency - USEPA, 2016). These institutions are all present in the Ramula Gold Mining Project area.

Table 4-43: Selected Sensitive Receptors in the Vicinity of the Project Area

SR	Description	Current Uses	Approximate Distance to the nearest min infrastructure (m)
RA_AQ_001	Residential	Dwelling	North of Project Fenceline
RA_AQ_002	Residential	Dwelling	South Inside Project Fenceline
RA_AQ_003	Residential	Dwelling	North of Project Fenceline
RA-AQ_004	Residential	Dwelling	East of Project Fenceline
RA_AQ_005	Residential	Educational	South Inside Project Fenceline

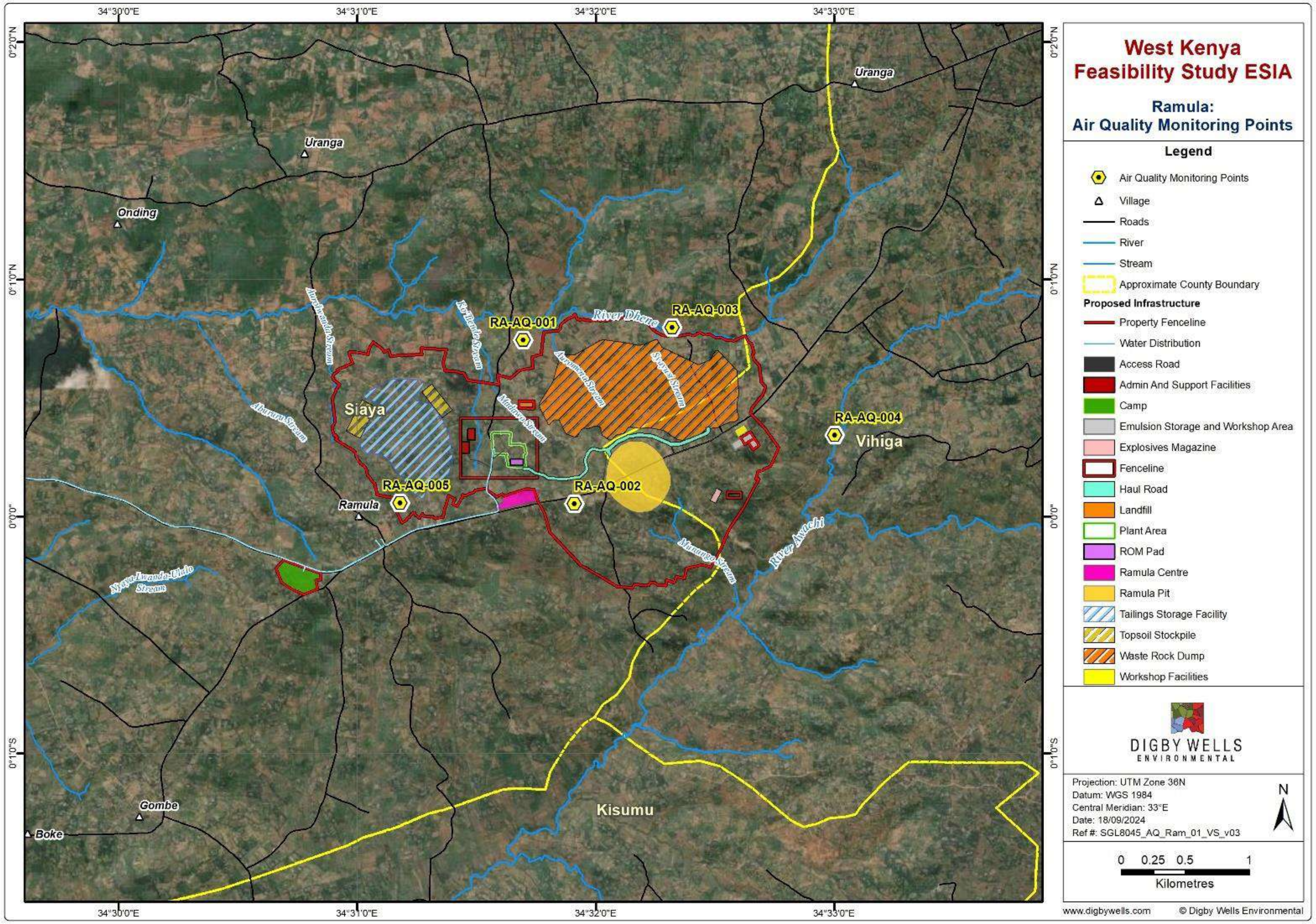


Figure 4-64: Local Setting showing Project Boundary and Sensitive Receptor locations

4.12.1. Onsite Air Quality Climatology

Baseline data collection in the form of PM_{10}, $PM_{2.5}$ and gaseous NO_2, SO_2, ozone (O_3), hydrogen sulfide (H_2S), carbon monoxide (CO), nitrogen oxide (NO), Volatile Organic Carbon (VOC), NOx ($NO+NO_2$) and carbon dioxide (CO_2) measurement commenced in August 2024 at sites designated as RA_AQM, which stands for Ramula Air Quality Monitoring. These sites include RA_AQM_001 (Kevin Otieno), RA_AQM_002 (Pamela Odhiambo), RA_AQM_003 (Ezekiel Odhiambo), RA_AQM_004 (Francis Anjili), and RA_AQM_005 (Ramula Primary School) all covering the four compass directions - north, south, west and east of the proposed mine infrastructure. It is assumed that ambient air quality monitoring will continue at these locations until the mining operation commences.

Since mining has not commenced, all the air quality monitoring locations are categorised as residential (Figure 4-64). Once mining commences, some of the monitoring locations will be moved and redesignated as industrial and the regulatory standard will change. In addition, the number of monitoring locations will increase from the current five different locations specified above. It is worth mentioning that sampling seemed to be conducted once off over 24 hours at a particular location. The latter is classified as a snapshot, as opposed to the norm, which is real-time continuous monitoring over a lengthy period – over a week, month, and throughout the year.

The data shared was pulled into an Excel® spreadsheet environment for statistical analysis to determine the ambient levels of these particulate and gaseous pollutants collected at the monitoring locations in and around the Project fence line. The real-time monitor is setup to run from day 1 to day 2 to complete a 24-hour cycle. So, just one day of data at a monitoring location was made available. For PM_{10} and $PM_{2.5}$, the following observations were made of the measured results:

4.12.1.1. *PM_{10} Findings*

- PM_{10} data was available for a day per site;
- Two of the sites RA_AQM_001 and RA_AQM_004 were in exceedance of the WHO 2021 guideline of 45 $\mu g/m^3$;
- The latter accounts for a 40% exceedance considering the available data; and
- The PM_{10} concentration across the site varied between 17 $\mu g/m^3$ and 157 $\mu g/m^3$.

4.12.1.2. *$PM_{2.5}$ Findings*

- $PM_{2.5}$ data was available for a day per site;
- Two of the sites RA_AQM_001, RA_AQM_002 and RA_AQM_004 were in exceedance of the WHO 2021 guideline of 15 $\mu g/m^3$;
- The later accounts for 60% exceedance considering the available data; and

- The PM_{10} concentration across the site varied between 11 µg/m^3 and 42 µg/m^3.

A graphical representation of the results measured during the monitoring campaign is presented below (Figure 4-65).

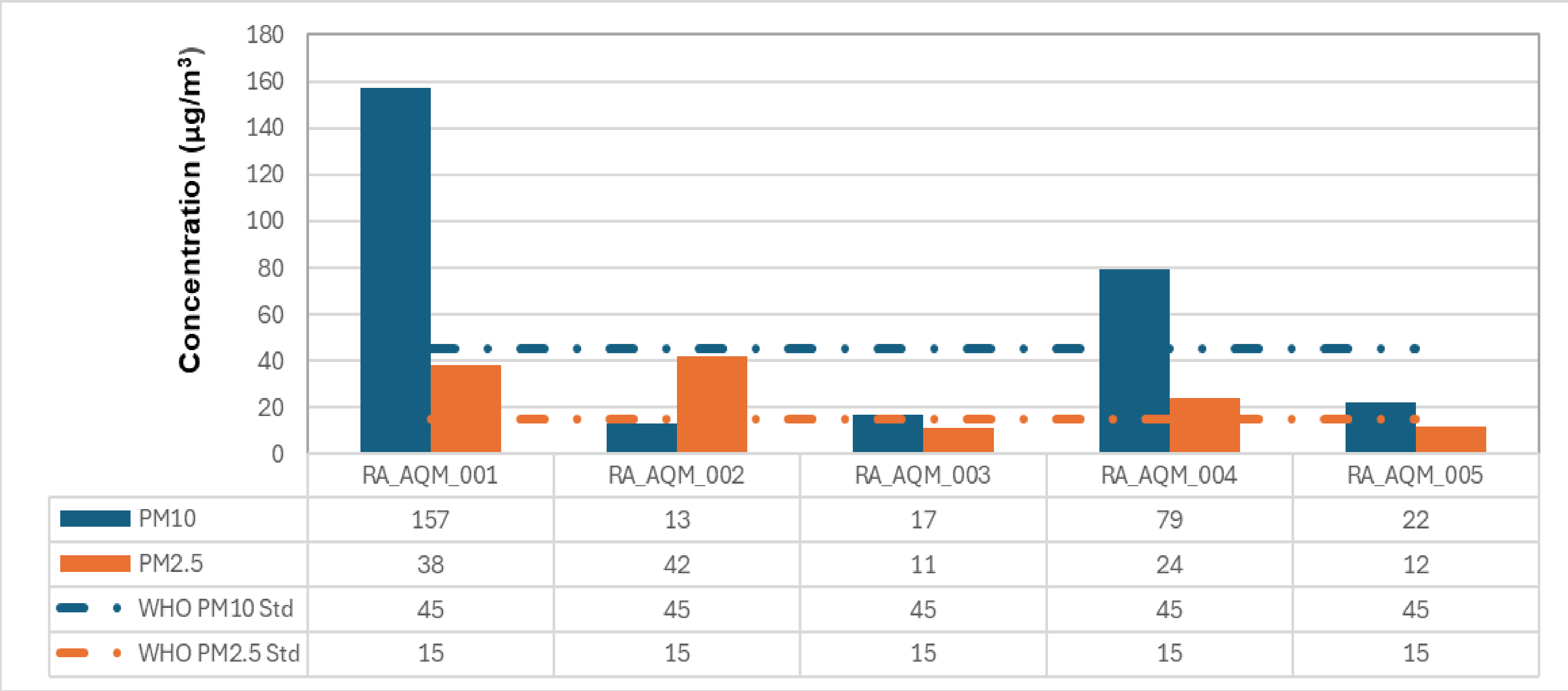


Figure 4-65: PM_{10} and $PM_{2.5}$ Concentrations on site

Source (SGKL Limited)

The real-time concentration of gaseous pollutants measured data were made available for all the monitoring locations. For the gaseous pollutants: NO_2, SO_2, O_3, CO, VOC and H_2S, the levels of each air pollutant in the atmosphere are discussed briefly:

4.12.1.3. NO_2 Records

- A 24-hour ambient concentration is available per site, except for RA_AQM_002. The reasons for the non-availability of data were not provided;
- The maximum ambient concentration measured was 0.39 µg/m^3. This value is considered negligible when compared with the WHO 2021 24-hour guideline of 25 µg/m^3; and
- As a result of the above, no exceedance was measured at the different sites, hence, the percentage exceedance is zero.

4.12.1.4. SO_2 Records

- The 24-hour ambient concentration of SO_2 was available per site, except for RA_AQM_002. The reasons for the non-availability of data were not provided;
- The maximum ambient concentration measured was 0.06 µg/m^3. This value is considered negligible when compared with the WHO 2021 24-hour guideline of 40 µg/m^3;
- As a result of the above, no exceedance was measured at the different sites, hence, the percentage exceedance is zero; and
- The graphical representation of the data collected in comparison with the applicable guideline is not depicted as the levels are very low, negligible to be precise.

4.12.1.5. CO Records

- The 24-hour ambient concentration of CO was available per site, except for RA_AQM_002. The reasons for the non-availability of data were not provided;
- The maximum ambient concentration measured was 0.39 µg/m^3. This value is considered negligible when compared with the WHO 2021 24-hour guideline of 4.0 mg/m^3;
- As a result of the above, no exceedance was measured at the different sites, hence, the percentage exceedance is zero; and
- The graphical representation of the data collected in comparison with the applicable guideline is not depicted as the levels are very low, negligible to be precise.

4.12.1.6. VOC Records

Most guidelines refer to an ambient concentration of 0.5 mg/m^3 is considered as acceptable threshold limit. Since VOC is diverse, i.e. encompasses the most common - present in the air we breathe: Acetone, Arsine, Benzene, Ethylene glycol, Formaldehyde, Hydrogen sulfide, Methylene chloride, Nitric oxide, Styrene, Tetrachloroethylene, Toluene, and Xylene. It was then assumed that the field survey data was for Total VOC (TVOC). A further breakdown of the concentration ranking in ambient air confirms the following in Table 4-44.

Table 4-44: Acceptable TVOC Levels in Ambient Air (mg/m^3)

TVOC (mg/m^3)	Level of Concern
Less than 0.3	Low
0.3 to 0.5	Acceptable
0.5 to 1	Marginal
1 to 3	High

- The maximum anytime ambient concentration TVOC measured was 0.05 mg/m^3;
- Data was not available for RA_AQM_002;05
- The maximum ambient concentration measured was 0.05 mg/m^3. This value is considered negligible when compared with the acceptable limit of 0.5 mg/m^3;
- As a result of the above, no exceedance was measured at the different sites, hence, the percentage exceedance is zero; and
- The graphical representation of the data collected in comparison with the applicable guideline is not depicted as the levels are very low, negligible to be precise.

4.12.1.7. H_2S Records

- The maximum ambient concentration of H2S was available per site, except for RA_AQM_002. The reasons for the non-availability of data were not provided;
- The maximum ambient concentration measured was 2.1 µg/m^3 measured at RA_AQM_004 is higher than the – Acute Inhalation Exposure Guideline of 42 µg/m^3 published by the California Environmental Protection Agency (CalEPA, 1999);
- As a result of the above, no exceedance was measured at the different sites, hence, the percentage exceedance is zero; and
- The graphical representation of the data collected in comparison with the applicable guideline is not depicted as the levels are very low, negligible to be precise.

4.13. Ambient Noise Levels

An Environmental Noise Assessment was conducted as part of this EIA process and is included as Appendix M To establish the baseline ambient noise levels, monitoring was undertaken at Noise Sensitive Receivers (NSRs) surrounding the Project area.

The receiving environment is characterised by multiple land uses, these include:

- Residential land use – densely populated residential areas/communities (such as Ramula villages/communities);
- Commercial land use – informal/formal trading (marketplaces and retail stores) mainly within the Ramula community; and
- Transportation land use – informal and main road networks.

These land use types and associated activities represent perennial sources of noise in the area, such as:

- Noise generated as a result of day-to-day activities from community living; and
- Noise generated from the usage of light (motorcycles and cars) and heavy vehicles (buses and trucks) across the network of roads in the area.

Noise emissions from these anthropogenic sources (activities mentioned above) and noise emissions from natural elements such as animals (birds, including insects etc.), weather events (rain, wind) etc. contribute to the existing soundscape (baseline environment) of the area.

4.13.1. Ambient Noise Level Measurements

The results of the baseline measurements are presented in Table 4-45 and Table 4-46 below. The ambient noise levels recorded on site, along with the EMC regulation's and IFC-EHS guidelines are presented side by side for comparison. The time history graph per noise measurement location (RA_AQ_NO_001 – RA_AQ_NO_005) can be seen in Figure 4-66 to Figure 4-70. The graphs show the noise profile data as recorded onsite and is presented in the A-weighted scale. In addition, the graph displays compliance with the IFC-EHS guidelines hourly noise levels limits.

Table 4-45: Results of the Baseline Noise Measurements in relation to Kenya's EMC Regulations

Sample Location ID	Kenya's EMC Regulations Maximum Permissible Noise Levels for the General Environment									
	Type of Receptor	Period	Acceptable Noise Level dBA	Ambient Noise Level (Measured) $LA_{eq,T}$ dBA	Minimum dBA	Maximum dBA	Start Date (DD/MM/YYYY)	End Date (DD/MM/YYYY)	Duration (HH:MM:SS)	Compliance (Yes/No)
RA_AQ_NO_001	Residential	Daytime	50	60	50	71	13/08/2024	14/08/2024	23:12:42	No
		Night-time	35	53	48	60				No
RA_AQ_NO_002	Residential	Daytime	50	77	49	91	14/08/2024	15/08/2024	23:33:02	No
		Night-time	35	58	53	67				No
RA_AQ_NO_003	Residential	Daytime	50	61	38	68	15/08/2024	16/08/2024	23:53:12	No
		Night-time	35	56	54	67				No
RA_AQ_NO_004	Residential	Daytime	50	65	55	73	16/08/2024	17/08/2024	21:10:11	No
		Night-time	35	51	47	59				No
RA_AQ_NO_005	School	Daytime	40	52	24	62	12/08/2024	13/08/2024	24:00:00	No
		Night-time	35	46	41	52				No
		Indicates current LA_{eq},T levels above either the daytime rating limit of 55 dBA or the night time rating limit of 35dBA residential								
		Indicates current LA_{eq},T levels above either the daytime rating limit of 40 dBA or the night time rating limit of 35dBA for silent zone								

Table 4-46: Results of the Baseline Noise Measurements in relation to the IFC-EHS Guidelines

Sample Location ID	IFC-EHS Guidelines Maximum Noise Level Limits									
	Type of Receptor	Period	Acceptable Noise Level dBA	Ambient Noise Level (Measured) $LA_{eq,T}$ dBA	Minimum dBA	Maximum dBA	Start Date (DD/MM/YYYY)	End Date (DD/MM/YYYY)	Duration (HH:MM:SS)	Compliance (Yes/No)
RA_AQ_NO_001	Residential; institutional; educational	Daytime	55	60	50	71	13/08/2024	14/08/2024	23:12:42	No
		Night-time	45	52	48	60				No
RA_AQ_NO_002	Residential; institutional; educational	Daytime	55	77	49	91	14/08/2024	15/08/2024	23:33:02	No
		Night-time	45	58	53	72				No
RA_AQ_NO_003	Residential; institutional; educational	Daytime	55	61	38	68	15/08/2024	16/08/2024	23:53:12	No
		Night-time	45	56	52	67				No
RA_AQ_NO_004	Residential; institutional; educational	Daytime	55	63	51	70	16/08/2024	17/08/2024	21:10:11	No
		Night-time	45	61	47	73				No
RA_AQ_NO_005	Residential; institutional; educational	Daytime	55	52	24	62	12/08/2024	13/08/2024	24:00:00	Yes
		Night-time	45	45	41	53				No
		Indicates current $LA_{eq,T}$ levels above either the daytime rating limit of 55 dBA or the night time rating limit of 45 dBA								

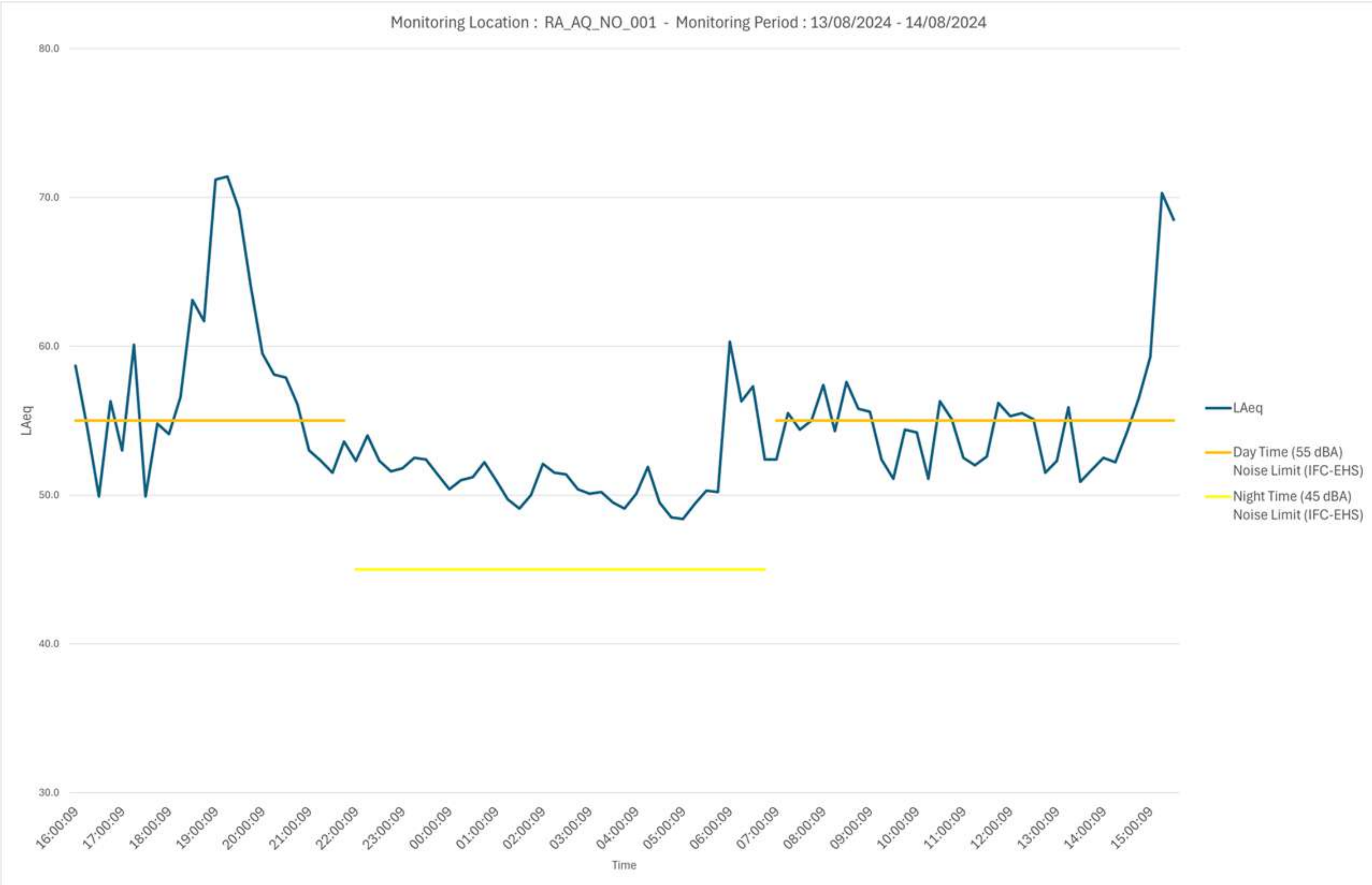


Figure 4-66: Noise Time Series Graph for RA_AQ_NO_001 Monitoring Location

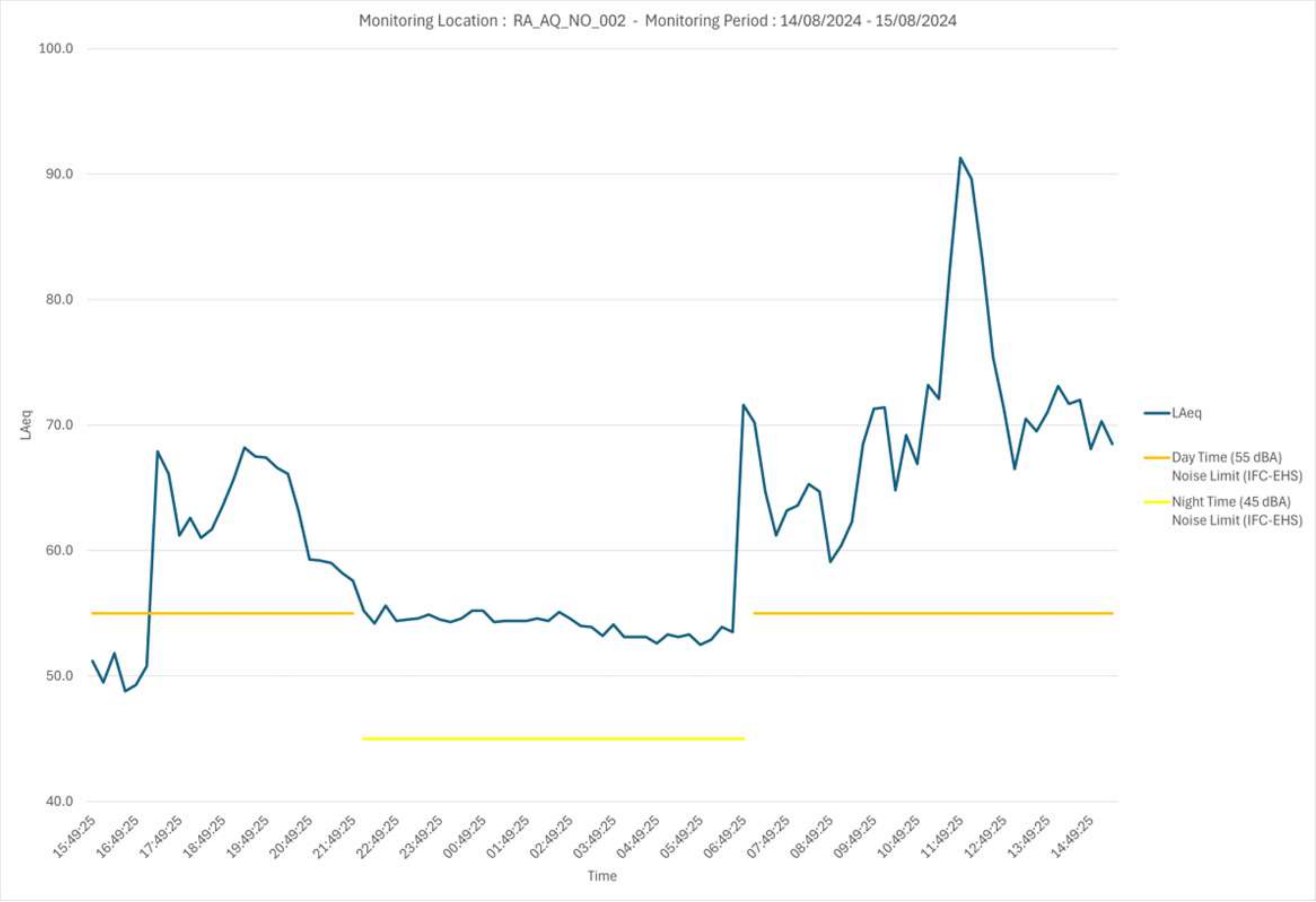


Figure 4-67: Noise Time Series Graph for RA_AQ_NO_002 Monitoring Location

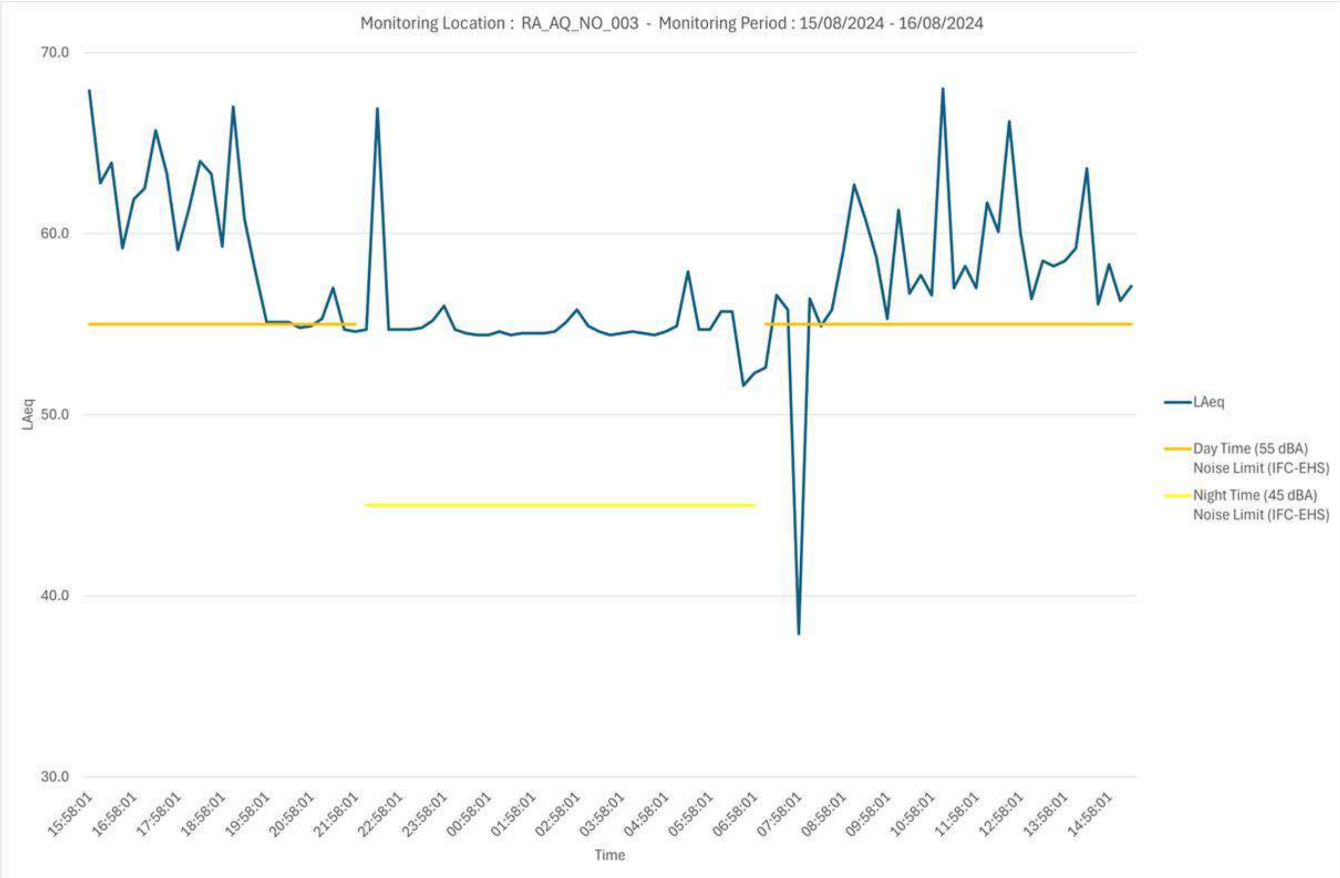


Figure 4-68: Noise Time Series Graph for RA_AQ_NO_003 Monitoring Location

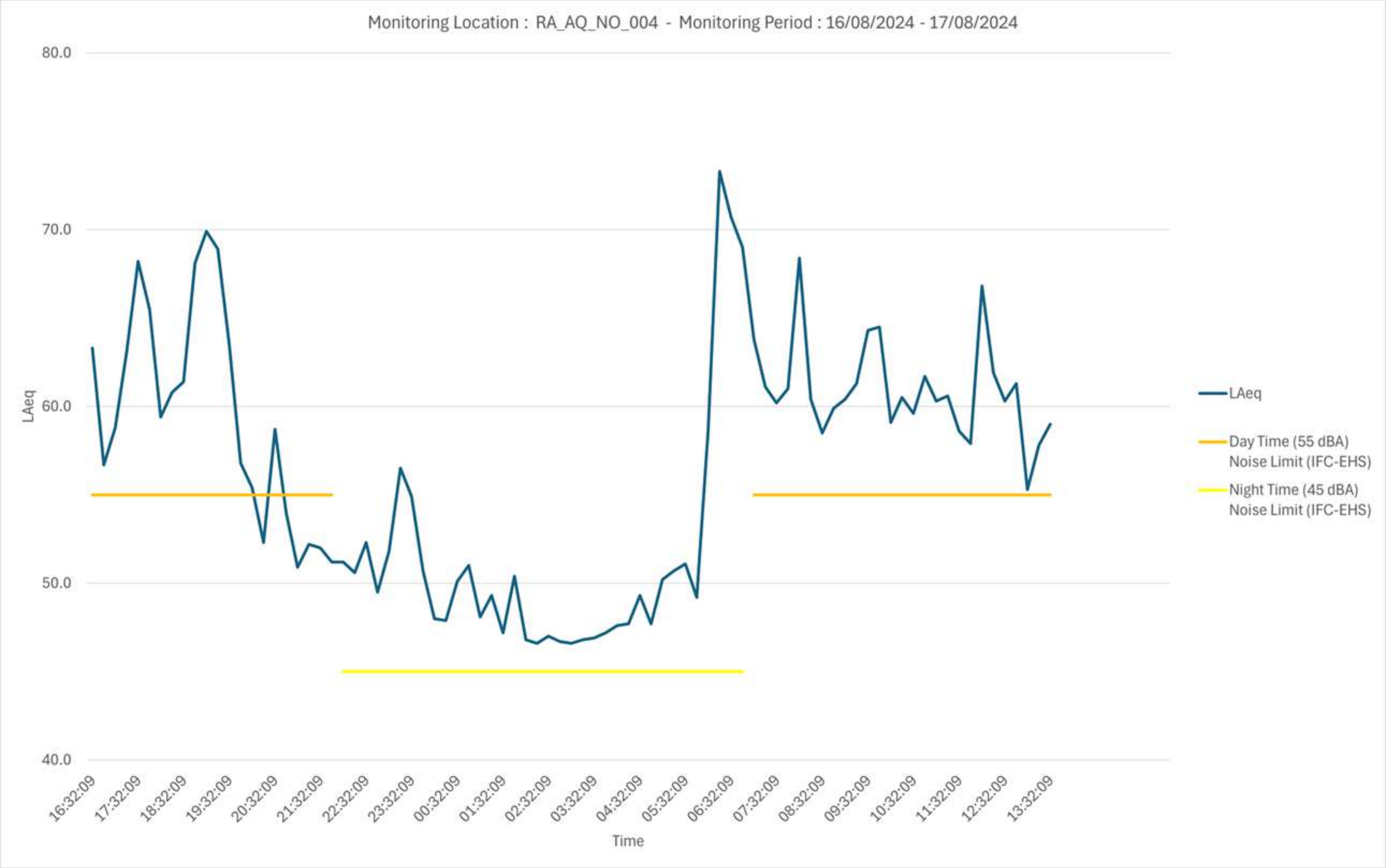


Figure 4-69: Noise Time Series Graph for RA_AQ_NO_004 Monitoring Location

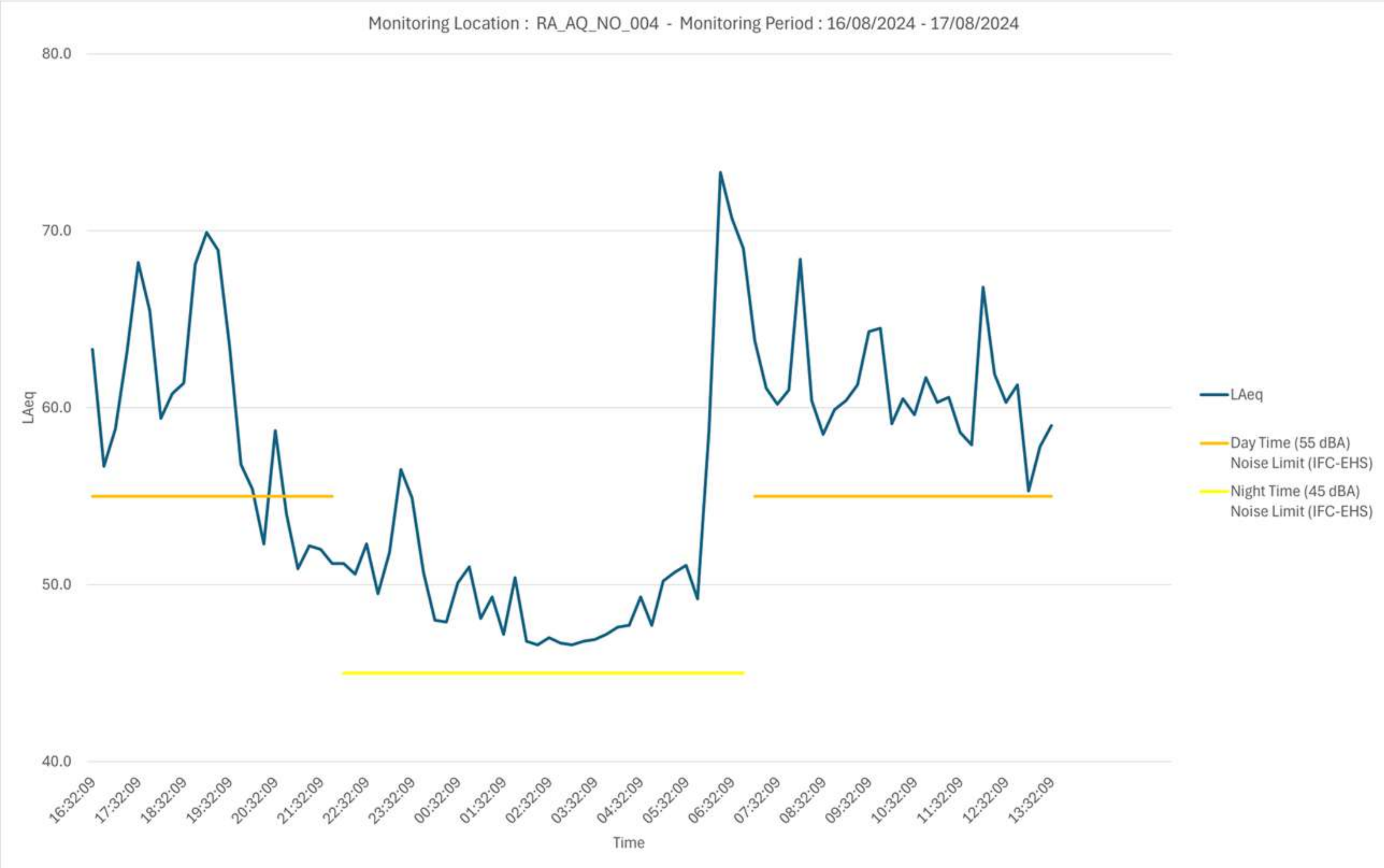


Figure 4-70: Noise Time Series Graph for RA_AQ_NO_005 Monitoring Location

4.13.2. Day-Time Results

The measured LAeq noise levels for daytime ambient noise at measurement locations are indicated as follows; RA_AQ_NO_001 (60dBA), RA_AQ_NO_002 (77dBA), RA_AQ_NO_003 (61 dBA), RA_AQ_NO_004 (65 dBA) and RA_AQ_NO_005 (52 dBA). The results for daytime exposure indicate that all measurement locations experienced ambient noise levels that were above the EMCRs maximum permissible noise level limit rating of 50 dBA and 40 dBA for outdoor daytime ambient noise at residential and silent zones respectively. These results indicate that the existing soundscape exceeds the acceptable daytime noise level limits for ambient noise therefore is non-compliant with the EMC regulations. With the ambient noise levels at these measurement locations already high, it will aid in masking the noise impacts associated with the proposed Project.

From an IFC-EHS guidelines perspective, the results for daytime exposure indicate that all measurement locations (except RA_AQ_NO_005) experienced ambient noise levels that were above the IFC-EHS guidelines maximum permissible noise level limit rating of 55 dBA for outdoor daytime ambient noise at residential, institutional and educational receivers. These results indicate that the existing soundscape exceeds the acceptable daytime noise level limits for ambient noise therefore is non-compliant with the IFC-EHS guidelines. With the ambient noise levels at these measurement locations already high, it will aid in masking the noise impacts associated with the proposed Project.

4.13.3. Night-Time Results

The measured LA_{eq} noise levels for night time ambient noise at measurement locations are indicated as follows; RA_AQ_NO_001 (60dBA), RA_AQ_NO_002 (77dBA), RA_AQ_NO_003 (61 dBA), RA_AQ_NO_004 (65 dBA) and RA_AQ_NO_005 (52 dBA). The results for night time exposure indicate that all measurement locations experienced ambient noise levels that were above the EMC regulations maximum permissible noise level limit rating of 40 dBA and 35 dBA for outdoor night time ambient noise at residential and silent zones respectively. With the ambient noise levels at these measurement locations already high, it will aid in masking the noise impacts associated with the proposed Project.

From an IFC-EHS guidelines perspective, the results for night-time exposure indicate that all measurement locations experienced ambient noise levels that were above the IFC-EHS guidelines maximum permissible noise level limit rating of 45 dBA for outdoor nighttime ambient noise at residential, institutional and educational receivers. These results indicate that the existing soundscape exceeds the acceptable daytime noise level limits for ambient noise therefore is non-compliant with the IFC-EHS guidelines. With the ambient noise levels at these measurement locations already high, it will aid in masking the noise impacts associated with the proposed Project.

4.14. Traffic

A Traffic Impact Assessment (TIA) was conducted as part of this EIA process and is included in Appendix N. The Project spans across rural communes where numerous rural communities/villages are located within the project area as well as several nature reserves. The primary land uses comprise agriculture and dispersed rural villages. There are no other substantive land-use traffic generators in close proximity to the Project site.

4.14.1. Existing Road Network

4.14.1.1. Road Network Overview

Kenya has about 162 600 km of roads of which 45 532 km is managed by the National Government, and 117 068 km is managed by the County Governments. National trunk roads are under four institutions: Kenya National Highways Authority (KeNHA); Kenya Urban Roads Authority (KURA) and Kenya Rural Roads Authority (KeRRA). The Kenya Wildlife Services (KWS) manages all National Trunk Roads and County Roads within the national parks and game reserves. These institutions are responsible for the planning, development, and maintenance of roads for motorized, intermediate and non-motorized transport under their jurisdictions.

Table 4-47: Kenya Road Lengths by Class, Surface Type and Condition

Category	Road Agency	Road Class	Length Km (2016)	Length Km (2023)
National Trunk Roads (NTR)	KeNHA	A	7,751	8,108
		B	10,802	13,783
		S	81	357
	KeNHA Total		**18,634**	**22,248**
	KeRRA	C	21,585	18,711
	KeRRA Total		**21,585**	**18,711**
	KURA	Au	130	120
		Bu	315	2,067
		Cu	1,945	2,386
	KURA Total		**2,390**	**4,574**
NTR Total			**42,609**	**45,532**
County Roads	County	D	11,162	10,702
		E	13,858	11,483
		F	9,611	9,027
		G	86,601	85,855
	County Total		**121,232**	**117,068**
Grand Total			**163,841**	**162,600**

Source: Draft Roads Register (KRB 2023)

The four main roads forming the East African Community (EAC) Regional Trunk Road Network (RTRN) in Kenya are: (i) the Northern Corridor from Mombasa port through Nairobi to Malaba, with a branch line to Kisumu; (ii) the Great North Road Corridor from Namanga (Tanzania) through Nairobi to Thika, Isiolo, and Moyale (Ethiopia); (iii) the Northern Tanzania – Southern Sudan Corridor from Isebania through Kisumu to Kakamega, Kitale, Lodwar and Nandapal/Nakodok (South Sudan), and, (iv) Lunga Lunga (Tanzania) to Garissa through Mombasa, Malindi and Lamu. The other important national roads are: (i) Isiolo to Mandera through Wajir; (ii) Mai Mahiu to Isebania through Narok and Kisii; and, (iii) Voi – Taveta. These road links are part of the Primary Road network in Kenya, and important for international transport and trade facilitation.

Non-Motorized Transport (NMT) has been recognized as an important means of transport in Kenya, to date 1 070 km footpaths, 110 km cycle lanes, 97 km footbridges have been constructed. Rural areas contained 69% of Kenya’s population based on the 2019 Population and Housing census. The socio-economic activities within the rural setting are especially based in agriculture, horticulture, livestock farming and fishing. It is estimated that 85% of the movements in the rural areas usually take place off the major roads (using tracks and paths) to support rural mobility needs between homes and farms, markets, rivers, meeting grounds, schools, health centres, churches, local administrative offices and rural homes. Most trips are made using Non-Motorized and Intermediate Means of Transport (NMIMTs) which include walking and head loading, on bicycles, and animal transport. Motorcycles and three wheelers are also used in large scale. These journeys facilitate the production of goods and their movement to markets and their supply to urban areas. The government through implementation of the low volume seal roads, has provided 10 000 km in the last 10 years.

4.14.1.2. Road Accessibility

The majority of roads in Kenya consist of local and community roads with sand and or earth type formation. Some of these roads are to be used for local access to the Project site whereas the Siaya Road, E382 and C29 which are bitumen roads, will be used for road-based haulage of construction and operational stage trips. The condition and traffic loading of the Kenya road network is illustrated in Figure 4-71

Typical engineered paved road

Typical un-engineered gravel access road

Typical engineered paved road

Typical engineered laterite gravel road

Figure 4-71: Illustration of Road Types in Study Area (Examples)

Key problems related to road accessibility in the Study Area can be summarised as follows:

- Lack of public road maintenance leading to high number of potholes and unsafe areas of road surfaces.
- Narrow single-track roads with overgrown verges and deep roadside ditches in places causing safety concerns for passing vehicles.
- Reliance on community self-help groups for vegetation clearance and road repairs to maintain road accessibility.
- In high rainfall areas (> 1 000 mm /year), gravel loss is very high and re-gravelling is required every two to three years.

- Generation of dust is a constant hazard to inhabitants living nearby and their crops as well as posing a serious road safety problem to overtaking motorists, especially in the dry season.
- Unpaved road shoulders which create for unsafe travelling conditions.

4.14.2. Traffic Growth

Traffic growth rates were assumed to align with current Kenya GDP growth and as such appropriate traffic growth of 5% per annum was used in the analyses.

4.14.3. Traffic Surveys Results

Traffic surveys were conducted at the various intersections, as illustrated previously. It must be noted that traffic surveys were conducted during market days to account for the highest peak of event-based fluctuation of background traffic. The traffic surveys consisted of:

- Seven day traffic counts (24/04/2024 – 30/04/2024) from 6:00am to 18:00pm; and
- Classified counts distinguishing between light vehicles, heavy vehicles, cyclists, motorbikes, and pedestrians.

The following aspects were evident based on the analysis of the traffic volumes traversing through the intersections during the survey periods as follows:

- motorised are the main mode of use through Intersection 1 during both AM and PM peak periods;
- motorised are the main mode of use through Intersection 2 during both AM and PM peak periods. Non-motorised transport especially pedestrian movements are considered high during peak periods;
- motorised are the main mode of use through Intersection 3 during both AM and PM peak periods. Non-motorised transport especially pedestrian movements are considered high during peak period;
- motorised are the main mode of use through Intersection 4 during both AM and PM peak periods. Non-motorised transport especially pedestrian movements are considered high during peak periods; and
- motorised are the main mode of use through Intersection 5 during both AM and PM peak periods. Non-motorised transport especially pedestrian movements are considered high during peak periods also. The traffic data was used to derive peak turn movement volumes for each direction of travel through the intersection.

4.15. Visual

A Visual Impact Assessment was conducted as part of this EIA process and is included in Appendix O

General views (images gathered from site visit undertaken in the area) of the landscape surrounding the Project area are displayed in Figure 4-72. Observations from the general views indicate that the Project area is located in a landscape that has been transformed for residential and commercial land use purposes. The activities associated with these land uses have transformed the natural landscape from a pristine environment to one of a disturbed nature. As such, the sense of place can be described as a partially disturbed landscape. The residential and commercial areas and associated infrastructure have become an integral part of the landscape's visual character also influencing other biophysical characteristics such as the vegetation cover and land use of the receiving environment.

Figure 4-72: General Views of the Receiving Environments Landscape

4.15.1. Identification of Sensitive Visual Receptors

The analysis of the available datasets indicates that the majority of the receptors are people/residents living within the Project area and the surrounding areas (villages and towns) within 20 km of the ZVI. Due to the densely populated nature of the receiving environment whereby visual receptors are not only densely scattered in the surrounding areas but also within the Project area itself, it was assumed that only human settlements identified in the "Places" dataset of the OSM database within the 20 km ZVI will be used as visual receptors for this study.

The "Places" dataset provides the geographical locations of settlements which fall within various administration areas such as hamlets, villages, towns etc. Transportation routes (roads) are also classified as visual receptors as well as the Maragoli Forest Reserve, which is the only protected area within the ZVI zone.

The identified receptors in the vicinity of the Project area have been illustrated in Figure 4-73. A total of 172 visual receptors have been identified within the ZVI. Furthermore, all 172 potential visual receptors are considered to be of high sensitivity.

In addition, a portion of the unclassified access roads will be visually exposed to the Project related infrastructure area and therefore also considered as visual receptors. However, these roads are not classified as scenic routes therefore are considered to be of low impact.

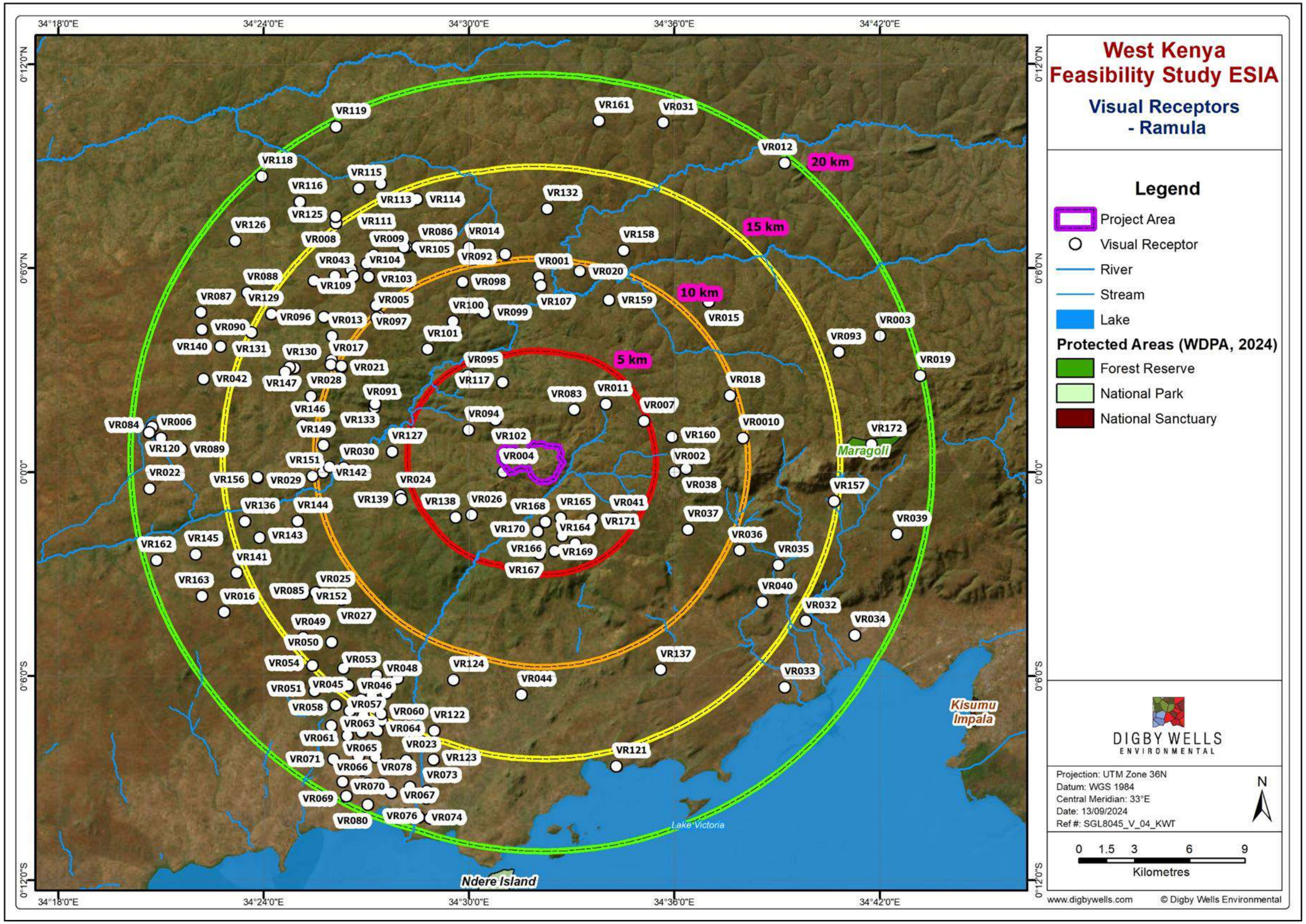


Figure 4-73: Location of Identified Potential Visual Receptors

4.15.2. Characterisation of Visual Impacts

Through the application of the methods of assessing visual impacts, the Project was defined as a **Category 5 Development**. The environment within which the Project is located is considered to be **disturbed or degraded**. Therefore, a **moderate visual impact** is expected.

A moderate visual impact assessment requires a **Level 4 Visual Assessment**, which includes:

- Identification of issues raised in the scoping phase of the EIA;
- Site visit;
- Description of the receiving environment and the project;
- Establishment of view catchment area, view corridors, viewpoints and receptors;
- Indication of potential visual impacts using established criteria;
- Inclusion of potential lighting impacts at night;
- Description of alternatives, mitigation measures and monitoring programmes;
- 3D modelling and simulations, with and without mitigation; and
- Review by independent, experienced visual specialist (if required).

4.15.3. Viewshed Analysis

The results from the viewshed modelling process are presented in this section, where individual viewsheds were run to model the potential visual impact of the most significant infrastructure features are detailed in Figure 4-74.

The viewshed analysis for this Project was designed to indicate the potential visibility of the Project infrastructure in relation to the nearby visual receptors within a 20 km ZVI. The 20 km ZVI covers a total area of 1 421.6 km^2. In addition, Table 4-48 lists the receptors that will be visually influenced by the Project.

4.15.3.1. Pit Viewshed Analysis

Figure 4-74 shows the viewshed model result for the Pit area. The area of potential visual exposure is measured at 87.2 km^2, which accounts for approximately 6.0% of the ZVI area. The small area of visual exposure is due primarily to the screening effect of the topography. The pit is located at the top of a hill along the ridge and extends across and down each slope of the ridge. Therefore, it will not be visible to receptors at the base of the hill. In addition, the pit is a void therefore ground/surface level would be its highest elevation.

For the areas that are visible, refer to Figure 4-74. Observed results indicate that visibility decreases as you move away from the Pit, with visibility being highest “object likely to be clearly visible” within approximately 2-3 km of the Project area as well as within the Project area. The only protected area within the ZVI is the Maragoli Forest Reserve and the model results suggest that the proposed Pit will not be visible to the protected area

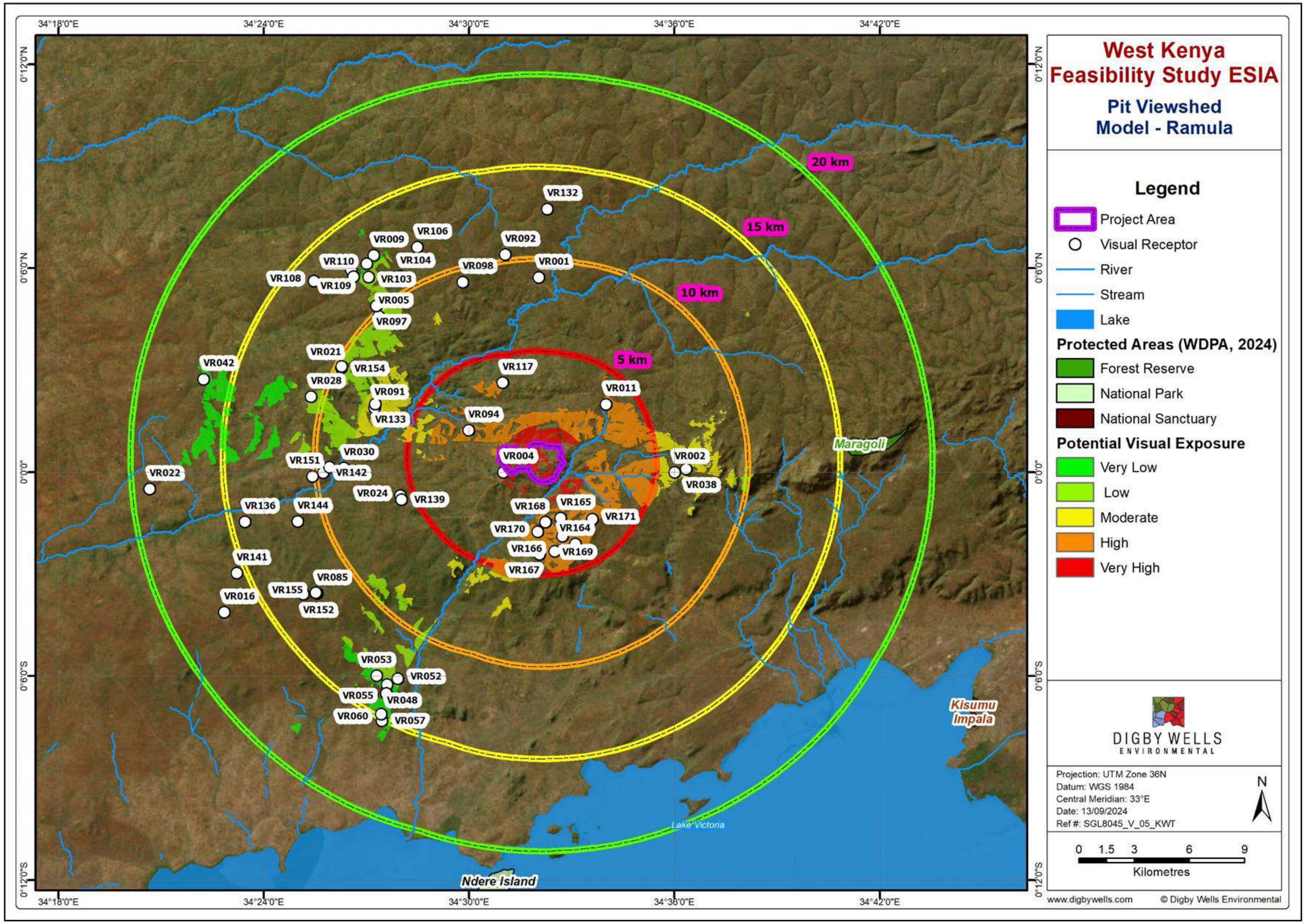


Figure 4-74: Pit Viewshed Model for the Project

4.15.3.2. Waste Rock Dump Viewshed Analysis

Figure 4-75 shows the viewshed model result for the WRD. The area of potential visual exposure is measured at the 161.2 km^2, which accounts for approximately 11.2% of the ZVI area. The small area of visual exposure is due primarily to the screening effect of the topography.

The WRD is located along the side of a hill stretching down into a valley. Therefore, it will not be visible to receptors on the other side of the hill. Only receptors located on the surrounding larger hills and within the valley will be visually exposed to the WRD.

For the areas that are visible, refer to Figure 4-75. Observed results indicate that visibility decreases as you move away from the WRD, with visibility being highest within 5 km of the Project area as well as within the Project area.

The only protected area within the ZVI is the Maragoli Forest Reserve and the model results suggest that the proposed WRD will not be visible to the protected area.

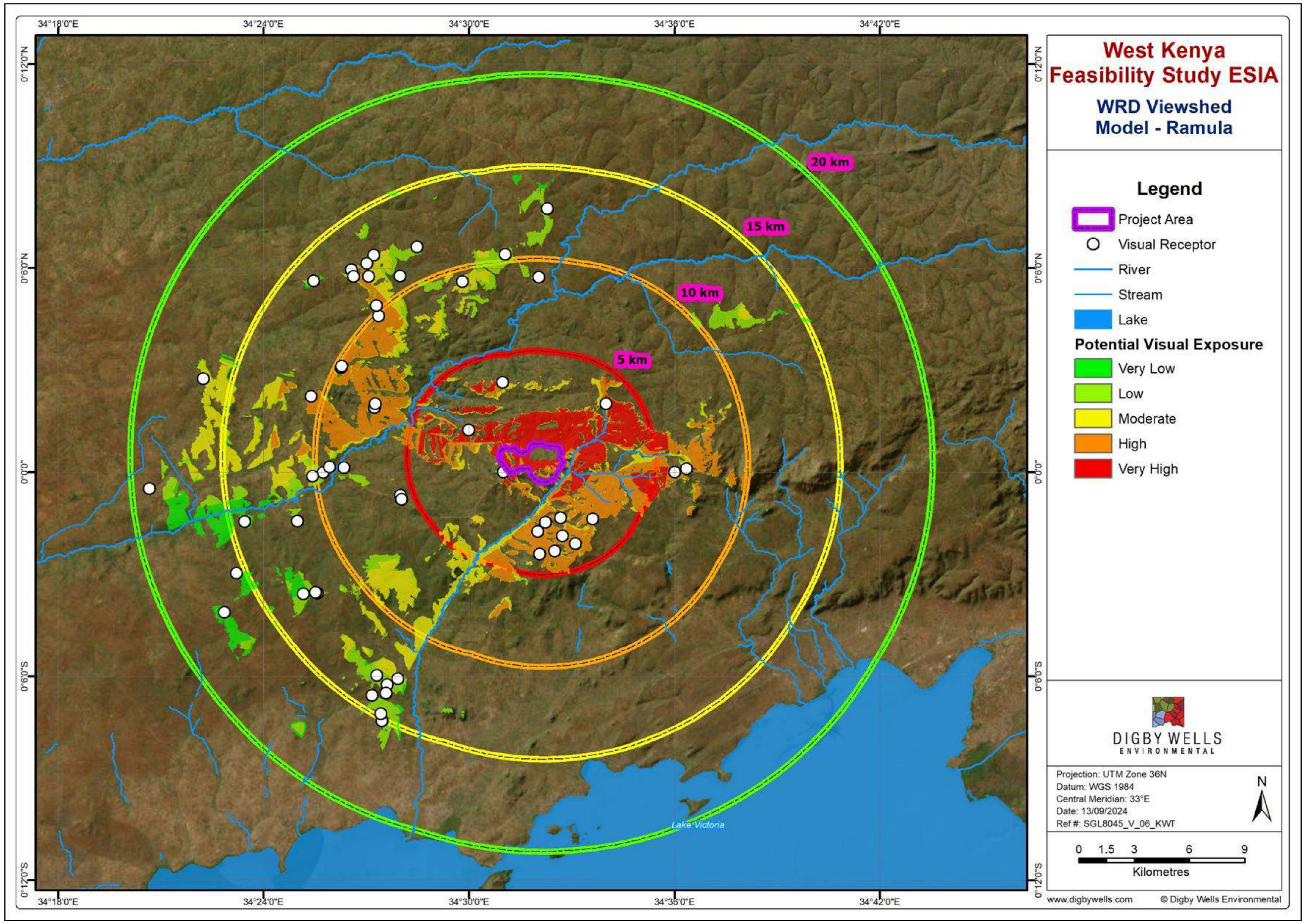


Figure 4-75: WRD Viewshed Model for the Project

4.15.3.3. Tailings Storage Facility Viewshed Analysis

Figure 4-76 shows the viewshed model result for the TSF. The area of potential visual exposure is measured at 161.2 km^2, which accounts for approximately 11.2% of the ZVI area. The small area of visual exposure is due primarily to the screening effect of the topography.

The TSF is also located along the side of a hill stretching down into a valley. Therefore, it will not be visible to receptors on the other side of the hill. Only receptors located on the surrounding larger hills and within the valley will be visually exposed to the TSF.

For the areas that are visible, refer to Figure 4-76. Observed results indicate that visibility decreases as you move away from the TSF, with visibility being highest within 5 km of the Project area as well as within the Project area.

The only protected area within the ZVI is the Maragoli Forest Reserve and the model results suggest that the proposed TSF will not be visible to the protected area.

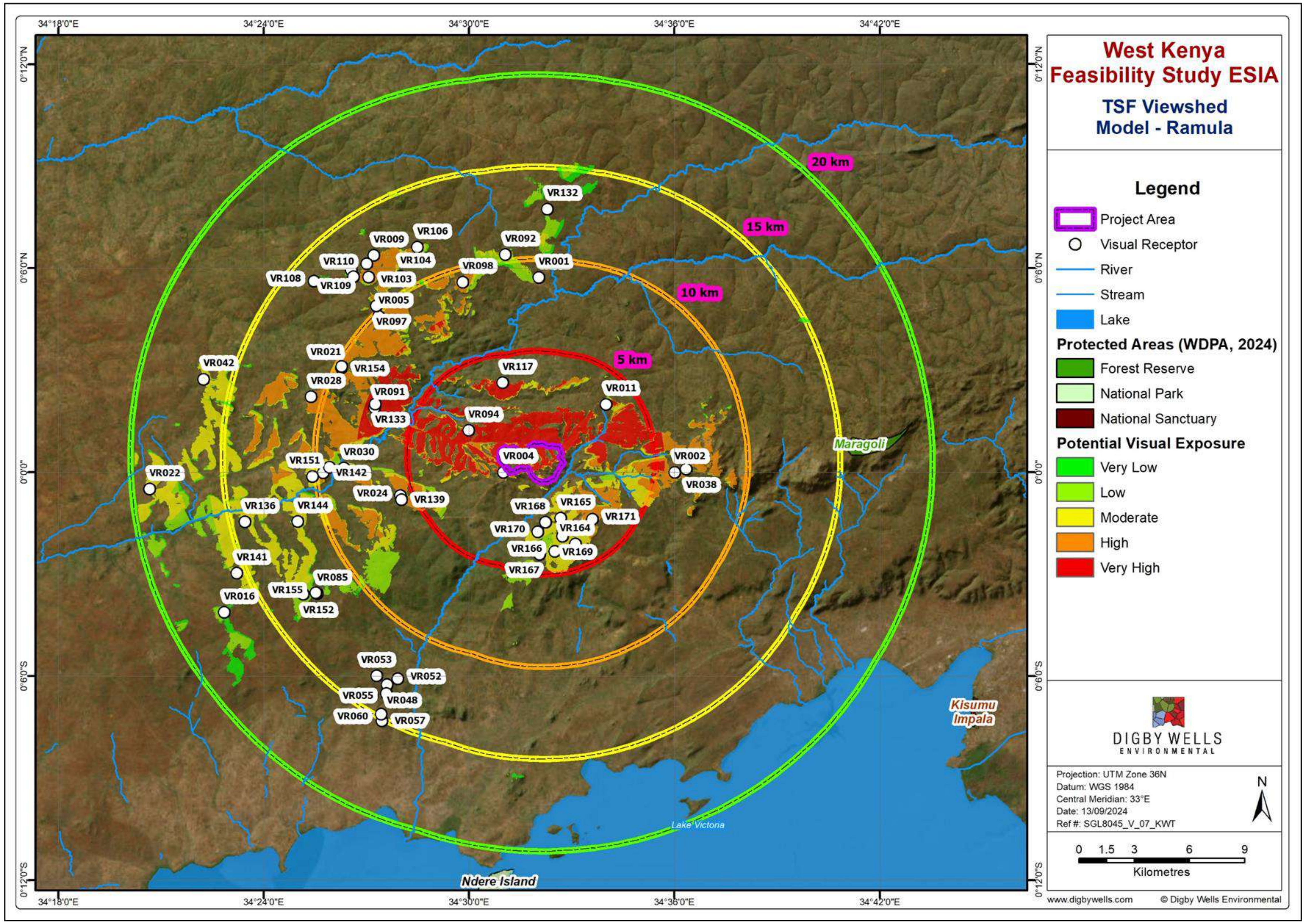


Figure 4-76: TSF Viewshed Model for the Project

4.15.3.4. Stockpiles Viewshed Analysis

Figure 4-77 shows the viewshed model result for the Stockpiles (Topsoil, ROM and Landfill). The area of potential visual exposure is measured at 86.4 km^2, which accounts for approximately 6.0% of the ZVI area. The small area of visual exposure is due primarily to the screening effect of the topography.

The stockpiles are also located along the side of a hill stretching down into a valley. Therefore, it will not be visible to receptors on the other side of the hill. Only receptors located on the surrounding larger hills and within the valley will be visually exposed to the Stockpiles.

For the areas that are visible, refer to Figure 4-76. Observed results indicate that visibility decreases as you move away from the stockpiles, with visibility being highest within 5 km of the Project area as well as within the Project area.

The only protected area within the ZVI is the Maragoli Forest Reserve and the model results suggest that the proposed Stockpiles will not be visible to the protected area.

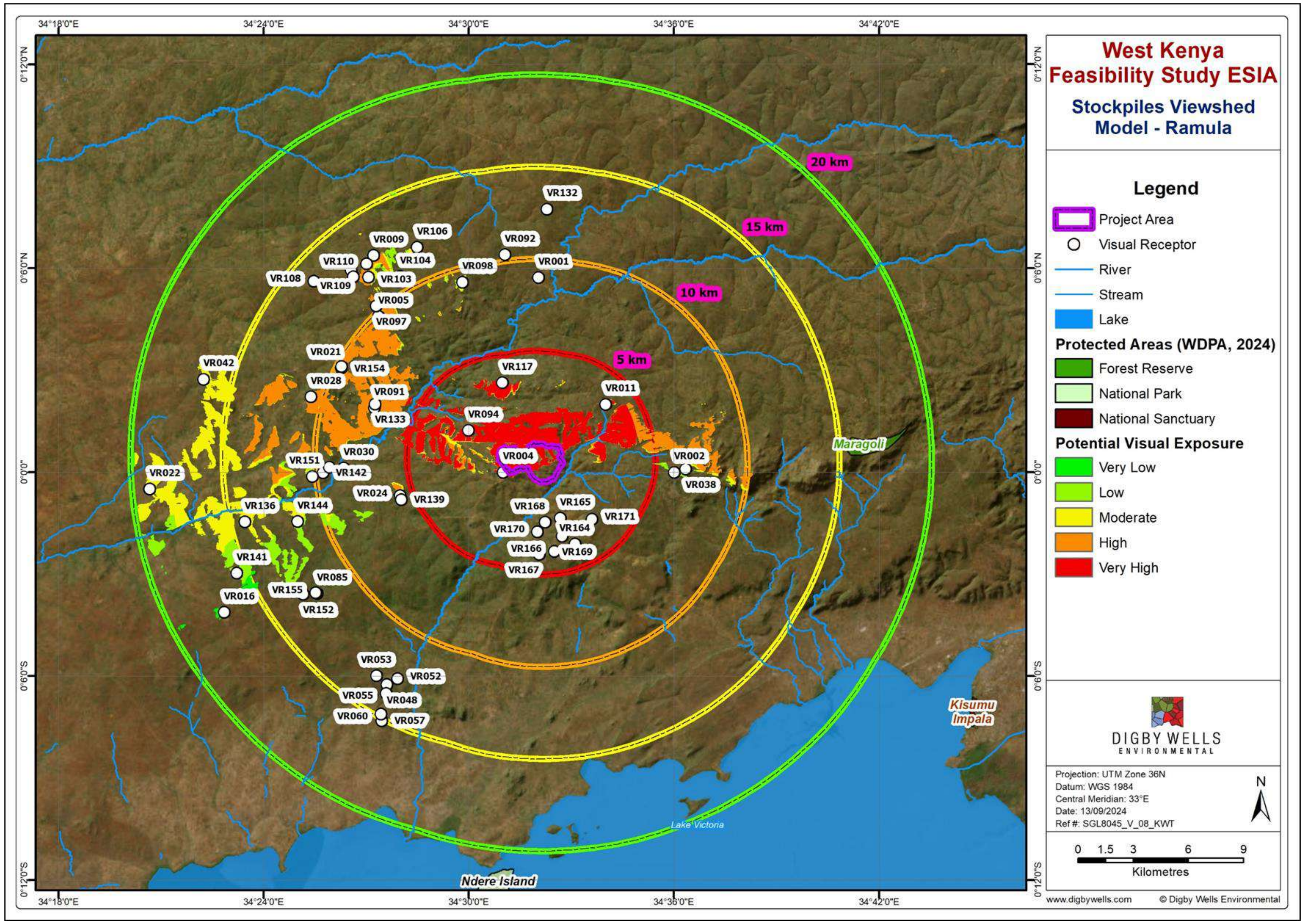


Figure 4-77: Stockpiles Viewshed Model for the Project

4.15.3.5. Plant and Workshop Viewshed Analysis

Figure 4-78 shows the viewshed model result for the plant and workshop facility. The area of potential visual exposure is measured at 111.9 km^2, which accounts for approximately 7.7% of the ZVI area. The small area of visual exposure is due primarily to the screening effect of the topography.

The plant and workshop facility is also located along the sides of a hill stretching down into a valley. Therefore it will not be visible to receptors on the other side of the hill. Only receptors located on the surrounding larger hills and within the valley will be visually exposed to the plant and workshop facility.

For the areas that are visible, refer to Figure 4-78. Observed results indicate that visibility decreases as you move away from the plant and workshop facility, with visibility being highest within 5 km of the Project area as well as within the Project area.

The only protected area within the ZVI is the Maragoli Forest Reserve and the model results suggest that the proposed Plant and Workshop facility will not be visible to the protected area.

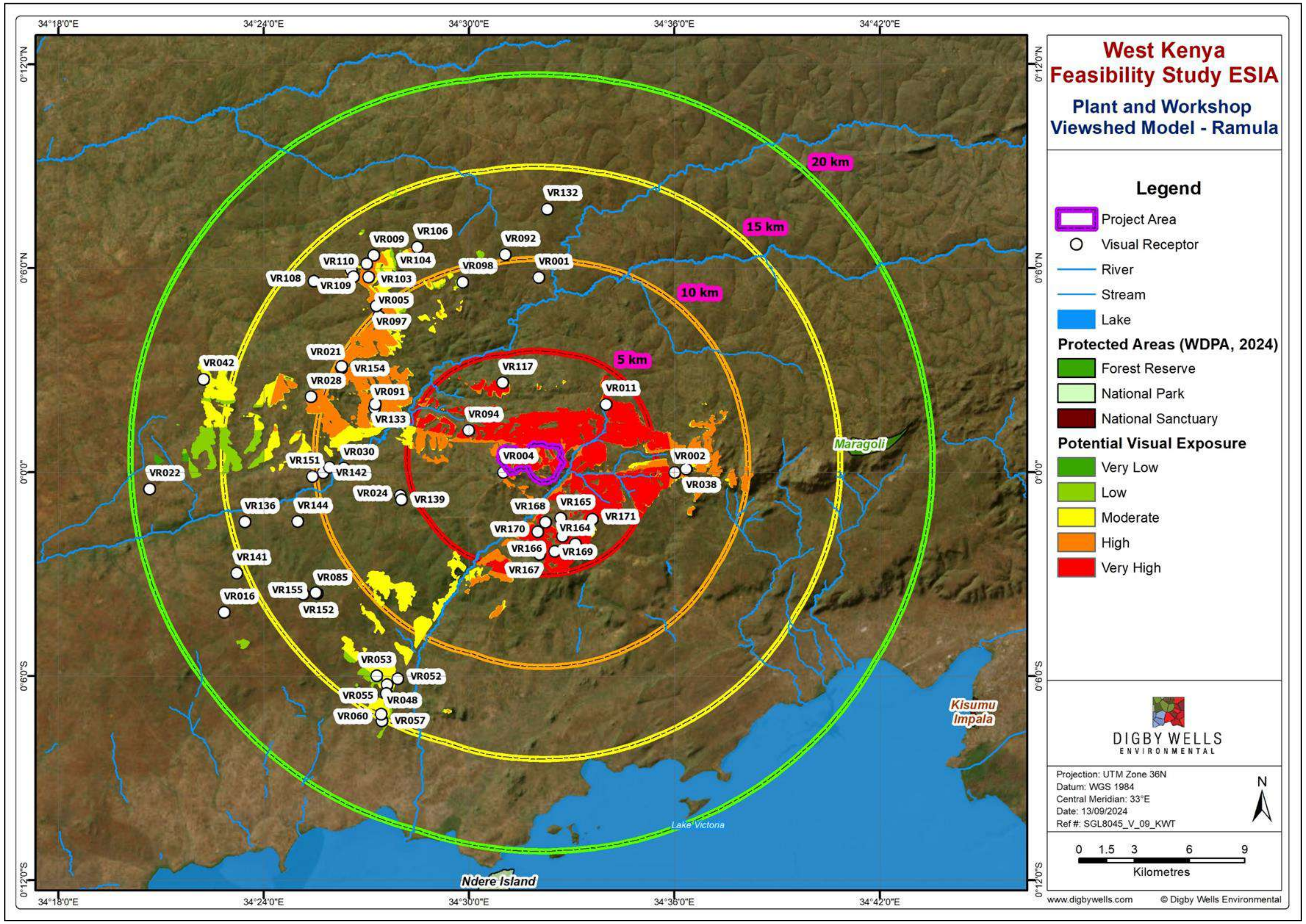


Figure 4-78: Plant and Workshop Viewshed Model for the Project

4.15.3.6. Admin and Support Infrastructure Viewshed Analysis

Figure 4-79 shows the viewshed model result for the admin and support infrastructure. The area of potential visual exposure is measured at 6.0 km^2, which accounts for approximately 0.4% of the ZVI area. The small area of visual exposure is due primarily to the screening effect of the topography.

The admin and support infrastructure are also located along the sides of a hill stretching down into a valley. Therefore, it will not be visible to receptors on the other side of the hill. Only receptors located on the surrounding larger hills and within the valley will be visually exposed to the admin and support infrastructure.

For the areas that are visible, refer to Figure 4-79. Observed results indicate that visibility decreases as you move away from the plant and workshop facility, with visibility being highest within 5 km of the Project area.

The only protected area within the ZVI is the Maragoli Forest Reserve and the model results suggest that the proposed Admin and Support Infrastructure will not be visible to the protected area.

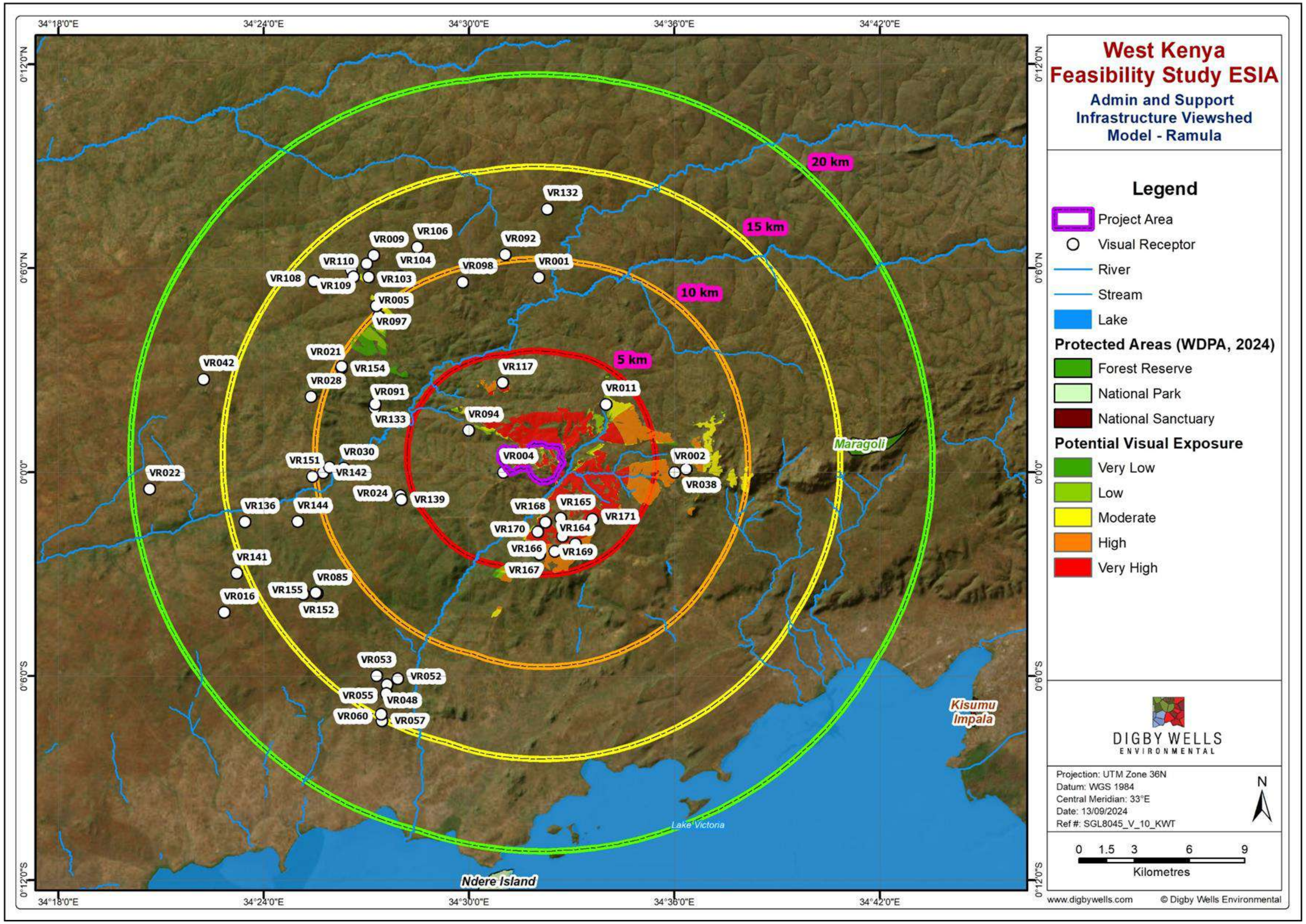


Figure 4-79: Admin and Support Infrastructure Viewshed Model for the Project

4.15.3.7. Visual Exposure of the Sensitive Visual Receptors

The results from the cumulative viewshed analysis (as depicted in Figure 4-74) indicates that of the 172 sensitive visual receptors identified only 55 receptors will be visually exposed to the Project-related infrastructure (refer to table). Therefore, the majority of the identified receptors will not be visually influenced by the Project. Of those influenced (as indicated in Table 4-48) by the Project related infrastructure:

- 16 receptors will experience very high visibility of Project related infrastructure;
- 11 receptors will experience high visibility;
- 24 receptors will experience moderate visibility;
- 4 receptors will experience low visibility; and
- The remaining 117 receptors will not be visually influenced by the Project.

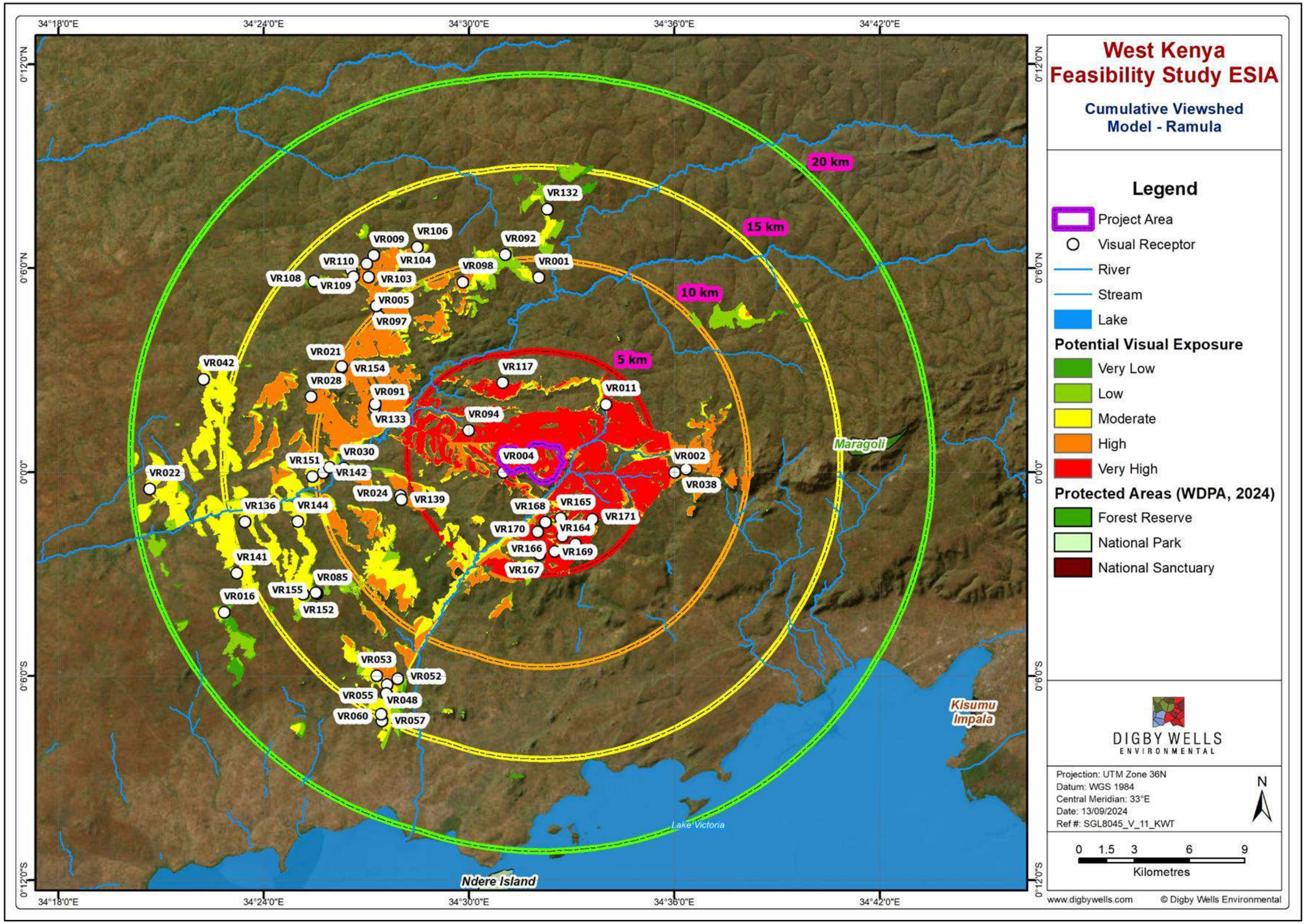


Figure 4-80: Cumulative Viewshed Model for the Project

Table 4-48: Identified Sensitive Receptors Anticipated Visibility of the Project

ID	Administration Class	Name	Receptor Code	Sensitivity of Receptor	Project infrastructure visible to receptor	Visibility of the Project area	Distance to Project Area (Km)
1	Town	Yala	VR001	High	Yes	Low	9.0
2	Village	Akala	VR085	High	Yes	Low	12.2
3	Village	Sirandu	VR104	High	Yes	Low	10.8
4	Village	Koywa	VR155	High	Yes	Low	12.3
5	Village	Nyangweso	VR005	High	Yes	Moderate	9.8
6	Village	Emmaloba	VR011	High	Yes	Moderate	3.4
7	Village	Ndori	VR016	High	Yes	Moderate	17.0
8	Village	K'ogelo	VR022	High	Yes	Moderate	19.0
9	Village	Rera	VR030	High	Yes	Moderate	8.4
10	Village	Ng'iya	VR042	High	Yes	Moderate	16.5
11	Village	Reru Market	VR047	High	Yes	Moderate	14.2
12	Village	Koyoo	VR048	High	Yes	Moderate	13.2
13	Village	Kaura	VR052	High	Yes	Moderate	12.7
14	Village	Kapudo	VR053	High	Yes	Moderate	13.1
15	Village	Kauka	VR055	High	Yes	Moderate	13.7
16	Village	Komolo	VR057	High	Yes	Moderate	15.1

ID	Administration Class	Name	Receptor Code	Sensitivity of Receptor	Project infrastructure visible to receptor	Visibility of the Project area	Distance to Project Area (Km)
17	Village	Kochienge	VR060	High	Yes	Moderate	14.8
18	Village	Bar Sauri	VR092	High	Yes	Moderate	10.3
19	Village	Ukaya	VR106	High	Yes	Moderate	11.8
20	Village	Ndagaria B	VR108	High	Yes	Moderate	13.6
21	Village	Anyiko	VR132	High	Yes	Moderate	12.7
22	Village	Konyango B	VR136	High	Yes	Moderate	14.2
23	Village	Kabura B2	VR141	High	Yes	Moderate	15.5
24	Village	Kotoo C	VR142	High	Yes	Moderate	9.6
25	Village	Kasiwa	VR144	High	Yes	Moderate	11.4
26	Village	Kotoo B	VR151	High	Yes	Moderate	10.2
27	Village	Akala D	VR152	High	Yes	Moderate	12.9
28	Village	Kanyilaji A	VR153	High	Yes	Moderate	9.2
29	Village	Siriba	VR002	High	Yes	High	6.0
30	Village	Kodiaga	VR009	High	Yes	High	12.6
31	Village	Wagai	VR021	High	Yes	High	9.7
32	Village	Aluor	VR024	High	Yes	High	5.7
33	Village	Komouk	VR028	High	Yes	High	10.6

ID	Administration Class	Name	Receptor Code	Sensitivity of Receptor	Project infrastructure visible to receptor	Visibility of the Project area	Distance to Project Area (Km)
34	Town	Maseno	VR038	High	Yes	High	6.7
35	Village	Masogo	VR097	High	Yes	High	10.3
36	Village	Rawalo	VR098	High	Yes	High	9.2
37	Village	Usuha	VR103	High	Yes	High	11.8
38	Village	Kakech	VR109	High	Yes	High	12.7
39	Village	Ngolo	VR110	High	Yes	High	12.4
40	Village	Nyangera	VR128	High	Yes	High	12.3
41	Village	Osir	VR139	High	Yes	High	5.7
42	Village	Ginga A	VR154	High	Yes	High	9.7
43	Village	Karabala B	VR164	High	Yes	High	3.7
44	Village	Ojwero	VR165	High	Yes	High	2.1
45	Village	Ramula	VR004	High	Yes	Very High	0.2
46	Village	Uriri	VR091	High	Yes	Very High	7.2
47	Village	Onding	VR094	High	Yes	Very High	2.0
48	Village	Mahanga A	VR117	High	Yes	Very High	3.5
49	Village	Upper Central Unit	VR133	High	Yes	Very High	7.2
50	Village	Kosanjo A East	VR166	High	Yes	Very High	3.8

ID	Administration Class	Name	Receptor Code	Sensitivity of Receptor	Project infrastructure visible to receptor	Visibility of the Project area	Distance to Project Area (Km)
51	Village	Kosanjo B West	VR167	High	Yes	Very High	3.9
52	Village	Kosanjo B	VR168	High	Yes	Very High	2.2
53	Village	Nduta	VR169	High	Yes	Very High	3.1
54	Village	Nyamor	VR170	High	Yes	Very High	2.7
55	Village	Urudi A	VR171	High	Yes	Very High	3.0

4.16. Cultural Heritage

A Heritage Impact Assessment (HIA) was conducted as part of this EIA process and is included in Appendix P.

This Section details the observations relating to cultural heritage sites and features made during the site visit which was undertaken between the 28 May and the 01 June 2024. It also provides an overview of information gained from stakeholder engagement sessions (Figure 4-81), regarding the cultural issues linked to the planned mining and related activities in the Project area.

Focus Group Discussion

Key Informant Interview

Figure 4-81: Stakeholder Engagement Sessions

The Project area is inhabited by communities living in the following villages including Naya, Obwanda A, Obwanda B, Siandha A, and Siandha B, Nyangulu on the Siaya side and Munungo and Esitsimi on the Vihiga side. The majority of the area is comprised of homesteads, agricultural lands and mining-related development. Figure 4-82 below shows the Project area where the pit is proposed to be located.

Project area next to the Ramula pit

Topographic view of the area opposing the planned Ramula Pit

Back view of the proposed Ramula Pit footprint

Front view of the proposed Ramula Pit footprint

Figure 4-82: Proposed Ramula Pit

4.16.1. Social Aspects

According to stakeholders, large-scale projects risk disrupting the community's social harmony as there is a possibility of an influx of people leading to cultural admixture (dilution) with increased accessibility of the area. Informants pointed out that over the years, mining has had negative cultural ramifications for the people of Ramula. These include the loss of farmlands, displacements from ancestral homes, resettlements, and the introduction of deviant behaviours. Mining has attracted miners from the neighbouring counties including Bungoma, Kisii, Busia, Kakamega, Vihiga, Kisumu and Homa Bay among others. The increase in migration has led to increased community conflicts and tension.

The community is also concerned about externally driven investments and alternative land for their settlement and livelihood. The project is expected to lead to the displacement of the community from their ancestral land which has several consequences including inaccessibility to certain traditionally valued resources. One of the most valued resources are indigenous trees. There are specific trees grown in homesteads which are highly regarded and considered sacred. These trees provide shade and in most homes are used by men to host other men as they discuss community issues. These trees are used during prayers to bring rain besides having medicinal value. In case one cuts down such trees accidentally, a sacrifice is required to cleanse the culprit and appease the dead. When men inherit land, they are to ensure such trees planted by their fathers in the homestead are not cut down. These sacred trees are Ngou, Keyo, Yuello, Bondo, Mrembe and Obeyo.

4.16.2. Cultural Heritage Features

Some intangible heritage aspects are present among the communities and relate to burial practices, locally referred to as *tero buru*. The Luo, like many African communities, believe in ongoing relations between the living and their dead. They conceptualise death as a transition - or rite of passage - and this belief evidently shows in how they fear and respect the dead and their ancestors. Cultural ties underpin the way people perceive and think about death, burial and life after death (SALGA, 2016).

The Luo have remained loyal to the conventional burial practices which involve the interring of the deceased in graves, and have elaborate death rituals or burial rites which must be fulfilled at death and over several years after burial. It is believed that a dead person has the ability to ‘see everything’ and serve as a cultural resource, watching over and guiding the living. Funerals take place at home, in communal ceremonies, followed by burial in culturally determined sites depending on one’s position in the family, age, and gender. Elderly persons are buried with their heads facing west, the direction the Luo are believed to have migrated from. Graves are marked by planting Siala, an indigenous tree.

Over the years, communities have adopted contemporary ways of marking graves which includes headstones but there remains a risk of finding unmarked graves during the Project’s construction phase.

These graves consequently are important cultural spaces that are consulted in times of misfortune. The "right" burial ensures that the ancestor doesn't remain to haunt and exert power over the living, but instead rests in peace and protects the family. According to local elders, a grave is best protected by preservation in its place, since removal is likely to result in irreparable damage or destruction of the society. Most members of the community believe graves cannot be moved under any circumstances.

According to them, there are no technically or financially feasible alternatives to warrant removal or interference with graves – particularly those of elders. If the deceased are disturbed, their ghosts can remain as a part of the world of the living and wander around and cause harm. The harm was explained to include experiencing bad dreams and nightmares, haunting of family members, and health problems such as mental issues. According to stakeholders, it is considered equivalent to killing the entire community.

Some members of the community had differing opinions on the relocation of graves. In their opinion, if the overall benefit of the Project conclusively outweighs the anticipated cultural heritage loss, then it is possible to consider their movement under certain conditions. In inevitable cases where graves have to be relocated or are disturbed accidentally, sacrifices and rituals have to be made.

4.16.2.1. Tero Buru sites

This Luo tradition involves escorting or chasing away the spirits of the dead from the deceased’s homestead. Mourners take cattle to the homestead of the deceased early in the morning and prepare for the journey. A rooster or hen is killed without using a knife and meat shared between the male members who form part of the mourners escorting the spirits. Participants blow buffalo horns *(oporo)* and beat drums (*bul) as* the cattle are driven towards the river with the dust left behind expected to symbolise the spirits of the dead being blown off.

There is a specific place within Ramula where Tero Buru is performed which requires protection for community use as well as for heritage preservation. This cultural heritage is best protected by preservation in its place, since removal is likely to result in irreparable damage or destruction of the cultural heritage.

4.16.3. Identified Heritage Sites and Observations

A total of 24 tangible heritage observations (see Table 4-49) were identified through stakeholder engagement sessions, which were then classified into three groups, namely Places of Worship, Burial Grounds and Graves (BGGs) and Sacred Sites. While the locals did not disclose the locations of these sites, the presence of these heritage observations within the area of planned development means social consultation will be required to agree upon mitigation measures and to formulate a Culture Heritage Management Plan (CHMP).

Table 4-49: Heritage Observations in the Project Area

Village	Burial Grounds and Graves	Places of Worship	Sacred Sites	TOTAL
Naya	4	5	0	9
Obwanda A	0	3	1	4
Obwanda B	0	4	0	4
Siandha A	0	3	0	3
Siandha B	0	2	2	4
TOTAL	4	17	3	24

4.17. Human Rights Assessment

A Human Right Impact Assessment (HRIA) was conducted as part of this ESIA process and is included in Appendix Q.

A Human Rights Impact Assessment (HRIA) is required to identify and assess actual and potential human rights impacts and risks. Therefore, this report outlines the methodology, approach to the tasks, findings of the human rights assessment, existing management measures, and recommendations for improvements.

In conducting the HRIA, the consultancy team used the UN Guiding Principles on Business and Human Rights (UNGPs) as both the approach to the work and the methodology for carrying out the due diligence. The instruments used to determine what constitutes human rights included the UN Declaration on Human Rights, the International Bill of Human Rights and the International Labour Organisation's Declaration on Fundamental Principles and Rights at Work.

Key human rights issues were identified in relation to the Project, and these include physical and/or economic displacement, water and ecosystems services, artisanal mining, employment, and gender.

4.18. Critical Habitat

Critical Habitat Assessment (CHA) was conducted as part of this ESIA process and is included in Appendix R.

The proposed Project is located in the Lake Victoria Forest-Savanna ecoregion (a type of biodiversity unit classification) - directly east of Lake Victoria, but there are no protected areas or Key Biodiversity Areas (KBAs) in the immediate vicinity. Specialists have noted that the area is modified with notable agriculture present.

4.18.1. Defining the Area of Influence and Ecologically Appropriate Area of Analysis

To assess the significance of the associated potential biodiversity-related sensitivities, it is important to define the ecologically appropriate boundaries of the study area to contextualise the scale of the overall project.

For the purposes of the assessment, the Project Area of Influence (AoI) was defined by a 500 m buffer around the proposed infrastructure layout. This was intended to account for 'edge effects' relating to ecological disturbances and the area that is anticipated to be impacted by the Project (i.e. direct footprint).

Additionally, multiple Ecologically Appropriate Areas of Analysis (EAAA) were identified in consideration of the biodiversity across freshwater and terrestrial ecosystems, as well as the expected species' movement and habitat needs. Three EAAAs were identified, including:

- An EAAA catering for terrestrial fauna within the region (EAAA 1 = 1 539.85 km^2),
- An EAAA catering for terrestrial flora (EAAA 2 = 52.20 km^2), and
- An EAAA considering the potential freshwater biodiversity (EAAA 3 = 967.46 km^2).

4.18.2. Natural and Modified Habitat

The Project's AoI comprises several aquatic and terrestrial habitat types that were delineated through vegetation mapping from specialist studies and through the use of remote sensing data.

The entirety of the Project AoI, 11.68 km^2, is identified as containing *modified* habitat. While no natural habitat was identified, different habitat types were identified as having varying degrees of habitat modification. For example, specialists note that the riverine habitat still holds more functionality than other habitats, as it acts as a potential movement corridor for terrestrial species. Although there are no explicit project requirements in terms of management obligations towards *modified habitat*, it is recommended that management mitigate any impact on these habitats to ensure that some ecological functionality is retained and to conserve and enhance the remnant habitat, biodiversity and ecosystem services.

4.18.3. Critical Habitat Assessment

Although threatened and migratory species were identified, these species did not trigger Criteria 1 and 3, while the threatened status of the terrestrial ecoregion did not meet the thresholds of Criterion 4. Specialists did not identify any possible triggers for Criterion 5. Therefore, no critical habitat was identified in the Project AoI

4.19. Ecosystem Services

Ecosystem Services Assessment (ESA) was conducted as part of this ESIA process and is included in Appendix S.

ESA has been undertaken to ensure alignment with the requirements of the International Finance Corporation (IFC) Performance Standard 6 (PS6) which requires projects to preserve the benefits from ecosystem services that communities depend on and that the project may adversely impact (Type I); and that the environmental and social risks and impact identification process considers a project's dependence on ecosystem services (Type II).

A six-step approach was followed to undertake the Ecosystem Services Assessment. First, a list of relevant ecosystem services was compiled through Focus Group Discussions (FGDs) and a socio-economic survey with local communities and through a review of background documentation. Second, these services were prioritized using IFC PS6 criteria. Third, baseline information was summarized for the ecosystem services and underlying ecosystems from which they flow. Fourth, Project impacts and dependencies were assessed throughout the Life of Mine. Finally, an Ecosystem Services Management Plan was developed.

The following priority ecosystem services were identified for which significant impacts would adversely affect communities and/or Project operations:

- Air quality regulation: The Project's activities will likely degrade air quality, affecting community health and operational conditions;
- Building materials: The Project's use of local building materials may deplete resources available to communities;
- Cultural services: The Project could restrict access to community cultural sites and practices. Sacred sites were identified during stakeholder engagement, but communities did not disclose the locations of these. The Project depends on maintaining these services for a social license to operate;
- Food supply: The Project's infrastructure and water use could disrupt existing agricultural lands, reducing food supply for communities, and impacts from soil erosion and invasive species spread risk limiting future agricultural opportunities particularly in a region already under pressure from artisanal and small-scale mining and population growth;
- Raw materials: Gold: The Project's dependence on gold may conflict with local artisanal mining activities, impacting community livelihoods;

- Soil erosion and flood control: Vegetation clearance, construction, and operational activities are likely to increase erosion and flood risks, affecting soil quality and agriculture;
- Water supply: While the Project's source of water does not conflict with existing community sources, its high-water demand and hydrological alterations could exacerbate local water scarcity, decrease groundwater level within the zone of influence, and compete with community needs; and
- Water quality regulation: Project activities may impair wetland functions, worsening already poor water quality for local communities.

4.20. Blasting and Vibration

Blasting and Vibration Assessment was conducted as part of this ESIA process and is included in Appendix T.

Blasting and Vibration Assessment is for the planned blasting activities during the operational phases of the blasting activity at the Ramula Pit. This pit is located within a relatively high concentration of houses and infrastructure in the town of Ramula- Mwibona.

The assessment based on mining 10 m benches using 140 mm diameter holes in waste and 5 m benches using 115 mm holes in ore. The larger 140 mm hole diameters will dominate the blasting impact and most of the impact study is therefore based on the use of 140 mm holes on 10 m benches. Presplitting will be needed in the pit, and this aspect of blasting will have the highest significance ratings on air blast and fly rock. The aspects related to blasting that were investigated include ground vibration, air vibration (referred to as air blast in this report), and fly rock.

There are permanent communities within the proposed mine fence line that will be affected by ground vibration, air blast, and fly rock aspects of blasting. It is assumed these people will be relocated but that houses and people beyond the proposed mine fence line will not be moved.

Blasting and associated aspects (including air blast, fly rock, and fumes) will result in a medium-high negative impact significance on the neighbouring communities, houses, roads, and infrastructure within 1000 m of blasting operations. There is a low impact significance for Ground Vibration for people and structures outside the mine fence line.

4.21. Climate Change Risk and Vulnerability Assessment and Greenhous Gas Estimation

Climate Change Risk and Vulnerability Assessment and Greenhouse Gas Estimation was conducted as part of this ESIA process and is included in Appendix U.

This Climate Change Risk and Vulnerability Assessment considers the climate change risks that the Project is projected to be exposed to as well as the Project's contribution to climate change. The former explores the potential climate-related risks identified through a CCRVA, while the latter calculates the estimated Greenhouse Gases (GHG) associated with the Project.

The Project's GHG emissions were estimated for scope 1 and scope 2 emissions. It is estimated to contribute an average of 37,700 tCO_2e emissions per year, or 339,500 tCO_2e emissions across the 9-year operational life. The project's annual emissions contribute approximately 0.2% to the national annual emissions.

The Intergovernmental Panel on Climate Change (IPCC) stated in the Sixth Assessment Report (AR6) that the continuous release of GHG emissions into the atmosphere will lead to increased global temperatures that will exceed 1.5°C above pre-industrial levels by the middle of the century 2100 (IPCC, 2022b).

The IPCC's SSP5-8.5[13] projections show that annual precipitation will increase, and flood hazards will become increasingly more intense. There will also be a decrease in both the length and duration of drought periods. Annual temperatures in the region will increase by approximately 0.58°C over the life-of-mine (LoM), and the number of hot days[14] will double to ~7 days per year. Overall, the frequency and severity of extreme weather events and wildfires are also projected to increase.

Given the climate time lag and uncertainty, climate projections and risks need to be continuously monitored, reviewed, and updated to ensure mitigation and adaptation measures align with changing risks. Provision also needs to be made to account for future changes in physical risk.

The implementation of the recommendations will not necessarily eliminate the identified climate risks but will reduce the impact of and bolster resilience to climate change risks and hazards. Increased climate resilience will protect employees and infrastructure, improve operational efficiencies, and promote sustainable and continuous value creation for stakeholders. Furthermore, effectively responding to identified climate risks illustrates good corporate governance. Acknowledging potential climate change impacts, when paired with proactive steps to manage risks, helps to ensure transparency and accountability.

[13] Shared Socio-economic Pathways (SSPs) represent different potential emissions scenarios in relation to different global climate change responses. SSP5-8.5 represents a 'worst-case scenario' outlook that considers a very weak global response to reducing emissions and can be used to highlight the most prominent risks from climate change.
[14] Days with maximum temperatures > 30°C

5. Description of the Socio-economic Environment

Whilst there is a broader socio-economic environment for the Shanta Gold West Kenya Project, this section encompasses the Kenya as the regional area, Vihiga and Siaya Counties as the secondary study area, and the PACs as the primary study area. A Social Impact Assessment (SIA) was conducted as part of this EIA process and is included in Appendix U.

5.1. Overview of the Regional Study Area

The Ramula-Mwibona Project is located in Kenya, a country in East Africa along the coastline of the Indian Ocean. Table 5-1 provides an overview of the socio-economic baseline characteristics of Kenya.

5.1.1. Administrative Structure and Governance

Kenya is divided into 47 counties, each led by an elected governor who acts as the principal representative of the county government. The governor is supported by the County Executive Committee, which oversees various county departments. Additionally, each county has a county assembly composed of elected Members of the County Assembly (MCAs), responsible for enacting legislation, approving budgets, and overseeing the county executive[15].

Counties are further subdivided into sub-counties, each managed by a sub-county administrator appointed by the county government. These sub-counties are further divided into wards, the smallest administrative units, each represented by an elected member of the MCAs. Wards/locations are subdivided into sub-locations, which are administered by chiefs, facilitating grassroots administration and delivery of public services. This structured administrative hierarchy ensures effective governance and service delivery from the national to the local level (ibid.).

Table 5-1: Summary of Socio-Economic Indicators for the Regional Study Area

Indicators	Statistics	Source
Population size (Census 2019)	47,564,296	Kenya National Bureau of Statistics (KNBS), 2019
Population growth rate (Census 2019)	2.2%	Kenya National Bureau of Statistics (KNBS), 2019
Population distribution	Rural - 32,732,596 Urban - 14,831,700 Rural: 68.9%, Urban: 31.1%	Kenya National Bureau of Statistics (KNBS), 2019
Gender distribution	Male - 23,548,056 (49.5%) Female - 24,014,716 (50.5% Intersex – 1,524 (0.003%)	Kenya National Bureau of Statistics (KNBS), 2019

[15] The Government of the Republic of Kenya, 2024

Indicators	Statistics	Source
Number of households (Census 2019)	12,143,913	Kenya National Bureau of Statistics (KNBS), 2019
Average household size (Census 2022)	3.7	Kenya Demographic and Health Survey (KDHS) Summary Report, 2022
Main economic activities (% contribution to GDP) (2020)	Agriculture sector accounting for 23% of the total value of the economy in 2020.	Kenya Economic Survey, 2021
Labour force (Q4 2021)	66.1%	KNBS-Quarterly Labour Force Report, 2021 (Q4)
Employment number (Q 4 2021)	62.4%	KNBS-Quarterly Labor Force Report, 2021 (Q4)
Employment gender split (Q4 2021)	62.4%	KNBS-Quarterly Labor Force Report, 2021 (Q4)
Unemployment % of labour force (Q 4 2021)	5.6%	KNBS-Quarterly Labour Force Report, 2021 (Q4)
Youth employment (Q 4 2021) % of total employment	78.5%	KNBS-Quarterly Labour Force Report, 2021 (Q4)

Source: KNBS 2019 and 2022

5.2. Description of the Socio-Economic Conditions of the Secondary Study and Primary Study Areas

The project is located across two counties, Vihiga and Siaya. These fall in the secondary study area. The primary study area comprises the sub-counties and project affected communities (PACs) and these include:

- Siandha A;
- Siandha B;
- Naya;
- Obwanda A;
- Obwanda B;
- Odundo;
- Nyangulu B
- Munungo; and
- Esitimi A.

5.2.1. Political Administrative and Economic Context

Vihiga County

Vihiga County is one of the four counties with its headquarters located in Mbale Town. It is situated in the Lake Victoria Basin in the Western Kenya Region. The county borders Nandi County to the east, Kisumu County to the south, Siaya County to the west and Kakamega County to the North and covers an area of 563.7 km^2 (Vihiga CIDP 2023-2027).

Vihiga is home to different communities originating from diverse parts of Kenya. The four major Indigenous sub-tribes are the Maragoli, Banyore, Tiriki and the Terik. The Maragoli are believed to be the largest sub-tribe, residing mainly in the Sabatia, Vihiga, and Hamisi sub-counties. The Tiriki and the Terik are found in Hamisi Sub-County, whilst the Banyore reside in Luanda and Emuhaya sub-counties. Vihiga County is also inhabited by other communities originating from diverse parts of Kenya (ibid.).

Administratively, Vihiga County is divided into five sub-counties namely, Hamisi, Emuhaya, Luanda, Sabatia and Vihiga. The county is further subdivided into 25 wards, 41 locations, and 140 sub-locations. As illustrated in Table 5-2, Hamisi Sub-County is the most expansive with an area of 188.9 km^2, Sabatia 110.9 km^2, Vihiga 90.2 km^2, Emuhaya 89.5 km^2, and Luanda at 84 km^2 (ibid.)

Table 5-2: Vihiga County Administrative Structure

Sub-County/Constituency	Wards	Locations	Sub-Locations	Area (Km^2)
Hamisi	7	11	37	188.9
Sabatia	6	8	31	110.9
Vihiga	4	5	18	90.2
Emuhaya	3	7	25	89.5
Luanda+	5	10	29	84
Total	25	41	140	563.7

Source: Vihiga CIDP, 2023-2027

The county's major economic activities include cottage industries, small scale subsistence farming, tea farming, wholesale and retail trade, as well as quarrying and mining. Vihiga County is a member of Lake Region Economic Bloc (LREB) comprising 13 other counties. These include Kisumu, Migori, Homabay, Nyamira, Kisii, Siaya, Bungoma, Kakamega, Vihiga, Busia, Bomet, Trans-Nzoia and Kericho.

The Project area is in Luanda Sub-County, covering a total area of 84.3 km^2. The Sub-County consists of five wards: Ekuanda Township, Luanda South, Emabungo, Mwibona and Wemilabi. The Project lies within Mwibona Ward, in Munungo village.

Siaya County

Siaya County is one of the 47 counties established under the Constitution of Kenya, 2010. There are six sub counties and thirty wards, with the county headquarters located in Siaya Town, and sub-county headquarters located in Yala, Bondo, Aram, Ukwala and Ugunja. Covering approximately 2,530 km^2 of land, the county borders Busia County to the northwest, Vihiga and Kakamega counties to the northeast, Kisumu County to the southeast, and Homa Bay County across the Winam Gulf to the south (Siaya CIDP 2023-2027).

The county comprises six sub-counties, thirty wards, and ninety-eight villages. Alego Usonga is the largest sub-county out of the six with an approximate area of 605.8 km^2, whilst Ugunja is the smallest with an approximate area of 200.9 km^2. These administrative units form the service delivery points for county government services, projects, and programmes (ibid.).

The county also comprises six constituencies that align with the sub-counties, each having a designated number of wards: Alego Usonga (Siaya), Bondo, and Gem (administratively split into Gem Wagai and Gem Yala) have six wards each; Rarieda has five; Ugenya has four; and Ugunja has three wards (ibid.) as outlined in Table 5-3.

Table 5-3: Siaya County Administrative Structure

Sub-County	Division/Wards	Locations	Sub-Locations	Villages
Siaya/Alego Usonga	6	10	42	22
Gem (Yala and Wagai)	6	9	39	16
Ugenya	4	9	28	14
Ugunja	3	7	21	11
Bondo	6	11	26	21
Rarieda	5	8	23	14
Total	**30**	**54**	**179**	**98**

Source: Siaya CIDP, 2023-2027

The county is predominantly inhabited by the Luo Community with minority communities such as Luhya and Basabe commonly found in the border points. Emerging communities such as the Maasai, Somalis and Kisii (among others) have immigrated into the county after decentralization. The majority of the residents are Christians with Islam and other African traditional denominations also being practiced.

The main economic activity is agriculture comprising crop and livestock production, as well as fishing. Crop and livestock production in the area is largely for subsistence with a key focus on maize, beans, cassava, finger millet, sweet potatoes, bananas, tomatoes, sorghum, cattle, sheep, goats, and chicken. Other economic activities include Small, Micro and Medium

Enterprises (SMMEs), such as *boda boda*[16], *jua kali*,[17] groceries, transport, and retail stores. The county also hosts two light industries that produce oxygen and construction materials (nails, chain link fence). The county has potential in irrigation agriculture, ranching, fish processing, apiculture, textile industry and tourism.

The Project area is in Gem Sub-County, which is administratively divided into Gem Wagai and Gem Yala. Covering a total area of 405.0 km^2, the sub-county consists of six wards: North Gem, South Gem, East Gem, Central Gem, Yala Township, and West Gem. The Project lies within the East Gem Ward, which spans 71.9 km^2 and includes three sub-locations, with Ramula being the primary sub-location of interest.

5.2.2. Demographic Characteristics

This section provides the demographic characteristics for Vihiga and Siaya Counties, Gem and Luanda sub-counties, as well as direct PACs. These include:

- Population
- Gender Distribution
- Age Distribution

5.2.2.1. Population

Vihiga County

According to the KNBS Census (2019), Vihiga has a population of 590,013, reflecting an increase of approximately 1.5% compared to 2009 (554,622). This population accounts for about 1.23% of Kenya's total population. The population is projected to reach 634,074 by 2027 (ibid.). The population density of the county is estimated to be 1,085 persons per km^2.

Vihiga County has a relatively youthful demographic. Specifically, the age group 10-14 years constitutes the highest population of 87,659 individuals, representing 14.9% of the total population in 2019, while the age group 75–79 years has the lowest population, with 7,324 people, accounting for 1.24%. The county is further characterised by an average household size of 4.1 people, which is higher compared to the national level (3.9). The county has a total of 143,365 households (ibid.).

Luanda Sub-Country, is one of five sub-counties within Vihiga County, had a population in 2019 of 106,694 (18% of Vihiga County) (KNBS, 2019). The population of Luanda was projected to increase to 109,591 (2.7%) in 2022, 112,611 (5.6%) in 2025 and 114,660 (7.5%) in 2027.

[16] Boda boda refers to motorcycle taxis that are a popular and affordable means of transportation in Kenya and other East African countries. They are often used for short-distance travel within towns, cities, and rural areas. They are a significant source of employment for many young people and play a crucial role in the local transport economy.

[17] Jua Kali literally translates to "hot sun" in Swahili and is used to describe the informal sector of the economy, particularly those engaged in small-scale, often manual, and unregulated businesses. The jua kali sector includes a wide range of activities, such as metalworking, carpentry, mechanics, tailoring, and other trades. These businesses are typically characterized by their flexibility, creativity, and resilience, operating without formal employment contracts or extensive government regulation.

Siaya County

According to the KNBS Census (2019), the population in Siaya County was 993,183 in 2019, representing 2.08% of the Kenyan population. This marks a slight increase from 842,304 in 2009, with an approximate 1.7% annual population growth rate. The population was projected to increase to 1,040,616 in 2022 and 1,097,141 in 2025 (ibid.).

Siaya County has a predominantly youthful population, this is supplemented by the KNBS data of 2019 which shows that over 57.1% of the total population in Siaya county fall under the age of 15-65 years and that 38.1% are of the group 0-14 years whilst only 4.8% of the population fall under the age group of 65+ years. In 2019, the county had an average of 3.9 people/household and comprised approximately 250,698 households (KNBS, 2019). According to the 2019 KNBS, Gem Sub-County, one of the six sub-counties within Siaya County, has a population of 179,792 (18% of Siaya County). Within Gem Sub-County, East Gem Location has a total population of 18,992 (10.5% of the sub-county) (KNBS, 2019). The population was projected to increase to 188,379 in 2022 and 198,611 by 2025.

Gem Sub-County consists of a broader area encompassing several sub-locations, including Ramula Sub-Location, which is the specific focus of the Project. Ramula Sub-Location has a population of 8,172. This is approximately 43% of the sub-county and 0.8% of Siaya County.

The survey data revealed that Siandha B is the most populous village with 801 people (0.12% of the sub-county and 2.67% of the Ramula sub-location). The least populated village is Odundo A with 88 people (0.01% of the sub-county and 0.26% of the Ramula sub-location).

As shown in Table 5-4 all the six direct PACs are situated within the project's immediate area of influence, where the project infrastructure will be established.

Table 5-4: Direct PACs Population

Villages	Population	% Population	% Population of Sub- County	% Population of Ramula Sub-location
Siandha B	818	25.0	0.12	2.67
Siandha A	762	23.3	0.11	2.33
Naya	578	17.7	0.10	2.25
Obwanda A	557	17.7	0.08	1.86
Obwanda B	467	14.3	0.06	1.51
Odundo A	88	2.7	0.01	0.26
Total	3270	100	0.48	10.9

Source: Panafcon Household Survey, 2024

Implications

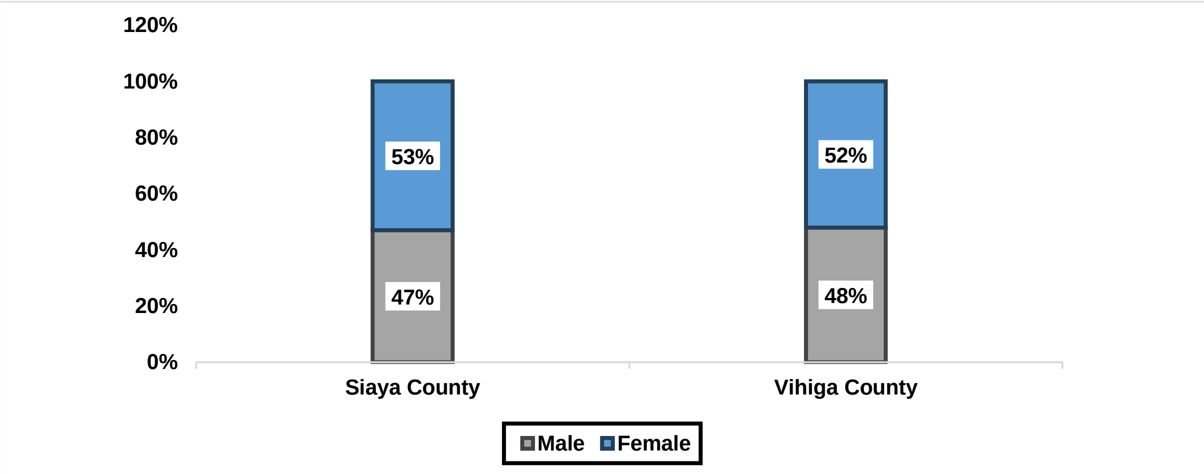
The data indicates an increase in population in the indirect PACs. An increase in population is due to several contributing factors that include high fertility and low mortality rate, and in-migration. A high child fertility rate is prevalent in Kenya, as well as in the Project Social AoI, despite government efforts to promote family planning and provide contraceptive programmes as preventative measures.

In terms of population figures, the data illustrates that around 10.9% of the sub-location's population is directly affected by the Project (villages which are closest to the Project site). Although these villages represent only 0.08% of Siaya County's total population, their concentration within the Project area means that any Project socio-economic impacts could disrupt livelihood activities. An indication of population movements and influx could not be confirmed, as the project remains in its early phase. However, it is possible that the area will experience an influx in anticipation of potential socio-economic benefits from the project. There could be cases of people encroaching on the project site or viewing the area as desirable due to expected development.

With a population growth projection indicating increased demand for resources and services, any potential in-migration resulting from the Project could put additional strain on local infrastructure and services. Vihiga County will need effective planning and management to address potential increases in population and resource demand, ensuring that benefits are maximised and negative impacts are mitigated.

5.2.2.2. Gender Distribution

Figure 5-1 provides the gender profiles for the two counties. As shown, the KNBS Population and Housing Census (2019) outlines that most of the Siaya County population (53%) is dominated by females. This represents a male-to-female ratio of 1:1.13. Vihiga County is also dominated by females accounting for 52% of its population. For Luanda Sub-County, this gender profile ratio is 1:1.0 (ibid.). This data is aligned with the male-to- female ratio for the country, which is 1:1.13 (ibid.).



Source: KNBS, 2019

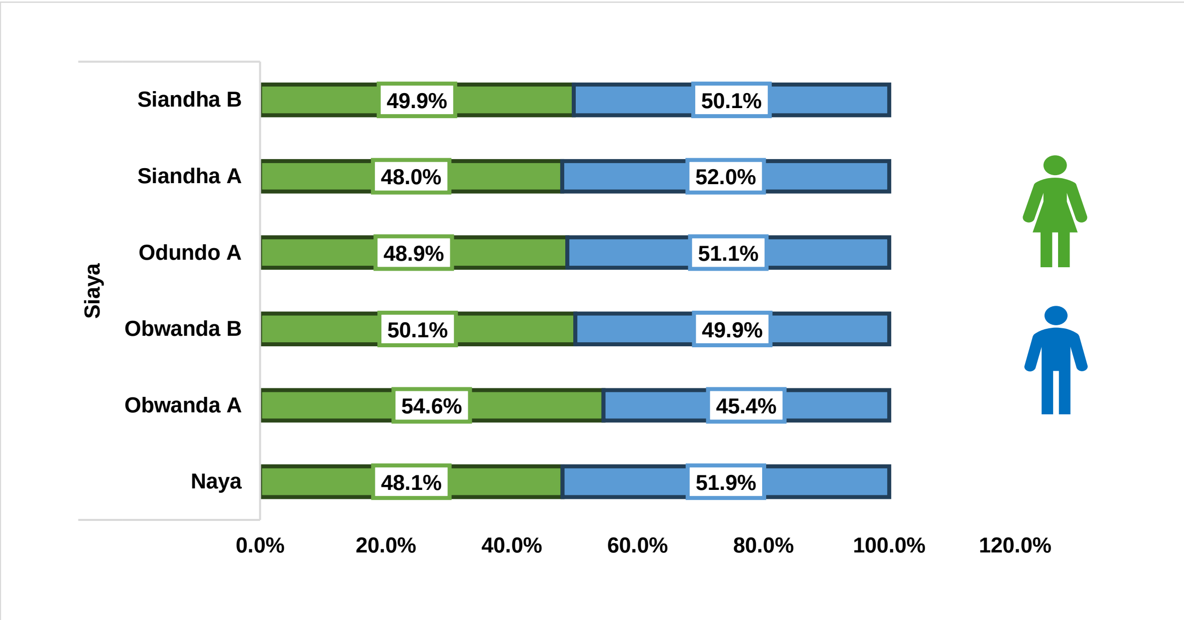
Figure 5-1: County Level Gender Distribution

In Gem Sub-County within Siaya County, females represent 52% of the population; this equates to a male-to-female ratio of 1:1.10. According to KNBS (2019), in East Gem Location, 52.5% of the population comprise females (ratio: 1:1.11). This pattern is reflected in Ramula Sub-Location, where females also comprise 52% of the population.

Vihiga County is similarly dominated by females. This trend is also observed in its Luanda Sub-County, where females represent 52% and males 48% (ratio 1:1.08). In Mwibona Location and Munungo Sub-Location within Vihiga County, the gender distribution mirrors the broader county trend.

Within the Project's proximity, there are six PACs, Figure 5-2 provides the gender profiles for the direct PACs. The survey data indicates that direct PACs are mostly dominated by males compared to the indirect PACs in the generally affected counties and sub-counties, The male dominance can be notable in Siandha B, Siandha A, Odundo A, and Naya villages. However, this is different in Obwanda B and Obwanda A villages as there are more females than males. This equates to a male-to-female ratio of 3.24:1.

Figure 5-2 illustrates that Siandha A has the highest male-to-female ratio 6:1. The village with the most females is Obwanda A (54.6%) compared to other villages.



Source: Panafcon Household Survey, 2024

Figure 5-2: Direct PACs Gender Distribution

Implications

Siaya County, according to the 2019 KNBS Population and Housing Census, has a female majority, with women constituting 53% of the population. Similarly, Vihiga County has 52% females. This trend is consistent in Gem Sub-County and East Gem Location, as well as in Luanda Sub-County, Mwibona Location, and Munungo Sub-Location, where females make up approximately 52% of the population. However, the household survey in Ramula Sub-Location reveals a significant gender imbalance among the most direct PACs, being male. This suggests that mining activities could exacerbate the gender disparity, with males likely to dominate the workforce. Therefore, the project must incorporate gender-sensitive approaches in its planning and implementation to ensure equitable opportunities for both men and women. Mining activities and developments in Siaya and Vihiga Counties are likely to change the gender dynamics, seeing males becoming more dominant population. This is attributed to most males seeking employment opportunities in the mining sector owing to its physical demands.

5.2.2.3. Age Distribution

The KNBS Population and Housing Census (2019) provides information on the predominant age groups in Siaya County and Vihiga County. Most of the people in Siaya County (57.1%) are between the ages of 15-64, followed by 38.1% who are between the ages of 0-14 years. The age groups between the two counties are similar. The predominant age cohort in Vihiga County is between 15-64 (58.3%), and 33.5% for the 0-14 cohort as depicted in Table 5-5. The data indicates that both counties are characterised by a predominantly young population which is essential for the future and economic development of these regions.

Table 5-5: County-Level Age Distributions

Age Group	Siaya County	Vihiga County
0-14 years	38.1%	33.5%
15-64 years	57.1%	58.3%
65+ years	4.8%	8.2%

Source: KNBS, 2019

Youth is defined by the Kenya National Youth Policy (KNYP) of 2007 as people between the ages of 15-30 years. Using this definition, the socio-economic survey conducted reveals that the households in Ramula are predominantly youthful.

Table 5-6 illustrates that most of the population in the villages is relatively young, with an approximate average population of 55.3% between 15-64 years. This is then followed by a very young population between 0-4 years, that is probably in school with an average of 39.8%. Furthermore, there is a significant 4.9% of the elderly population that is over the age of 65 years. This trend aligns with the overall age population groups at the county level, where a significant number of the population is youthful.

Table 5-6: Direct PACs Age

Village	0-14 Years	15-64 Years	65+ Years
Naya	34.8%	58.7%	6.6%
Obwanda A	42.0%	52.4%	5.7%
Obwanda B	38.3%	55.7%	6.0%
Odundo A	39.8%	55.7%	4.5%
Siandha A	40.3%	56.4%	3.3%
Siandha B	42.3%	53.5%	4.2%

Source: Panafcon Household Survey, 2024

5.2.2.4. Marital Status

The majority of people within affected counties are single and have never married. Vihiga County had 63.5% of the population that have never been married, followed by monogamous marriages of about 29.1%. This was a similar trend in Siaya County, 61.8% of the population had never been married with 25.4% of monogamous marriages as depicted in Table 5-7.

Table 5-7: County-Level Marital Status

Couties	Single	Married Monogamous	Married Polygamous	Widowed	Divorced	Separated
Vihiga	63.5%	29.1%	1.4%	4.2%	0.5%	1.3%
Siaya	61.8%	25.4%	6.0%	5.9%	0.3%	0.7%

Source: KNBS, 2019

The survey data indicates that the direct PACs show different information on marital status. The majority of the population is married. As shown in Table 5-8, all affected villages are characterized by married people, Odundo A has the highest married population of 81.0% compared to other villages. Single people are the second highest population in the direct PACs, most are found in Obwanda B (29.2%).

Table 5-8: Direct PACs Marital Status

Village	Divorced	Married	Separated	Single	Widow	Widower
Naya	0.9%	69.2%	0.9%	19.7%	8.0%	1.2%
Obwanda A	1.5%	57.8%	1.9%	27.4%	10.4%	1.1%
Obwanda B	0.0%	63.1%	0.8%	29.2%	6.4%	0.4%

Odundo A	0.0%	81.0%	0.0%	14.3%	4.8%	0.0%
Siandha A	0.8%	64.3%	0.5%	27.2%	6.7%	0.5%
Siandha B	1.3%	66.7%	0.5%	21.8%	8.5%	1.3%

Source: Panafcon Household Survey, 2024

5.2.3. Land Tenure Status

Under the Land Act of Kenya (2012), the land ownership system in Kenya is categorized into three main types: Public Land, Community Land, and Private Land. Public Land is managed by the government and includes areas such as state-owned land, national parks, forests, and other lands designated for public use. Community Land is held collectively by communities under customary law, as recognized by the Community Land Act (2016), and is used for communal purposes, managed by community land management committees. Private Land is owned by individuals or entities and includes land held under freehold or leasehold titles, with ownership documented by title deeds.

In Kenya, private land transactions follow a structured legal process where the buyer and seller agree on the terms of the sale, formalized through a sale agreement. The buyer then conducts due diligence by verifying the authenticity of the title deed and ensuring that the land is free from disputes. Once satisfied, both parties sign a transfer document witnessed by a Commissioner for Oaths or Notary Public.

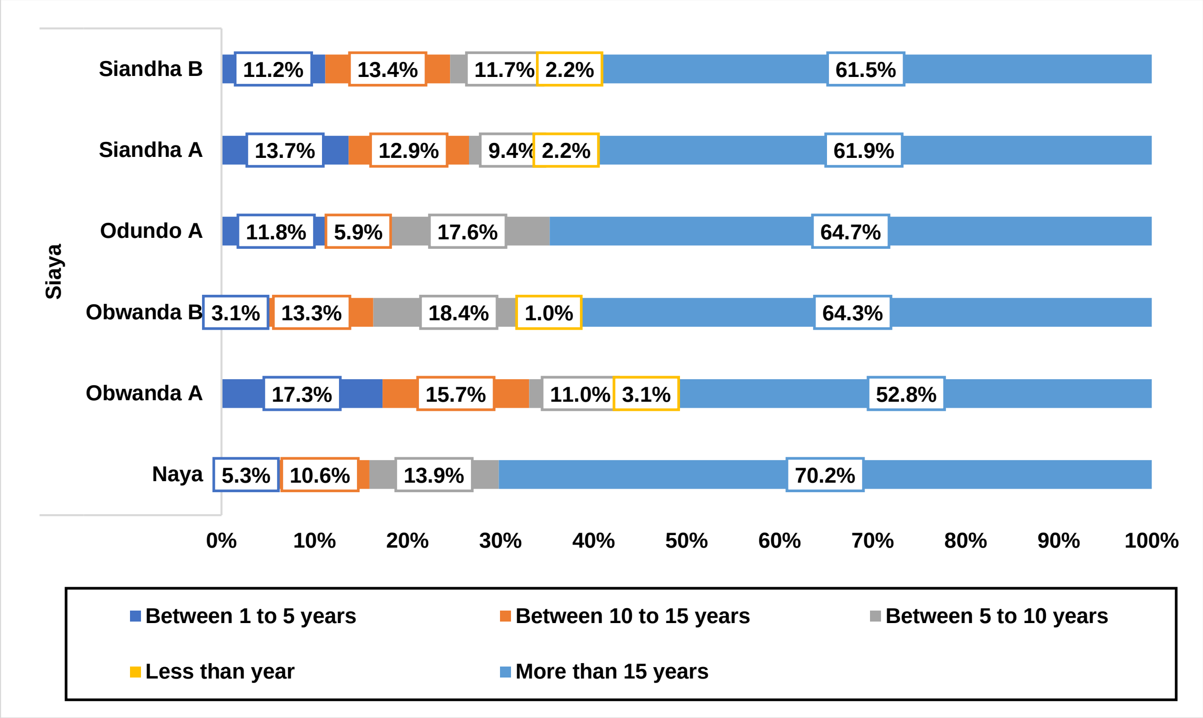
The buyer proceeds with payment, often handled through a lawyer to ensure secure transfer of funds. The transfer documents are then submitted to the land registry for registration, accompanied by the payment of stamp duty. Upon successful registration, the land registry issues a new title deed in the buyer's name, completing the transaction (ibid.).

For public land in Kenya, the government holds and manages the land on behalf of the public. The allocation of public land is governed by the National Land Commission (NLC), which has the authority to allocate or lease public land following established legal procedures. This allocation typically involves public tendering or auctioning to ensure transparency. Public land cannot be sold outright but can be leased for specified periods, typically for up to 99 years (Land Registration of Kenya, 2022).

Information from the focus group discussion with elderly revealed that most of their own land inherited from their grandfathers; however, formal succession processes and title deeds are often lacking. The socio-economic survey indicates that there are household structures within the mine license area and infrastructure zones.

Households were asked about the duration of residency in their respective villages. The data indicates that most of the households have resided in the direct PACs for more than 15 years with 70.2% in Naya, and the least residing in Obwanda A (52.8%). Additionally, there are households who have been affected areas between 1 to 5 years, most of these are in

Obwanda A (17.3%) as illustrated in Figure 5-3. This can be an indication of immigration from other counties and sub-counties.



Source: Panafcon Household Survey 2024

Figure 5-3: Direct PACs Length of Tenure

There are no known building guidelines in the direct PACs. Although larger towns generally feature more formal structures built with bricks, cement, and corrugated iron sheets, many villages consist of mixed types of buildings, including traditional structures made from thatch and mud.

Housing condition/materials in the direct PACs vary significantly, with some houses constructed using modern materials such as concrete blocks and iron sheets, while others rely on more traditional materials like mud walls (Figure 5-4 below). The latter are often more vulnerable to weather conditions and degradation over time. The lack of standardized building regulations leads to a mix of informal housing, with some houses displaying a higher degree of durability and others requiring frequent maintenance and repair due to their less resilient construction materials.

Source: KTL, 2024

Figure 5-4: Housing Materials Used in the Direct PACs

Implications

The presence of diverse residential structures within the proposed mine license area and infrastructure zones, coupled with varied land tenure statuses, presents significant challenges for the mining project. This highlights the need for a detailed resettlement and compensation strategy. The long-standing land tenure in some areas (such as 70.2% held for more than 15 years) adds complexity to the resettlement process. Post-resettlement monitoring, careful management and support will be essential to ensure the smooth integration of displaced residents, address disruptions, and respect established land rights.

5.2.4. Migration

The 2022 KDHS reports that 57% of women and 37% of men were born outside their current place of residence. Migration is the highest amongst those residents aged 25-29, with 67% of women and 49% of men in this group living away from their birthplace (KDHS, 2022). Education also influences migration. For example, residents who have higher education than secondary education levels tend to migrate more (ibid.).

5.2.4.1. Vihiga County

The Vihiga CIDP (2023-2027) outlines that the county continues to experience urbanisation attributed to increasing rural-urban migration and overall growth in population. Emerging urban centres include areas such as Majengo, Mbale, Chavakali, Jeptulu, Luanda, and Serem. The increasing population in the urban areas necessitates integrated planning for improved provision of requisite social services/ infrastructure such as housing, sewerage systems, solid waste management, health and education.

5.2.4.2. Siaya County

It is common for the youth to migrate to urban centers in search of a modern lifestyle, employment opportunities and other economic activities. The 2023-2027 Siaya CIDP outlines that there has been an increase in the number of urban centres both in the country and within counties. This can both be an indicator of population expansion, as well as (or rather) rural-to-urban migration.

The county hosts residents in its rural, urban, and peri-urban centres. Whilst a significant part of the population still resides in the rural centres, there has been continuous migration towards the urban centres in search of better work opportunities and quality services (Siaya CIDP, 2023-2027). The rural-urban migration has resulted in pressure on already limited resources in the urban and peri-urban centres like Siaya, Bondo, Usenge and Ugunja which are trying to meet the growing demand (such as government electricity and water provision).

Migration into the project area has been significantly influenced by various economic opportunities, particularly in gold mining. Data from focus group discussions (FGDs) indicate that there has been an influx of individuals from surrounding counties, such as Migori, Kakamega, and Vihiga, as well as neighboring countries like Uganda and Tanzania. This migration is primarily driven by the search for jobs/ income in artisanal mining, business ventures, and even intermarriage. Over the past five years, the village population has notably increased, attributed to the appeal of these opportunities.

The elderly participants highlighted that the village has historically been inhabited, with migration patterns shifting to accommodate modern economic activities, particularly gold mining. They expressed concerns that the Ramula-Mwibona Project is likely to attract even more people, prompting a need for agreements that respect and protect ancestral lands. However, men in the FGDs voiced worries about potential resource competition, security threats, and cultural erosion resulting from this population increase, fearing that new arrivals might disrupt community values.

Youth also noted that while the project could enhance job prospects and infrastructure, it poses risks such as increased insecurity and social issues, including early marriages and health concerns stemming from heightened immorality.

Implications

The Ramula-Mwibona Project is likely to attract an influx of both local and non-local populations seeking economic opportunities, thereby straining already limited resources in the area. This in-migration could lead to increased competition for housing, water, and essential services, exacerbating pressures on local infrastructure. While the project may provide job opportunities and stimulate economic growth, it also poses risks such as heightened security concerns and potential erosion of cultural values. To mitigate these challenges, it is crucial to implement community engagement strategies that ensure equitable access to resources and promote collaboration with local stakeholders.

5.2.1. Culture and Religion

The population of Vihiga County is predominantly composed of the Abaluhya community, with subgroups such as the Maragoli, Tiriki, and Wanga. These groups are the ancestral inhabitants of the region and form the majority ethnic population. Their rich cultural heritage deeply influences the traditions and practices within the county. Despite the predominance of the Abaluhya, Vihiga County also includes a mix of other ethnic groups, which adds to the cultural diversity of the area.

The primary language spoken in Vihiga County is Luhya, which is widely spoken among the Abaluhya community. In addition to Luhya, Kiswahili and English are also commonly spoken and understood. English, being Kenya's official language, is used in various formal and educational settings, while Kiswahili serves as a common language for communication across different ethnic groups within the county.

In terms of religion, the population of Vihiga County is predominantly Christian, with the majority of residents adhering to various denominations. Most people affiliate with Evangelical (41.0%) or Protestant (34.4%) churches. Additionally, there are smaller communities within the county that practice Catholicism, Islam, and traditional African religions, reflecting the religious diversity present in the region. This data is provided in Table 5-9.

Table 5-9: Vihiga County-Level Religion

Religion	Vihiga County
Catholic	4.0%
Evangelical	41.0%
Islam	1.0%
No religion	1.0%
Christian	18.3%
Other religion	1.0%
Protestant	34.4%
Traditional	0.2%

Source: KNBS, 2019

5.2.1.1. Siaya County

The population of Siaya County is predominantly Luo, who are the ancestral inhabitants of the region and form the majority ethnic group. The Luo people have a rich cultural heritage, with deep roots in Siaya's history. Despite the Luo majority, Siaya County also includes a mix of other ethnic groups, contributing to the cultural diversity of the area (Jua Kenya, 2024).

The primary language spoken in Siaya County is Dholuo, which is widely spoken by the Luo community. In addition to Dholuo, English and Swahili are also commonly spoken and understood due to the diverse population. English, being Kenya's official language, is used in various formal and educational settings, while Swahili serves as a common language for communication across different ethnic groups within the county.

In terms of religion, the population of Siaya County is predominantly Christian, with the majority adhering to various denominations, including Catholic, Anglican, and Protestant churches. According KNBS Population and Housing Census (2019), most of the population identifies as Christians (48.0%) or Catholics (39.0%). This data is provided in Table 5-10.

Table 5-10: Siaya County-Level Religion

Religion	Siaya County
Catholic	39.0%
Evangelical	4.0%
Islam	1.0%
No religion	1.5%
Christian	48.0%
Other religion	4.0%
Protestant	4.0%
Traditional	0.4%

Source: KNBS, 2019

The socio-economic survey revealed that, in the direct PACs, most of the population in Ramula Sub-Location identify as Christians. This reflects a strong predominance of Christianity in the area. Amongst the direct PACs, Christianity remains the most prominent religion as depicted in Figure 5-5. Notably, Siandha A has a small Muslim population, accounting for 1.9% and Obwanda A has 0.8% of Muslim population, whilst the other villages have no identified Muslims or adherents of other religions.

Elders from the FGD conducted echoed these findings, highlighting that Christians dominate the religious landscape, with an even distribution between Catholic and Protestant affiliations. Culturally, the Luo community is the majority, followed by the Luhya community. While traditional cultural practices, such as tooth removal as a rite of passage into adulthood, have diminished, dowry ceremonies remain prevalent. However, there are concerns that the Ramula-Mwibona Project may adversely affect cultural and religious practices, potentially leading to a decline in traditional ceremonies and mourning practices as new cultural influences emerge in the area.

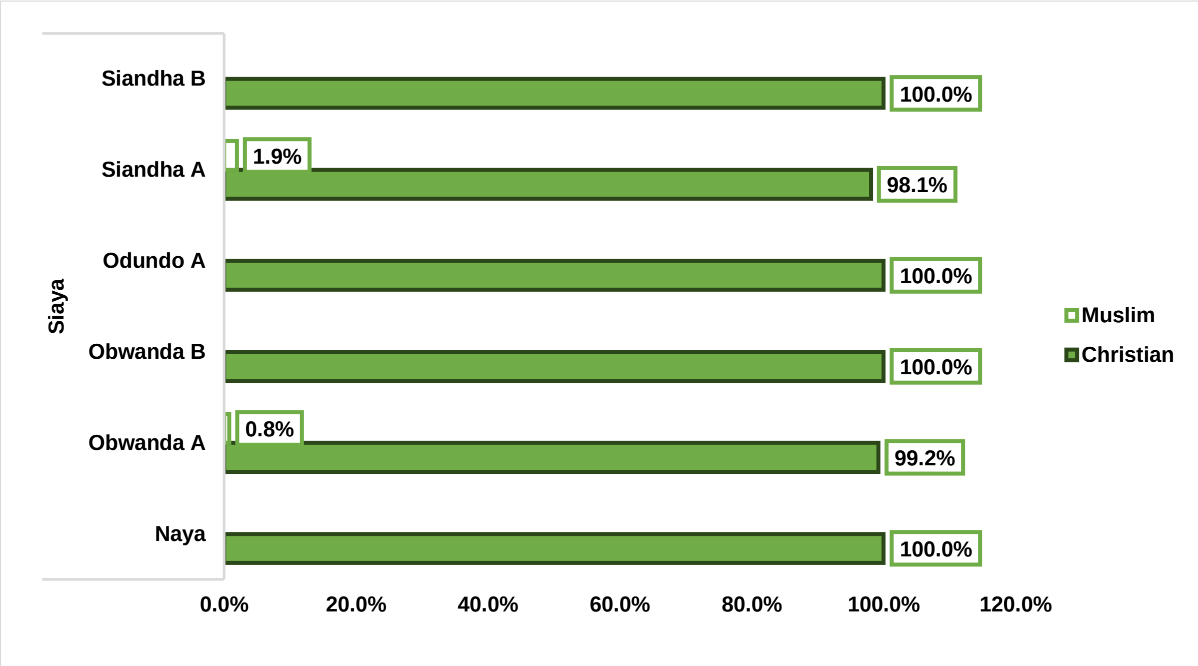


Figure 5-5: Direct PACs Religion

Source: Panafcon Household Survey, 2024

5.2.1.2. Energy

At a national level, the generation, transmission, and distribution of electricity in Kenya are primarily managed by the Kenya Electricity Generating Company (KenGen), Kenya Power, and the Rural Electrification Authority (REA). The country's electricity generation is predominantly sourced from renewable energy, with geothermal power accounting for 45%, followed by hydropower (20%), wind (15%), thermal (10%), and solar (4%) (KNBS, 2024). As of 2018, overall access to electricity in Kenya was estimated at 75%, encompassing both grid and off-grid solutions (KNES, 2018). Despite this progress, many households in Kenya still lack access to electricity, largely due to the high costs of extending electricity infrastructure to rural and peri-urban areas (ibid.). At a national level, the distribution of energy supply is a major challenge, as only 17% of all rural areas have access to electricity.

A significant portion of the population continues to rely on traditional biomass and waste, particularly fuelwood, for heating and cooking. Nationally, 68.8% of households use firewood as their main cooking fuel, and in rural areas, nearly 90% of the population depends on firewood for cooking and heating (KIPPRA, 2009).

The following section provides more details on access to household energy within the two affected counties. As an overview, both county's CIDPs' indicate that more than half of the country's population will be residing in urban areas in the near future. While a significant part of the counties' populations still resides in rural centres, there has been continuous migration towards urban centres as people search for better work opportunities and quality services. The rural-urban migration has resulted in pressure on limited energy resources. Furthermore, the mining sector is known to cause housing demands owing to the immigration of people seeking employment. With the Project, this means that the local energy demand may increase.

Vihiga County

According to the Vihiga CIDP (2023-2027), the county recognises the importance of energy efficiency and conservation measures in the industrial, commercial, and domestic sectors. The county increased household connectivity to the national grid to 12% for urban households and 7% for rural households. Previously, the main energy sources were lanterns (46.1%) and tin lamps (39.1%) as the primary lighting fuels, followed by electricity (11.8%) and solar (1.7%). The county is also characterised by rural and often remote areas, which creates a challenge for the government to supply electricity. The Project could potentially stimulate the economy and attract businesses. Such development could also accelerate the provision of energy in the area, which could benefit the PACs.

Siaya County

The Siaya CIDP (2023-2027) anticipates an increased demand of energy by 2027 driven by projected population growth. As development progresses, the influx of people is expected to further increase the demand for electricity.

As shown in Figure 5-6 below, the KNBS Population and Housing Census (2019) reveals that most 73% of the Siaya county’s population uses tin lamps for lighting, followed by those who use lanterns (21%). Electricity supply connected to the national grid (4%) is not commonly used as source of energy in the area.

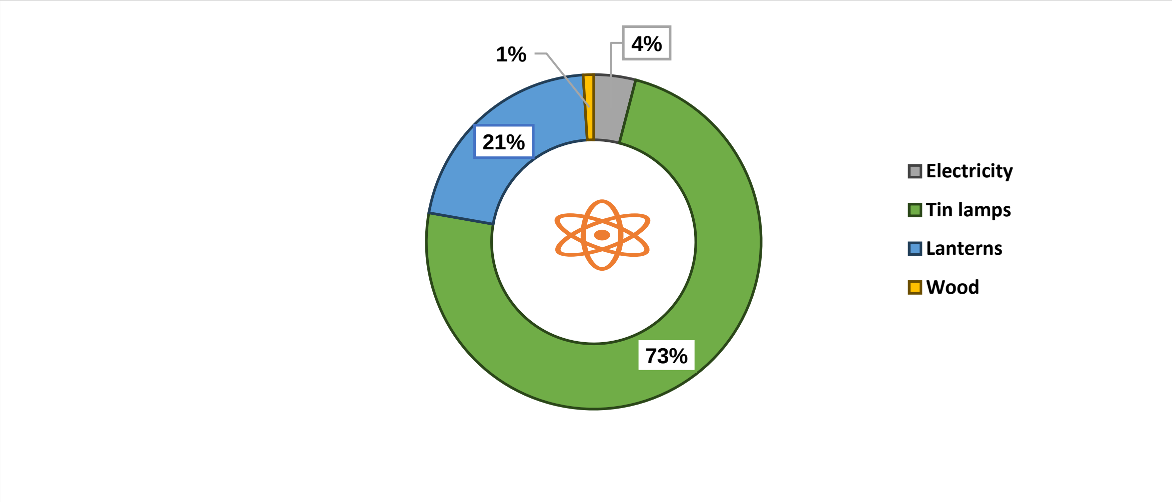


Figure 5-6: County-Level Sources of Energy

Source: KNBS, 2019

5.2.1.2.1. Source of Energy for Lighting

Some areas within the direct PACs are connected to the national grid, receiving electricity through the Rural Electrification Programme managed by the Rural Electrification and

Renewable Energy Corporation (REREC). However, access is limited due to high costs of extending the grid to remote areas.

Table 5-11 shows that the majority of households in the direct PACs use solar power for lighting. In Odundo A, all surveyed households rely exclusively on solar energy. A few households use a combination of electricity and solar power, while the use of wood for lighting is minimal, with Naya being the area with 5.8% of households use it.

Table 5-11: Direct PACs Energy Sources for Lighting

Village	Electricity	Electricity and Solar Power	Paraffin	Solar Power	Wood
Naya	5.1%	8.0%	4.4%	76.6%	5.8%
Obwanda A	8.3%	5.5%	9.2%	77.1%	0.0%
Obwanda B	1.1%	6.4%	2.1%	89.4%	1.1%
Odundo A	0.0%	0.0%	0.0%	100.0%	0.0%
Siandha A	5.4%	12.9%	1.4%	79.6%	0.7%
Siandha B	5.7%	13.9%	5.1%	73.4%	1.9%

Source: Panafcon Household Survey, 2024

5.2.1.2.2. Source of Energy for Cooking

Table 5-12 depicts household sources of energy for cooking in direct PACs. Charcoal emerges as the predominant energy source for cooking, with usage ranging from 68.8% in Odundo A to 47.8% in Obwanda B. Wood is commonly used as a secondary source across all villages, while gas usage varies more widely, indicating a moderate adoption of this energy source in some areas. Alternative energy sources such as electricity combined with charcoal and solar power are minimally utilized, with both recording very low usage across the villages.

Table 5-12: Direct PACs Energy Sources for Cooking

Village	Charcoal	Electricity and Charcoal	Gas	Solar Power	Wood
Siandha B	56.1%	0.6%	17.7%	0.6%	25.0%
Naya	59.2%	0.0%	12.2%	2.0%	26.5%
Siandha A	50.3%	0.0%	19.4%	0.0%	30.3%
Obwanda A	48.2%	0.0%	28.1%	0.0%	23.7%
Obwanda B	47.8%	0.0%	23.9%	0.0%	28.3%
Odundo A	68.8%	0.0%	18.8%	0.0%	12.5%

Source: Panafcon Household Survey, 2024

Implications

The establishment of Ramula-Mwibona Mining Project will have significant implications for energy use in both lighting and cooking.

Energy for Lighting: Solar power is the dominant energy source for lighting across all villages. However, there is still a noticeable portion of the population in other villages that combine solar power with electricity, though this usage remains low with few households using electricity only. The reliance on paraffin and wood for lighting is minimal, suggesting that the shift towards solar is already underway. The introduction of the mining project could further drive the adoption of electricity as a primary source of energy for lighting, particularly if the project enhances local infrastructure and power supply networks.

Energy for Cooking: The predominant use of charcoal for cooking reflects a continued reliance on traditional biomass fuels. Although gas usage is present, it remains secondary to charcoal and wood. The mining project's development could potentially increase the demand for cleaner and more efficient cooking energy sources, particularly if efforts are made to improve access to gas and electricity. Moreover, the project's impact on local forests, used for wood and charcoal, may necessitate a shift towards more sustainable energy sources for cooking, such as gas or expanded solar power options.

5.2.1.3. Water

According to the Water and Sanitation Strategic Plan (2018-2022), Kenya is classified as a water-scarce country, with a per capita freshwater endowment of approximately 527 cubic meters, significantly below the UN standard of 1,000 cubic meters for countries not under water stress. The situation worsens during drought periods, leading to a tight water balance due to a high demand-to-resource ratio, resulting in increased water stress. Despite these challenges, access to safe drinking water improved from 53.3% in 2013 to 60% in 2017, providing an additional 4.65 million people with clean and safe water. Urban water supply coverage also saw an increase, rising from 66.7% to 70% over the same period (ibid.).

Vihiga County

According to the Vihiga CIDP (2023-2027), the proportion of households in urban areas with access to clean and portable water improved to 20% surpassing the 2018-2022 target of 15%, while in rural households, such access improved to 64% exceeding the 2018-2022 target of 55%. This improvement is attributed to enhanced water infrastructure and better management practices.

Siaya County

Access to improved water sources in Siaya County is estimated at 66%, leaving a significant portion of the population reliant on unimproved sources. The county's water supply is managed primarily by the Siaya Bondo Water and Sanitation Company (SIBOWASCO), which oversees major water supply schemes. Additionally, there are over 40 medium-sized water supply schemes serving approximately 396,000 people. These schemes range from small community-based systems to larger piped water supplies, managed by various committees and service providers.

The distribution of water sources in the county is uneven, with people often walking long distances to fetch water. The common water sources in the county include streams, wells, boreholes, roof catchments, rivers, Lake Victoria, and piped supplies, though many are seasonal and not usable during dry periods (Siaya CIDP, 2023-2027).

According to the KNBS Population and Housing Census (2019), approximately 52% of the Siaya County population use drinking water from an improved source. The main improved sources of drinking water are protected wells and springs, whereas surface water is the most commonly used unimproved water source. More than 76% of the population use unimproved drinking water sources with an appropriate water treatment method; the most common being adding bleach/chlorine as demonstrated in Table 5-13. It is vital for the Project to consider possible water contamination mitigation measures, as most people in the area rely on wells and spring water as their main source of drinking water

Table 5-13: County-Level Water Sources

Indicator	%
Use of improved drinking water sources	52%
Water treatment	76%
Use of improved sanitation facilities	10%
Safe disposal of child's faeces	71%

Source: KNBS, 2019

According to the socio-economic data collected for the direct PACs, there is significant variation in drinking water sources. Households largely rely on streams or rivers for drinking water. Odundo A (100%) and Siandha B (90%) exhibit the highest dependency on streams or rivers. Obwanda B shows the highest reliance on borehole water with 18%. As shown in Table 5-14, piped water, traditional hand-dug wells and deep wells is minimally used across all villages highlighting a critical reliance on surface water sources. This was further confirmed during the FGDs, where participants indicated that water sources are primarily rivers (Dhene and Awach) and springs, which are often polluted. Only a few wealthier households have private wells, further emphasizing the limited access to clean water.

Table 5-14: Direct PACs Sources of Drinking Water

Villages	Stream or River	Borehole	Piped Water	Rainwater Tank	Spring	Traditional / Hand Dug Well	Well (Deep)
Naya	86%	3%	0%	4%	7%	0%	0%

Villages	Stream or River	Borehole	Piped Water	Rainwater Tank	Spring	Traditional / Hand Dug Well	Well (Deep)
Obwanda A	77%	3%	1%	16%	3%	0%	0%
Obwanda B	72%	18%	1%	6%	1%	1%	0%
Odundo A	100%	0%	0%	0%	0%	0%	0%
Siandha A	84%	5%	0%	9%	1%	0%	1%
Siandha B	90%	1%	2%	6%	1%	0%	0%

Source: Panafcon,Household Survey, 2024

Implications

In the Ramula area Most households depend on streams or rivers for drinking water. Mining activities could significantly increase pressure on these already strained water sources. Mining activities could potentially lead to surface and groundwater contamination and the depletion of the available surface water, which is crucial for the local population. Given the limited use of improved water sources such as piped water, boreholes and rainwater tanks, it is essential for the company to implement robust measures to mitigate its potential impact on water quality and availability, thereby protecting community health and maintaining essential water supplies.

5.2.1.4. Sanitation

In Kenya, progress in sanitation has been limited, particularly in rural areas where only 32% of the population has access to improved sanitation facilities. Urban areas, especially formally planned ones, generally have better sanitation services, but open defecation remains a critical issue, with national rates at 14% and some counties exceeding 70%. Despite efforts like the Open Defecation Free (ODF) Rural Kenya 2013 Campaign, cultural perceptions and safety concerns, particularly around children's use of latrines, hinder progress (Kenya Environmental Sanitation and Hygiene Policy 2016-2030).

Solid waste management is another major environmental challenge in Kenya, with waste generation projected to increase significantly. Most waste is residential, but hazardous industrial and medical wastes are often mixed with general municipal waste due to a lack of proper disposal facilities (ibid.).

Vihiga County

The Vihiga CIDP (2018-2022) indicates that only 85% of the county's residents use improved sanitation facilities. To address this, the County Government is actively working to enhance sanitation in public facilities, urban areas, and market centers by constructing public sanitary facilities. However, Vihiga County lacks a sewerage system, and both public and private institutions primarily rely on septic tanks and improved pit latrines for waste management within their premises.

In Vihiga County, waste streams include domestic, municipal, industrial, hazardous, and e-waste, as well as waste oil and tires. Poor waste management practices have led to significant environmental problems such as water and soil contamination, pollution, and leachate formation, particularly in urban centers. Waste is largely disposed of in open dumpsites, with inadequate segregation and treatment (Vihiga Municipal Solid Waste Management Policy 2019).

Siaya County

The Siaya CIDP (2023-2027) indicates that sewerage service provision has been a challenge in the county owing to inadequate infrastructure. The KNBS Population and Housing Census (2019) demonstrated a larger proportion (96%) of the County relies heavily on bush for human disposal as outlined in Figure 5-7, this can be attributed to most County's population residing in rural areas and having inadequate service delivery. The proposed mining developments in the area may contribute to providing basic services in affected communities as part of the social responsibility.

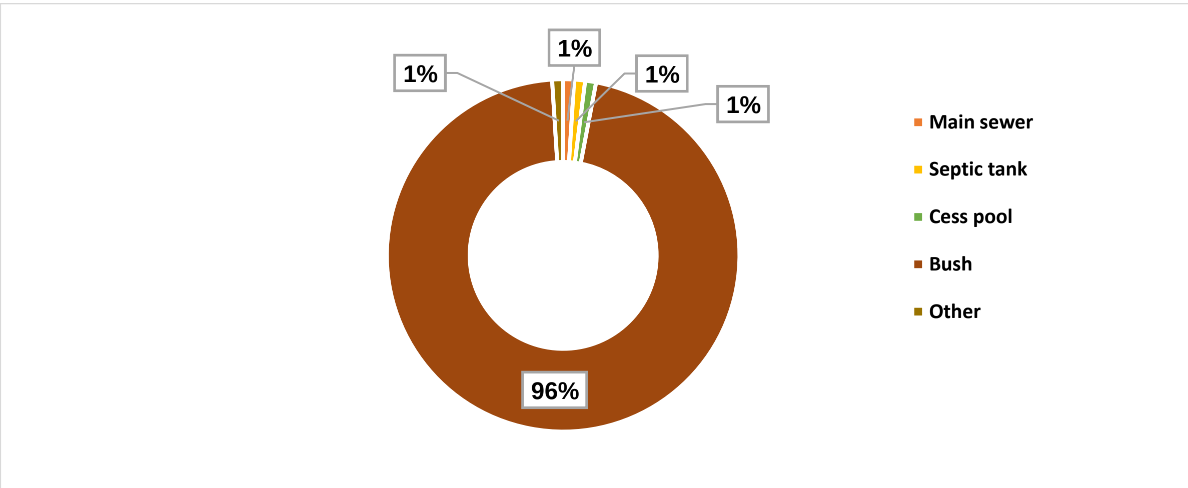


Figure 5-7: County-Level Human Waste Disposal

Source: KNBS, 2019

As shown in Table 5-15 below in the direct PACs, the most common type of sanitation facility used is the pit latrine. The highest use of pit latrine is in Obwanda A with 95.7% followed by Obwanda B with 94.7%. Other sanitation methods vary across all villages. Naya has the highest percentage (8.2%) of households sharing sanitation facilities with neighbours while

Odundo A has 6.3% of households using stream/river/lake. Siandha B has the highest rate of open defecation in gardens/bush/forest at 4.8%.

Table 5-15: Direct PACs Sanitation Facilities

Villages	Pit Latrine	Garden/Bush/ Forest	Sharing with neighbour	Stream/River/ Lake	Flush Toilet
Odundo A	93.8%	0.0%	0.0%	6.3%	0.0%
Obwanda B	94.7%	1.1%	2.1%	0.0%	2.1%
Obwanda A	95.7%	3.4%	0.0%	0.0%	0.9%
Naya	84.2%	5.5%	8.2%	0.0%	2.1%
Siandha A	93.5%	1.3%	3.2%	1.3%	0.6%
Siandha B	92.8%	4.8%	1.2%	0.6%	0.6%

Source: Panafcon Household Survey, 2024

As shown in Table 5-16, in the direct PACs, the most common method for waste disposal across all villages is the use of private waste pit. The highest use of private waste pits is observed in Odundo A at 75% and the lowest is Obwanda B at 48.9%. As shown in Table 5-16: Direct PACs Waste Disposal, in the direct PACs, the most common method for waste disposal across all villages is the use of private waste pits. Burning of waste follows as the next most utilised method, notably in Siandha A (21.3%). Formal waste depots or landfills are also frequently used, especially in Obwanda B (27.7%). Throwing waste away in the bush is more common in Odundo A (12.5%) and Naya (8.1%). Burying waste and informal communal dumps are minimally used across all villages.

Table 5-16: Direct PACs Waste Disposal

Villages	Burn Waste	Bury Waste	Formal Waste Depot/	Informal Communal Refuse Dump	Private Waste Pit	Throw Away in Bush
Naya	18.9%	0.0%	8.1%	0.0%	64.9%	8.1%
Obwanda A	16.4%	0.0%	21.6%	2.6%	53.4%	6.0%
Obwanda B	20.2%	0.0%	27.7%	2.1%	48.9%	1.1%
Odundo A	12.5%	0.0%	0.0%	0.0%	75.0%	12.5%
Siandha A	21.3%	1.3%	24.5%	0.6%	49.7%	1.9%
Siandha B	14.3%	0.0%	11.9%	0.6%	69.0%	4.2%

Source: Panafcon Household Survey, 2024

5.2.1.5. Education

Education is key in development processes since it builds up human capital, fosters economic growth, improves the wellbeing of the population, promotes income distribution, and enhances employability.

The education system in Kenya is structured as follows: Two years of pre-primary education, eight years of primary education, four years of secondary education, and four years of university education. Additionally, students may pursue vocational training or technical courses after secondary school, which typically range from one to three years.

The education sector in Kenya provides education services for over 16 million children and youth, with almost 500,000 teachers distributed in close to 90,000 pre-primary, primary and secondary education institutions (World Bank, 2022). The system is expanding to accommodate more students, especially in pre-school and post-primary education. In 2022, Kenya had a significant number of students enrolled in its public education system. Public institutions account for 70% of total enrollment in pre-primary education, 84% in primary education, 93% in secondary education, and 82% in tertiary education (ibid.)

In 2022, the percentage of adults aged 15 and older who can read was reported at 82.88% (World Bank's Collection of Development Indicators, 2024).

Vihiga County

According to the Vihiga CIDP (2023-2027), enrolment in primary schools for the county increased from 146,323 learners in 2017 to 157,917 (7.9%) in 2022. Of this enrolment, 50.5% of learners in 2022 were boys and 49.5% girls. This increase in enrolment was attributed to the government's compulsory and free primary education policy introduced in 2003. For secondary education, enrolment improved from 68,516 learners in 2017 to 82,700 in 2022 (an increase of 20.7%). Of these, 44.8% were boys and 55.2% girls. This data is depicted in Table 5-17. The overall education in the county is thus relatively low. The implications for the proposed Project are similar to those outlined under Siaya County.

Table 5-17: County-Level Education Level by Gender

Education Level	Male	Female
Pre-Primary School	50.1%	49.9%
Primary School	50.5%	49.5%
Secondary School	44.8%	55.2%

Source: Vihiga CIDP, 2023

Siaya County

Latest data from KNBS Economic Survey (2019) indicates levels of education by gender and shows that approximately 60% of the county's population (both males and females) have primary education. Less than 20% of the county's population have pre-primary and secondary education. This data is summarized in Table 5-18.

This can be associated with functional literacy [18] as people can read and write, however lack critical skills relevant for sustainability economic development. Poor educational attainment often results in a population with limited skills and qualifications, making it difficult for individuals to meet the demands of the job market. Where this is the case, mining developments have to source skilled workforce outside its AoIs, provide skills development for its PACs, and contribute to the county's education through Corporate Social Investment (CSI) projects.

Table 5-18: County-Level Education Level by Gender

Education Level	Female	Male
Adult Education	2%	1%
Pre-Primary	19%	19%
Primary	59%	58%
Secondary	16%	16%
TVET1	2%	2%
University	2%	3%

Source: KNBS, 2019

According to the socio-economic data, in the Ramula Sub-Location, educational attainment among the households within the PACs varies across the six villages.

The data reveals that most households have a primary education. Siandha B exhibits the highest primary education with 79.5%, followed by 70.6% in Odundo A, and the least of 59.0% in Obwanda B village. Secondary education is the second highest education level within direct PACs, having 29.4% of Odundo A as the highest compared to other villages. A very low attainment of higher education levels with PACs with at least 9.0% (higher compared to other villages) of the population reporting to have graduated in Obwanda B as depicted in Table 5-19.

Table 5-19: Direct PACs Education Level

Village	Not attended school	Primary School	Secondary	Post-Secondary	Graduate	Post-Graduate
Naya	1.9%	59.5%	32.3%	1.9%	3.8%	0.6%
Obwanda A	1.5%	65.4%	22.3%	3.1%	7.7%	0.0%
Obwanda B	2.0%	59.0%	26.0%	4.0%	9.0%	0.0%
Odundo A	0.0%	70.6%	29.4%	0.0%	0.0%	0.0%

[18] Functional literacy refers to the ability to read, write, and use numeracy skills in everyday situations.

Siandha A	0.6%	72.9%	21.9%	1.3%	2.6%	0.6%
Siandha B	2.6%	79.5%	14.2%	0.5%	3.2%	0.0%

Source: Panafcon Household Survey, 2024

Further data from the FGDs reveals that the education levels among youth in the area are quite low, with approximately 50% having completed only primary education, 35% achieving secondary education, and 15% attaining tertiary education. The general education status for men is similarly modest, as most have only completed primary education, with a minority progressing to secondary and a few reaching tertiary education. Women in the community have mostly accessed primary school education, reflecting a similar pattern among elderly individuals, who predominantly hold primary-level qualifications. The education status of widows and orphans is also largely confined to primary education, indicating limited opportunities for advancement.

In the community, skills are often acquired informally, reflecting the practical nature of the local economy. Youths have developed competencies in artisanal mining through hands-on experience rather than formal training. Many women demonstrate skills in farming, artisanal mining, tailoring, hairdressing, and small business management, while also expressing a strong interest in enhancing their skill sets in areas such as driving, entrepreneurship, and advanced hairdressing techniques. Men commonly possess skills in artisanal mining, farming, masonry, electrical work, plumbing, and driving. Additionally, widows often have informal skills in farming, tailoring, small business management, basketry, weaving, artisanal gold mining, and dressmaking. This diverse skill set highlights the community's resourcefulness and the potential for further development through targeted training initiatives.

Implications

The Project is likely to have a significant impact on education in the region. As the project develops, there will be an increased demand for skilled labour, which may drive improvements in local educational facilities and training programmes. This could lead to enhanced educational opportunities for the PACs, including vocational training and technical education. Additionally, the Project’s CSI initiatives may contribute to higher educational attainment and better school infrastructure. However, the influx of the mining workforce might also strain existing educational resources and require strategic planning to balance educational needs with workforce demands.

5.2.1.6. Health

The following section provides an overview of the health landscape in Kenya, Siaya County, and Vihiga County, as well as in the most direct PACs. It covers health facilities, the prevalence of illnesses such as malaria and HIV/AIDS, and mortality and fertility rates.

Kenya faces a triple burden of disease, where communicable diseases continue to dominate morbidity and mortality (Kenya Ministry of Health, 2023). Infectious diseases and injuries account for more than half of the deaths in the country. Non-communicable diseases, such as diabetes and cardiovascular conditions, contribute to approximately 39% of deaths (ibid.). It is projected that the share of deaths from non-communicable diseases and injuries will continue to increase in the coming years (ibid.).

Vihiga County

Vihiga County CIDP (2023-2027) indicates that the county is focusing on the improvement of the health infrastructure. The county aims to expand access to healthcare by enhancing existing facilities and establishing new ones to meet the population's growing healthcare needs. Currently, the Vihiga county has 144 health facilities spread across different levels of care, with the distribution shown in Table 5-20Table 5-20.

Table 5-20: Vihiga County Health Facilities

Facility type	Number	Percentages
Faith-based facilities	9	6.3%
Ministry of Health facilities	75	52.1%
NGO Facilities	3	2.1%
Private facilities	57	39.6%
Total	**144**	**100%**

Luanda Sub- County within Vihiga county plays a significant role in the county's healthcare network. Luanda hosts a total of 22 health facilities, accounting for 15% of the county's total facilities.

The county experiences the prevalence of HIV and malaria; however, HIV has reduced from (4.7%) in 2017 to (4.1%) in 2021. This is because there has been an improvement in the identification of people living with HIV from (74%) in 2017/2018 to 85% in 2021/2022. Furthermore, Vihiga county is among the counties within the lake region that is deemed to be malaria endemic zone. It then made a strategic investment towards reducing the prevalence of malaria, which stood at (27%) in 2017, dropping to (9.2%) in 2022.

Siaya County

Siaya County CIDP (2023-2027) outlines that it has achieved a reducing infant mortality from 59/1000 live births to 42/1000 live births and under-five mortality rate from 159/1000 live births to 67/1000 live births. This reduction is attributed to the increased immunization coverage to 88% of the targeted population, defaulter tracing of anti-natal and post-natal care, procurement of 40 fridges for cold chain maintenance of vaccines, and support from partners on mother-child health.

In Siaya County, there has been a reduction of communicable diseases owing to a decline in HIV prevalence from 17.6% to 14.7%; decline in Malaria prevalence from (38%) in 2018 to (19%); improved TB cure rate from (83%) in 2019 to (87%) in 2022.

The county has further reduced maternal mortality from 619/100,000 in 2011 to 424/100,000 and improvement in skilled deliveries from (65%) to (95%). These measures result from constructing six maternity wings, enhancing community health services through training, supporting boda boda[19] riders for transporting expectant mothers, offering youth-friendly services in seven health facilities, providing family planning services, screening for cervical cancer, and delivering early childhood development and education in all public health facilities.

Siaya County has a total of 290 health facilities, distributed across various categories to cater to the healthcare needs of its population with distribution shown in Table 5-21.

Table 5-21: Siaya County Health Facilities

Facility type	Number	Percentages
Faith-based facilities	20	6.8%
Ministry of Health facilities	173	59.7%
NGO Facilities	10	3.4%
Private facilities	87	30%
Total	**290**	**100%**

Within Siaya County, Gem Sub-County hosts 49 health facilities, which make up 17% of the county's total. In East Gem Location, there are six health facilities, which are Dolphil Nursing and Maternity Home, Lihanda Health Centre, Midhine Dispensary, Oding Dispensary, Ramula Health Centre and Sagam Community Hospital.

As shown in Figure 5-8, Ramula Health Centre serves as the primary healthcare provider for the project area, offering outpatient services and maternity inpatient care to an annual patient load of approximately 12,000. The facility refers to complex cases to Yala Level 4 Hospital. However, it faces challenges such as shortages of essential commodities (e.g., malaria and pregnancy test kits, and blood pressure tools) and staffing issues, with a lack of doctors and nurses.

[19] Boda boda refers to motorcycle taxis that are a popular and affordable means of transportation in Kenya and other East African countries. They are often used for short-distance travel within towns, cities, and rural areas. They are a significant source of employment for many young people and play a crucial role in the local transport economy.

Source: KTL, 2024

Figure 5-8: Ramula Health Facility

The disease profile in the project area is dominated by malaria, accounting for three-quarters of patient cases, while respiratory infections, typhoid, and abdominal issues make up the remaining 25%. Respiratory infections tend to rise during the rainy seasons and school holidays (April, August, and December). Other prevalent health issues include sexually transmitted infections (STIs), which are often treated privately due to stigmatization, with approximately 5 cases handled annually at the facility.

Teen pregnancies are also common, with about 10 cases reported monthly, partly due to cultural practices and low education levels. Child mortality averages 5 cases per year, while there have been no reported cases of maternal mortality. Vulnerable populations include children under 5, particularly susceptible to malaria, and the elderly, who are prone to respiratory infections and lifestyle diseases. The disease distribution across various groups reveals a distinct health pattern as shown in Table 5-22Table 5-22.

Table 5-22: Disease Distribution in the Project Area

Age group	Common diseases
Children	Malaria, respiratory infections, accidental injuries
25-40	Malaria, respiratory infections
40 and above	Malaria, respiratory infections, lifestyle diseases such as hypertension, diabetes, and arthritis

Vulnerable population	
Children under 5	Highly susceptible to malaria
Elderly	Weakened immunity makes them vulnerable; monthly screenings are conducted with cases treated at the clinic

Closer to the Project site, Table 5-23Table 5-23 below indicates different types of sicknesses in the direct PACs. Malaria is the most common disease with high rates across all villages, reaching up to 69.0% in Naya village. This is followed by Measles which shows significant prevalence, particularly in Siandha A (8.8%) and Odundo A (8.1%).

Other notable health issues include high blood pressure and pneumonia, with varying levels of occurrence. HIV is less common, with prevalence rates ranging from 0% in Obwanda B and 3.0% in Siandha B. Diseases such as tuberculosis, meningitis, and hepatitis have the lowest prevalence across all villages in the direct PACs.

Table 5-23: Direct PACs Illness Prevalence

Health Problem	Siandha B	Siandha A	Odundo A	Obwanda B	Obwanda A	Naya
Malaria	60.9%	66.8%	7.0%	66.0%	65.6%	69.0%
Measles	6.5%	8.8%	8.1%	6.0%	7.0%	3.4%
High Blood Pressure	7.9%	3.8%	3.9%	10.0%	5.0%	5.7%
Pneumonia	6.8%	5.6%	5.0%	4.0%	5.8%	5.1%
Tuberculosis	1.4%	1.2%	0.4%	0.0%	1.8%	0.2%
Diarrhea	2.2%	3.8%	4.7%	2.0%	2.8%	3.8%
Diabetes	1.1%	1.2%	0.4%	2.0%	2.2%	1.0%
Typhoid	1.1%	1.5%	1.9%	0.0%	1.6%	0.8%
Meningitis	0.0%	0.0%	0.4%	0.0%	1.0%	0.2%
Asthma	4.1%	2.6%	1.6%	8.0%	2.0%	3.2%
Cholera	0.0%	0.0%	0.0%	0.0%	0.6%	0.8%
Heart Problems	4.3%	2.9%	1.9%	2.0%	3.4%	5.1%
Hepatitis	0.8%	0.3%	0.4%	0.0%	0.2%	0.0%

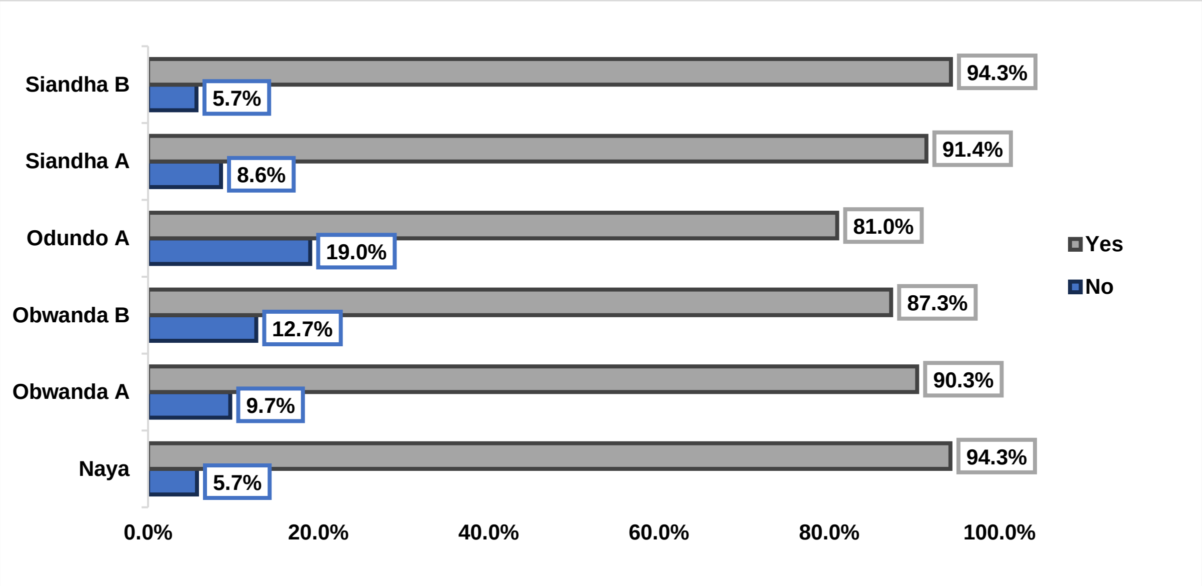
Health Problem	Siandha B	Siandha A	Odundo A	Obwanda B	Obwanda A	Naya
HIV	3.0%	1.5%	1.2%	0.0%	0.8%	1.8%

Source: Panfacon Household Survey, 2024

5.2.1.6.1. HIV/AIDS Awareness

Households were further asked if they were aware of HIV in their respective villages. As shown in Figure 5-9, HIV awareness is high across all villages, with Siandha A and Naya having the highest levels of awareness at 94.3%.

The lowest HIV awareness levels are also found in these villages where 5.7% of households reported a lack of awareness. This shows that a small proportion of the households within direct PACs are prone to HIV, although the greater population have the awareness, therefore more educational campaigns can be implemented.

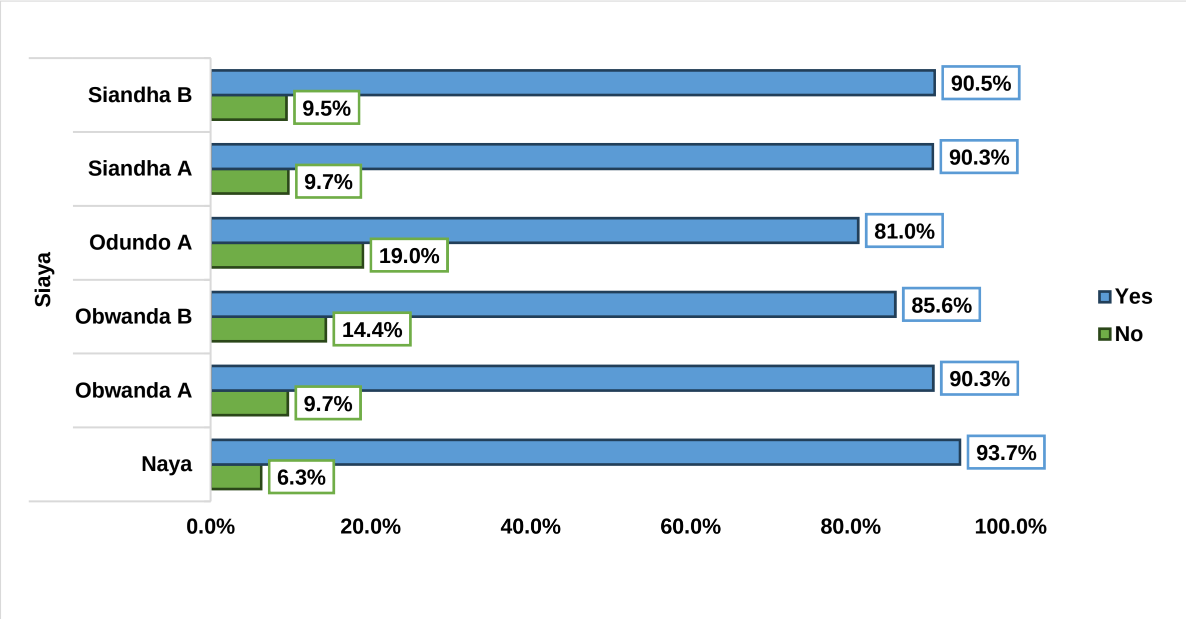


Source: Panafcon Household Survey, 2024

Figure 5-9: HIV Awareness in the direct PACs

5.2.1.6.2. Access to Hospitals

The household surveys in the direct PACs reveal that over 80% of households have access to hospitals. Accessibility is particularly high in Naya, where 93.7% of households report easy access, as shown in Figure 5-10 below. In contrast, only a few households face difficulties, with Odundo A having 19% of households lacking access to hospitals.



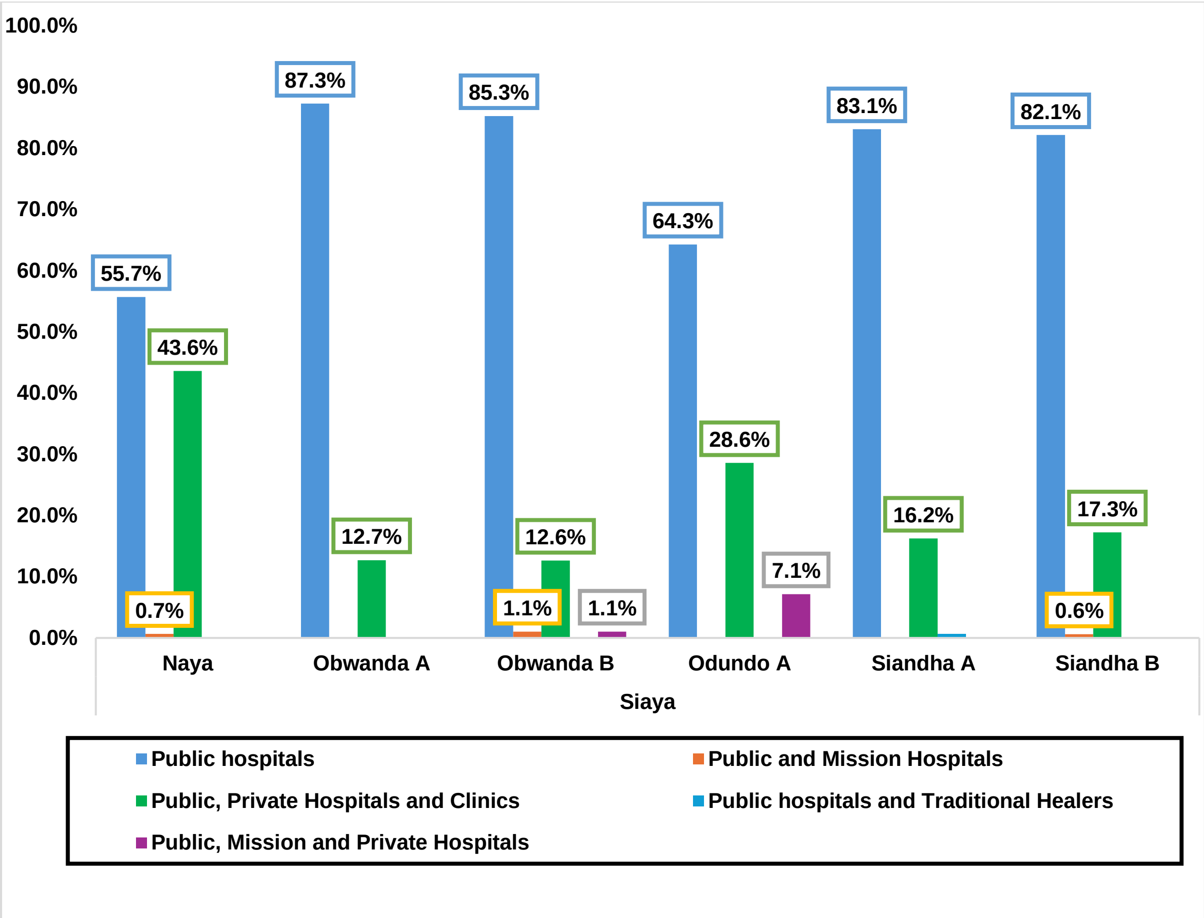
Source: Panafcon Household Survey, 2024

Figure 5-10: Direct PACs Access to Hospital

5.2.1.6.3. Accessible Type of Hospital

In direct PACs, households primarily access public hospitals. Access to public hospitals is notably high in Obwanda A where 87.3% of households use public hospitals, followed closely by Obwanda B at 85.3%.

In each village, there is a mixed use of healthcare facilities where mission hospitals, private hospitals, clinics, and traditional healers also play a role in providing healthcare services. As indicated in Figure 5-11, Siandha A has 0.6% of households that use both public hospitals and traditional healers. The use of both public and mission hospitals is relatively low across the villages.



Source: Panafcon Household Survey, 2024

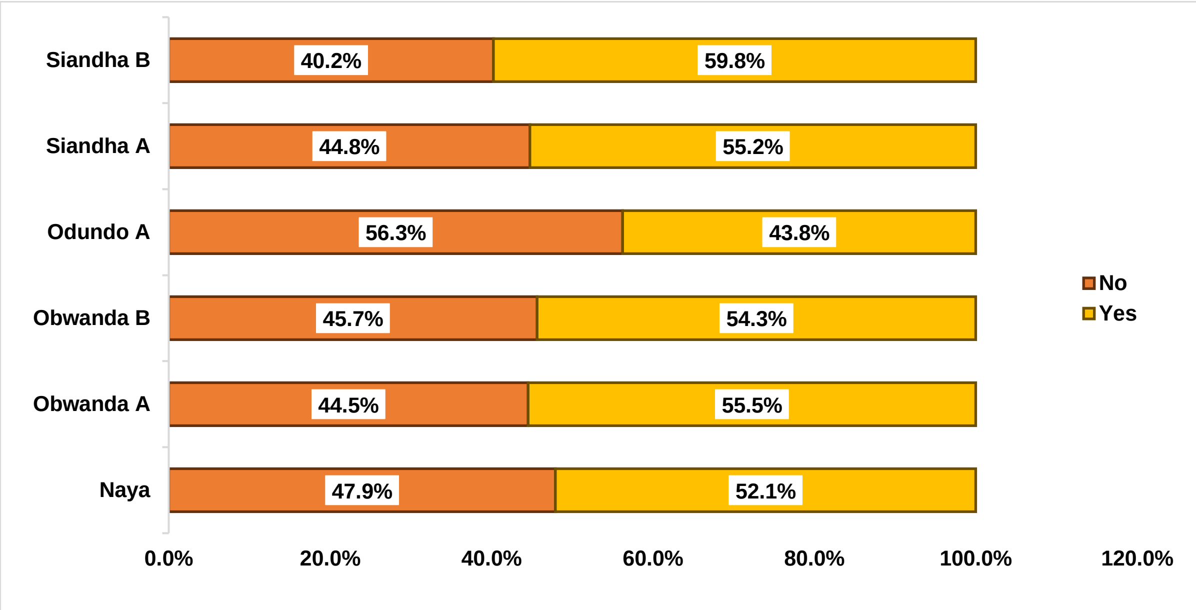
Figure 5-11: Accessible Type of Hospital

Implications

The Project will impact the health status of its PACs in several ways. While 80% of the direct PAC population has access to healthcare, disparities in access, such as in Odundo A, are evident. With more than 80% of households around the Project site using public hospitals, there is a risk of overburdening these facilities should more people move into the area. The Project should also be cognisant of health impacts which may be caused by the mining operation directly. Such vigilance could also see to improvements in disease management and collaboration with local health initiatives to mitigate potential strains on existing health infrastructure. Additionally, the company could consider that health education and preventive measures are provided to effectively address any new emerging health challenges, while supporting both the workforce and the mine's PACs.

5.2.1.7. Graves and Cemeteries

In Siaya County, the tradition of burying deceased family members within homestead/ household compounds is prevalent; however, limited data at the county level poses a challenge in gaining a comprehensive overview of the cultural practices. Among the surveyed villages, Siandha B has the highest proportion of homesteads with graves, at 59.8%, followed by Obwanda A at 55.5%. In contrast, Odundo A has the highest percentage, with 56.3% of households having no graves in their homesteads/ household compounds as shown in Figure 5-12.

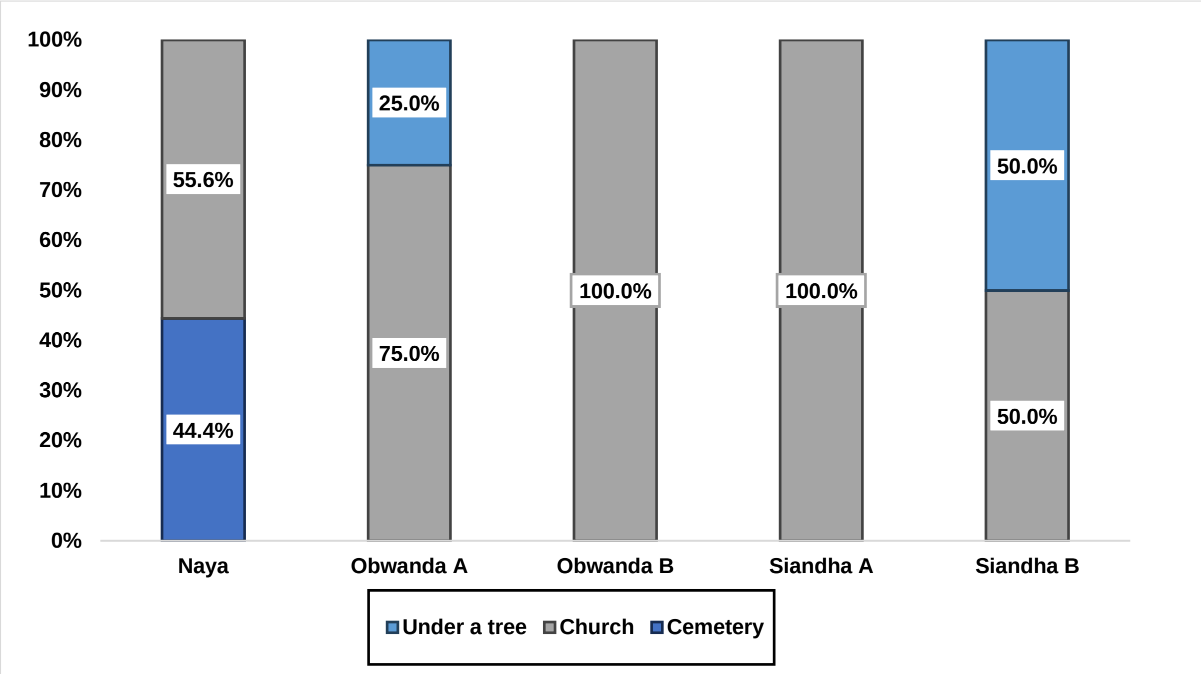


Source: Panafcon Household Survey, 2024

Figure 5-12: Direct PACs Household Graves

Further data from the surveyed households as presented in Figure 5-13 reveal that, churches are the most prominently recognized place of worship across the villages. Church exhibits high utilisation in Obwanda A and Siandha A with both at 100.0%. Cemeteries are homely utilized in Naya only at 44.4% of households using them as sacred places.

The use of under-tree areas as sacred spaces is less common across studied villages, with notable usage in Siandha B at 50.0% followed by Obwanda A at 25.0%. Odundo A village reports no household use of any sacred place, suggesting either a lack of recognized sacred spaces or differing local practices.



Source: Panafcon Household Survey, 2024

Figure 5-13: Direct PACs Sacred Areas

5.2.1.8. Safety and Security

Vihiga County

According to the baseline survey conducted by Kennedy Mkutu, titled *Crime and Violence Prevention Training, Baseline Survey: Nakuru and Vihiga (2014)*, the county faces a range of security concerns. Major issues include livestock theft, burglary, highway robbery, and conflicts over borders and land. Additionally, there are tensions between university students and local residents, drug trafficking and abuse, illicit brews, and petty offenses.

A significant challenge is the underreporting of crimes, especially domestic and sexual violence, due to stigma, fear of economic repercussions, or lack of awareness about legal rights. The survey also highlights concerns raised in a forum with various stakeholders, including violence against women and children, child labor, unemployment, youth gangs, boundary disputes leading to violence, traffic offenses involving boda bodas, motorbike theft, muggings, and disputes over circumcision/ initiation practices between Christian and traditional groups. This comprehensive view underscores the diverse and complex nature of security issues in the county.

The Crime Research Centre (2020) also highlights the prevalent crimes within the county. Burglary and house breaking (73.7%) is the highest type of crime, also higher compared to the national level. This is followed by illicit brews (71.1%) and stealing (67.1%) as depicted in Table 5-24.

Table 5-24: Vihiga County Type of Crimes

Crimes	Vihiga County	National (Kenya)
Burglary and House Breaking	73.7%	58.7%
Stealing	67.1%	64.5%
Theft of stock (including cattle rustling)	52.6%	37.2%
Possession of illicit brews	71.1%	51.6%
Possession of narcotic drugs	31.6%	34.3%
Assault Causing Actual Bodily Harm	36.8%	34.9%
Murder	21.1%	24.8%
Robbery (Including mugging)	32.9%	26.6%
Attempted Robbery	1.3%	0.4%
Robbery with Violence	19.7%	22.5%
Rape	7.9%	19.9%
Gender-Based Violence	61.8%	45.4%
Being Drunk and Disorderly	65.8%	49.1%
Defilement	40.8%	31.3%
Theft of Farm Produce	60.5%	23.1%
Child Abuse (including child neglect)	14.5%	26.9%
Forgery	1.3%	0.4%

Source: Crime Research Centre, 2020

Siaya County

According to data from the Crime Research Centre (2020), Siaya County experiences crime rates that are significantly higher than national averages across various categories. The most prevalent crimes in the county include stealing, affecting 90.4% of the population, and possession of illicit brews, noted in 87.5% of cases. Burglary and housebreaking are also major concerns, impacting 82.7% of the population as depicted in Table 5-25. Other significant issues include stock theft, cattle rustling, gender-based violence, including domestic violence, impacting 51.9% of the community.

Serious crimes such as robbery, including mugging, murder, and robbery with violence impact 30.8%, 29.8%, and 27.9% of the population, respectively, all above national averages. Assault causing actual bodily harm and possession of narcotic drugs are also prevalent, with 34.6% and 36.5% of cases involving these issues. Sexual crimes such as rape and defilement are significant concerns, impacting 25.0% and 35.6% of the population, respectively. Child abuse, including neglect, affects 21.2% of the population, and forgery is also identified as a crime in Siaya County. These high crime rates reflect the serious security challenges faced by the residents of Siaya.

Table 5-25: Siaya County Type of Crime

Crimes	Siaya County	National (Kenya)
Burglary and House Breaking	82.7%	58.7%
Stealing	90.4%	64.5%
Theft of stock (including cattle rustling)	54.8%	37.2%
Possession of illicit brews	87.5%	51.6%
Possession of narcotic drugs	36.5%	34.3%
Assault Causing Actual Bodily Harm	34.6%	34.9%
Murder	29.8%	24.8%
Robbery (Including mugging)	30.8%	26.6%
Robbery with Violence	27.9%	22.5%
Rape	25.0%	19.9%
Gender-Based Violence (Including Domestic Violence)	51.9%	45.4%
Being Drunk and Disorderly	67.3%	49.1%
Defilement	35.6%	31.3%
Theft of Farm Produce	30.8%	23.1%
Child Abuse (including child neglect)	21.2%	26.9%
Forgery	1.0%	0.4%

Source: Crime Research Centre, 2020

Closer to the project area, the Ramula Police Post serves the area by maintaining law and order, ensuring public safety, and providing essential security services to the local community (Figure 5-14.)

Source : KTL, 2024

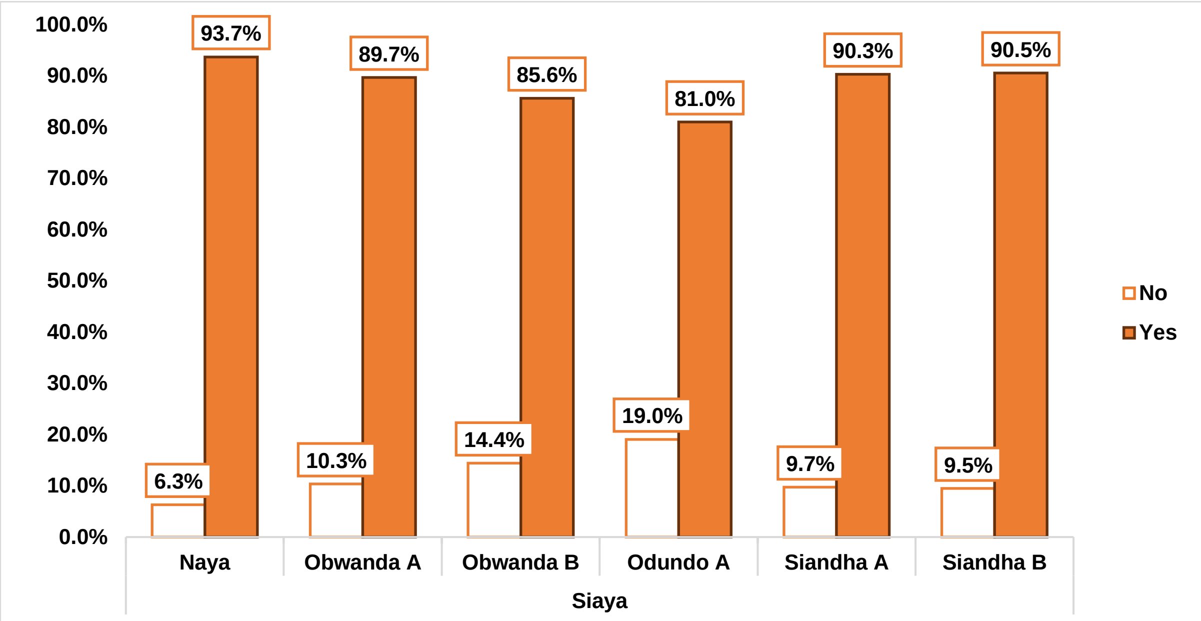
Figure 5-14: Ramula Police Post

The Ramula Police Post has recorded various criminal activities since 2020, reflecting distinct patterns and trends. These crimes include:

- Major assaults: assaults are a significant concern, primarily driven by land disputes, especially conflicts over land boundaries and within polygamous families. These incidents also occur during traditional mourning periods, known as "disco matanga," and are occasionally linked to gold-related disputes. On average, the police handle about 3 assault cases per week, with an increase in incidents toward the end of the year, particularly in November and December, when celebrations and the return of visitors from the diaspora and other regions peak.
- Theft and burglary: Motorcycle theft is common in the area, averaging 4 cases per month, while housebreaking and the theft of household items like electronics and utensils also occur at a similar rate. These crimes are concentrated in certain areas and typically occur during late-night hours.
- Gold ore theft: In 2022 and 2023, gold ore thefts were a notable issue, with an average of 6 cases per year, mostly involving ore stolen before final processing. However, since the introduction of increased police patrols in 2024, no such cases have been reported.
- Defilement and rape: Defilement and rape cases do occur, though many go unreported due to community reluctance to expose victims to further trauma. On average, 3 cases are reported each year, with a spike in incidents during December, coinciding with school holidays.

In the project area, certain locations have been identified as high-risk zones for criminal activities such as motorcycle theft and assaults. Specifically, Ramula-Luanda Road, Luanda-Siaya Road, and Luanda-Yala Road are notable hotspots where these crimes frequently occur. Criminal activity in these areas is most prevalent between 10:00 PM and 11:00 PM, indicating a pattern of elevated risk during late-night hours.

The Socio-economic data indicates that most of the surveyed villages have access to police stations as shown in Figure 5-15. Naya has the highest access with 93.7% of households able to reach a police station leaving 6.3% without access, this reflects strong police coverage in the area. On the other hand, Odundo A has the highest percentage of households (19%) with no access to a police station. This disparity suggests that, while most residents in these areas are well-served by police stations, a notable minority, particularly in Odundo A, may face challenges in accessing police services, potentially affecting their safety and emergency response times.



Source: Panafcon Household Survey, 2024

Figure 5-15: Direct PACs Access to Police Station

5.2.1.9. Road and Transportation

Vihiga County

The transport sector in Vihiga is a major contributor to the county's economy and holds significant potential for growth due to expansion of markets and trading points, increased investments in the "*matatu*[20]" and "*boda boba*" businesses, a rising population and a growing demand for better roads. However, this potential has been hampered by unregulated growth and the absence of a clear policy direction, as highlighted in the Integrated Transport Policy (2023).

[20] Matatu refers to a type of shared minibus or passenger vehicle commonly used for public transportation in Kenya. Matatus are a popular and affordable mode of transport, typically serving specific routes within urban and rural areas.

In response to these challenges, key priorities for road infrastructure development in Vihiga County include scaling up the expansion and maintenance of rural access roads and upgrading selected link roads to bitumen standards.

The sector improved road connectivity by increasing the number of bridges and river crossings constructed from 15 in 2017 to 46 in 2022. Concerning the upgrade of roads to bituminous standards, the county increased its road length from 191 km up to 206 km. The upgraded roads include: 2.8 km of the Mbale-Munoywa Road tarmacked under the Kenya Urban Support Programme (KUSP), Gisambai-Shamakhokho, Ekwanda, Luanda, Esirulo, Magada- Bukuga, Ebusyubi, and Epuche-Esiandumba roads under Kenya Rural Roads Authority (KeRRA) (Vihiga CIDP, 2023-2027).

Siaya County

Siaya County has made significant strides in improving its transport and communication infrastructure, crucial for facilitating economic activities and connectivity within the region. The county's transport development initiatives focus on expanding and upgrading road networks to enhance accessibility. Notable achievements include the construction of new roads, maintenance of existing ones, and upgrading critical road segments to bitumen standards. The county has also invested in building and maintaining bridges to support local transportation needs (Siaya CIDP 2023-2027).

As the economy and population within Siaya County continues to grow, there is a corresponding increase in both intra- and inter-regional freight and passenger transportation demands. This economic growth necessitates a robust, efficient, and expansive transport network to facilitate the movement of goods and provision of services (ibid.). Additionally, the mining sector’s operations will rely heavily on a viable transportation system and well-maintained access roads to support its activities.

Closer to the Project area, data from the socio-economic survey reveals that the most commonly used mode of transportation is boda boda with an overall usage rate of 70.1%. This mode of transport is especially prevalent in Odundo A and Siandha A, where 81% and 80.6% of the households, respectively, rely on motorcycles. Walking is the second most common mode of transport, utilized by 23.8% of the population across all villages, where the highest use in all of the villages is Naya with 30.5% of household members using this mode of transport. Public transportation is notably less prevalent in the area and personal vehicles and taxis are the least utilized mode of transport as indicated in Table 5-26Table 5-26-.

Table 5-26-: Direct PACs Transport Services

Villages	Bodaboda	Walking	Bicycle	Personal vehicle	Public transport	Taxi	Other
Naya	64.4%	30.5%	0.0%	1.7%	2.3%	0.0%	1.1%
Obwanda A	72.4%	20.0%	1.4%	2.1%	0.0%	0.0%	4.1%

Villages	Bodaboda	Walking	Bicycle	Personal vehicle	Public transport	Taxi	Other
Obwanda B	69.5%	22.0%	0.0%	0.8%	1.7%	0.0%	5.9%
Odundo A	81.0%	19.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Siandha A	80.6%	15.4%	0.6%	0.6%	0.6%	0.0%	2.3%
Siandha B	64.0%	29.4%	1.4%	0.0%	2.4%	0.5%	2.4%

Source: Panafcon Household Survey, 2024

Implications

The heavy reliance on bodaboda and walking for transportation in the direct PACs indicates a need for improved road infrastructure to support efficient mining operations and better access for local communities. The ongoing expansion and upgrading of roads in Vihiga County, including the increase in bituminous roads, align with these needs. Addressing these infrastructure needs will not only facilitate the mining operations but also enhance transportation options for residents, supporting overall economic development in the region.

5.2.1.10. Recreation and Associations

Vihiga County

Sports play a significant role in Vihiga County, where football, athletics, and volleyball are among the most popular activities. The county has a strong tradition of nurturing talented athletes who have represented Kenya in international competitions. Local sports clubs and tournaments provide important platforms for developing sporting talent and fostering healthy competition. Vihiga County has also invested in recreational facilities, including public parks, playgrounds, and sports fields. These amenities offer residents valuable spaces for leisure and social interaction, contributing to both physical and mental well-being and strengthening community bonds (Jua Kenya, n.d.; Siaya County CIDP 2023-2027).

Siaya County

In Siaya County, sports and recreational activities are integral to community life, supported by a network of sports facilities such as stadiums and sporting grounds. Popular sports include football, athletics, and volleyball, with local sports teams participating in regional and national competitions. The county also offers various recreational spaces, including parks, playgrounds, and community centers, which facilitate leisure activities and social interactions among residents. These facilities and activities play a significant role in enhancing quality of life and promoting community engagement in Siaya County (Jua Kenya, n.d.; Siaya County CIDP 2023-2027).

5.2.2. Employment and Livelihood Activities

5.2.2.1. Employment

Employment can be defined as either being regular (often referred to as “formal”) or non-regular (informal). Employment figures usually report only on those households between the internationally accepted working-age population brackets of between 18 and 64 years. Regular employment refers to work for which an employee has a formal and fixed contract with an employer (also referred to in some instances as being employed in the formal sector). Such work is usually long-term or without a fixed period, and could entail being employed by a company, the retail sector or even domestic work. Non-regular employment relates to a range of jobs that are usually short-term and mostly without a formal contract, but for which some form of remuneration is obtained. This often includes trading, small shops, or even carpentry, and some type of farm work that is paid.

Vihiga and Siaya Counties

Table 5-27 provides the employment status of the working-age population within both counties. As shown, data from the KNBS Population and Housing Census (2019) indicate that, in Siaya County, 53% of population between 18 and 64 years of age are employed. Of these, slightly more females are employed than men (28%, compared to 25%). In Vihiga, less people in this age groups are employed (44%: this includes self-employed farmers), with more women being employed once again. One possible reason for more women being employed could be the agricultural and tourism industries dominating the area. Within these industries, women are typically more involved.

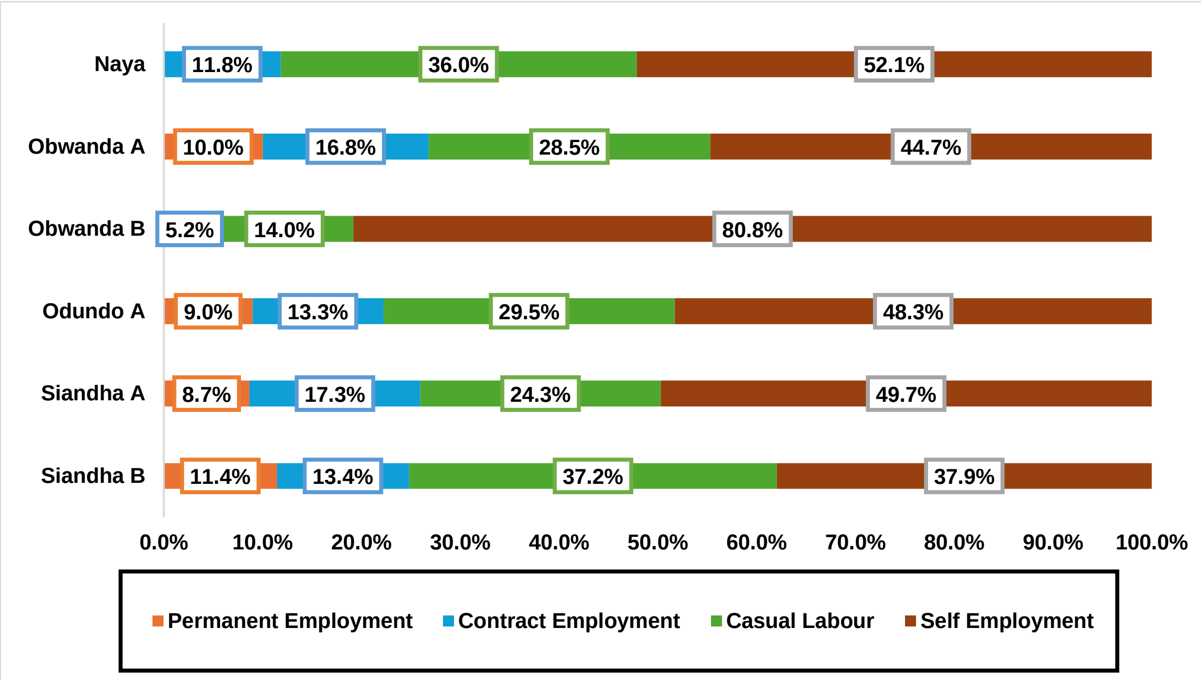
Table 5-27: County-Level Employment and Unemployment Rate by Gender

Employment by Gender	Siaya County	Vihiga County
Female seeking work	2.0%	4.0%
Male seeking work	2.0%	4.0%
Employed female	28.0%	23.0%
Employed male	25.0%	21.0%
Not economically active female	20.0%	25.0%
Not economically active male	18.0%	20.0%
Unspecified: Female	2.0%	2.0%
Unspecified: Male	2.0%	2.0%

Source: KNBS (2019)

Closer to the Project site, households were asked about the employment status. The data obtained during the surveys reveals that most households are self-employed compared to other employment categories, mentioning that they are involved in activities such as selling livestock, agricultural related products, and natural resources. Self-employment can be defined as any person who is an adult (over 18 years) that is having a business (including informal) and not relying on employer.[21]

As illustrated in Figure 5-16, Obwanda B had the largest population that is self-employed (80.8%) between 18 to 64 years, followed by Naya with 52.1%. There is a notable casual employed population within the direct PACs, Siandha B had the highest people with casual employment (37.2%) followed by 36.0% in Naya. Youth employment, as noted during the FGD, is predominantly self-employment. The employment figures in the direct PACs are likely to increase, particularly permanent and contract-based employment that isn't prominent in these areas. This is attributed to the Projects' anticipation to contributing to employment opportunities in the direct PACs.



Source: Panafcon Household Survey, 2024

Figure 5-16: Direct PACs Employment Categories

5.2.2.2. Economic Sectors

According to the Vihiga CIDP (2023-2027), the major economic activities that drive the county's economy include cottage industries, subsistence farming, tea farming, horticulture, livestock farming, wholesale and retail trade, quarrying, and mining. As more young people enter the workforce owing to rapid population changes, pressure on available employment opportunities is expected to increase. The counties are also characterized by high poverty, which manifests itself in other socio-economic outcomes such as poor nutrition, health, and access to education.

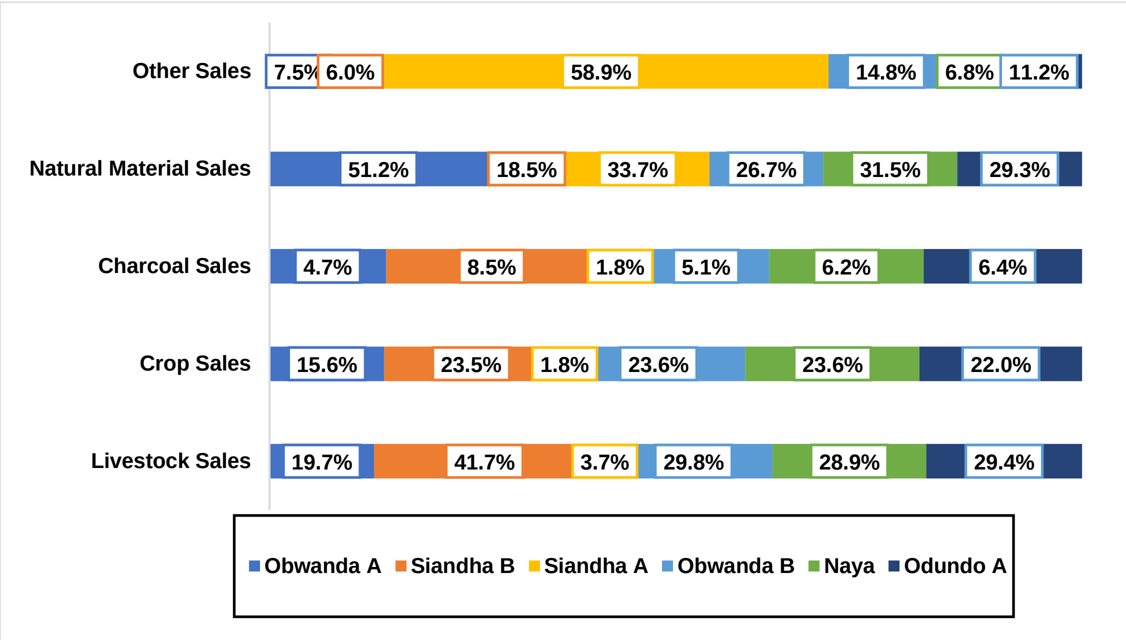
[21] https://africapay.org/kenya/career/self-employment

Siaya CIDP (2023-2027), alternatively outlines that most of its population are employed within the fishing, tourism, and agricultural sectors. There are limited opportunities in commercial ventures and public services. The survey data indicated the economic sectors in which most of household participate as part of their livelihood.

5.2.2.3. Household Income

Siaya County

Figure 5-17 provides the household incomes based on the household surveys conducted of the direct PACs. As shown, income from livestock sales is the highest in Siandha B (41.7%) and Odundo A (29.4%) compared to other villages. Household Income sources from sales of natural materials such as products from artisanal mining, fishing, and wood are prominent in Obwanda A accounting for 51.2%. Some households within the direct PACs rely on crop sales, this is more prevalent in Obwanda B and Naya, both accounting for 23.6% which is higher compared to other villages. Furthermore, the survey data indicates that households from Sianda A (58.9%) generate income from other sources. This cannot be compared to the broader income sources at county and sub-county level due to limited data.



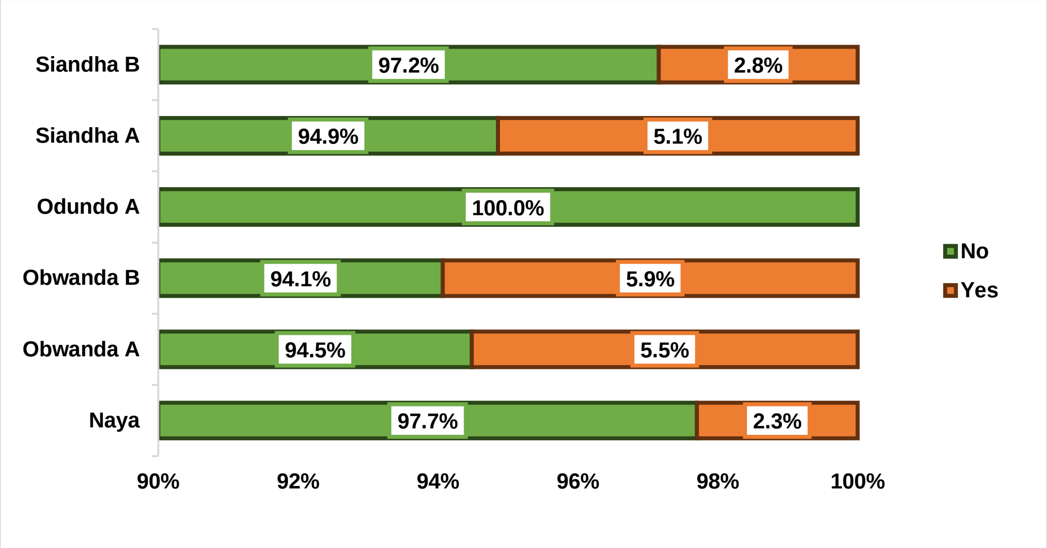
Source: Panafcon Household Survey, 2024

Figure 5-17: Direct PACs Household Income

5.2.2.3.1. Household Property/ House Rental

Households were also asked if they rent out some of their properties/houses to generate income. Most households mentioned that they do not rent out houses. However, some households in Obwanda A (5.9%), Obwanda A (5.5%) and Siandha A (5.1%) had the highest proportion of households sourcing income from house rentals, the least households renting houses can be found in Siandha B (2.8%) and Naya (2.3%) as depicted in Figure 5-18. The

Project is likely to attract migrants from other counties and sub-counties, this might increase housing demands in the direct PACs, and house rental can become prominent.



Source: Panafcon Household Survey, 2024

Figure 5-18: Direct PACs Household Property/Housing Rentals

Implications

The introduction of mining in the area could significantly impact local employment and economic activities in Siaya and Vihiga counties. By diversifying the economy beyond agriculture, fishing, and tourism sectors, the mining sector may create new job opportunities and skills development. This diversification could help alleviate pressure on existing employment opportunities, reduce poverty levels, and contribute to overall economic growth. However, disparities in employment and income sources across the six PACs highlight the need for targeted interventions to ensure equitable benefits from the mining project, as some areas, like Odundo A, show minimal engagement in current economic activities.

5.2.2.4. Household Expenditure

Siaya County

According to the surveys conducted, households were asked to provide information on household expenditures, the data revealed that most households spend their income on food. As shown in Figure 5-19, Siandha B had the highest households spending on food items (53.9%) compared to other villages, and other households within the village have their spendings on agricultural crops (12.2%). Notably, a significant 25.3% of the population of Obwanda B village spends some of their income on medical expenses, which is the highest compared to other villages. Additionally, households indicated to have expenditures on food, transport, school feels, clothes, energy, water, and agriculture livestock, although these were not prominent compared to other household expenses.

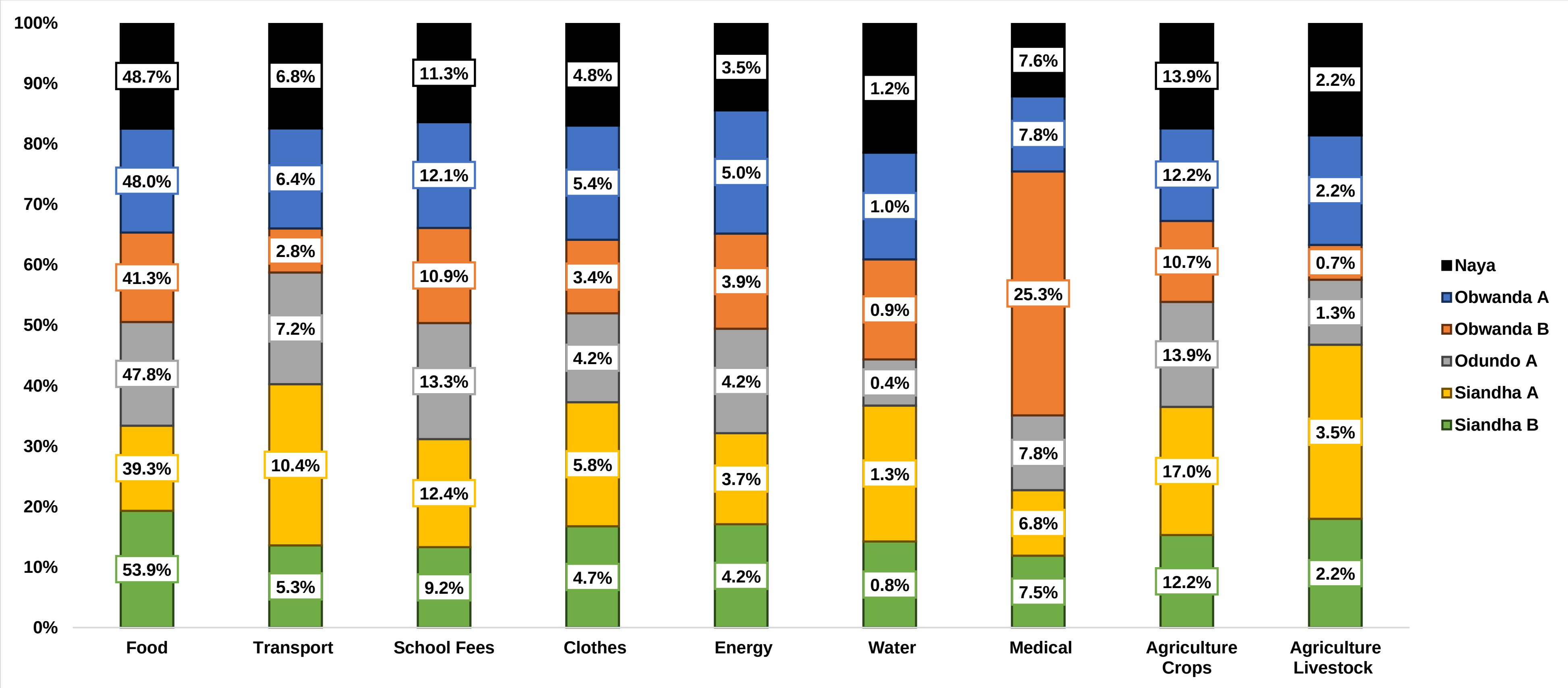


Figure 5-19: Direct PACs Household Expenditure

Source: Panafcon Household Survey, 2024

5.2.2.5. Livelihood Activities

This section provides the household activities within the direct PACs.

Siaya County

The socio-economic survey conducted in Ramula Sublocation within Siaya County reveals diverse engagement in livelihood activities across the six PACs. As summarised in Table 5-28, the prevalent livelihood activities in most of the direct PACs include wood harvesting. This form of livelihood is prominent in Odundo A (40.7%) followed by 37.0% of Obwanda A, then 36.4% in Obwanda B, 35.0% in Siandha B, and the least can be found in Siandha A with 26.9%.

Some of the households indicated to be involved in harvesting medicinal plants, most of these are in Odundo A (25.4%) and Obwanda B (23.1%). Furthermore, Obwanda B (24.2%) had households involved in animal bird harvesting, which was higher compared to other villages.

This correlates with the household income (see Table 5-28), indicating that some households within direct PACs depend on natural materials as their sources of income. This means that household livelihood activities also form part of the general household income within the affected villages.

The Project footprint might have an influence on the livelihood activities of the direct PACs. However, applicable measures to curb the severity of the impacts can be implemented.

Table 5-28: Direct PACs Livelihood Activities

Siaya County						
Activities	**Siandha B**	**Siandha A**	**Odundo A**	**Obwanda B**	**Obwanda A**	**Naya**
Harvest Fish	1.1%	3.0%	0.8%	3.0%	0.0%	1.0%
Harvest Wood	35.0%	26.9%	40.7%	36.4%	37.0%	29.5%
Harvest Wild Fruits	9.9%	14.2%	5.1%	9.1%	4.8%	12.9%
Harvest Medicinal Plant	15.7%	16.2%	25.4%	9.1%	23.1%	19.2%
Harvest Grass	22.3%	21.3%	20.3%	18.2%	21.6%	21.5%
Harvest Animals Birds	16.1%	15.7%	7.6%	24.2%	13.0%	15.9%
Harvest Sand	0.0%	2.5%	0.0%	0.0%	0.5%	0.0%

Source: Panafcon Household Survey, 2024

5.2.2.5.1. Natural Resource Use

The socio-economic data collected from the direct PACs indicates that most households harvest wood and a smaller proportion reported to harvest medicinal plants as part of their livelihood activities (refer to Table 5-28). Therefore, households were asked to provide information on the use of their natural resources. As summarised in Table 5-29, households reported to use these for their own consumption, selling, and both.

A portion of 19.0% of the Naya population sell and consume wood, higher compared to other villages. While 15.0% consume medicinal plants. In Siandha A, most households reported consuming medicinal plants (19.2%) and at least 10.5% sell and consume wood. Further, notably 15.3% of the Siandha B household also sell and consume wood.

Further insights from the FGDs reveal that traditional medicines are used in the community. Traditional medicinal plants, including ajua (*Ajuga*), *oketa*, arubaine *(Azadirachta indica)*, angwe *(Tagetes minuta),* nyalwetikwach, ochuoga, and ogaka *(Aloe kedongensis)*, are commonly gathered from local forests and bushes. It is evident that natural resources within direct PACs play an important role in contributing to the household income and general livelihood of the affected areas.

Table 5-29: Direct PACs Natural Resource Use

Village	Wood Use	(%) Proportion	Medicinal Plant Use	(%) Proportion
Naya	Consume	4.8%	Consume	15.0%
	Sell	1.6%	Sell and consume	5.1%
	Sell and consume	19.0%	-	-
Obwanda A	Consume	3.2%	Consume	8.9%
	Sell	2.7%	Sell	0.5%
	Sell and consume	8.3%	Sell and consume	5.6%
Obwanda B	Consume	5.1%	Consume	12.1%
	Sell	1.3%	Sell and consume	1.9%
	Sell and consume	6.2%	-	-
Odundo A	Consume	0.8%	Consume	1.4%
	Sell and consume	2.4%	-	-
Siandha A	Consume	6.7%	Consume	19.2%
	Sell	3.5%	Sell	0.5%
	Sell and consume	10.5%	Sell and consume	2.8%
Siandha B	Consume	5.4%	Consume	14.5%

	Sell	3.2%	Sell	0.9%
	Sell and consume	15.3%	Sell and consume	11.7%

Source: Panafcon Household Survey, 2024

5.2.2.5.2. Agriculture

Agriculture sector in Kenya plays a vital role in the rural economy contributing 33 per cent of the Gross Domestic Product (GDP) and another 27 per cent of GDP indirectly through linkages with other sectors. The sector employs more than 40 per cent of the total population and more than 70 per cent of Kenya's rural people. The sector accounts for 65 per cent of the export earnings, and provides the livelihood (employment, income and food security needs) for more than 80 per cent of the Kenyan population and contributes to improving nutrition through production of safe, diverse and nutrient dense foods (FAO, 2024).

According to the Vihiga CIDP (2023-2027), agriculture is the backbone of the county's economy contributing over 34% of its Gross County Product (GCP), and accounting for 80% of both direct and indirect employment. Alternatively, Siaya CIDP (2023-2027) also outlines that the agricultural sector is the backbone of the county's economy and supports the livelihoods of over 80% of the rural population. It further contributes over 60% to household incomes. The sector contributes to economic and social development through:

- Enhancing food security;
- Income generation; and
- Employment, and wealth creation.

The county's main economic activity is agriculture comprising of crop and livestock production as well as fishing. Crop and livestock production in the area is largely subsistence with a key focus on maize, beans, cassava, finger millet, sweet potatoes, bananas, tomatoes, sorghum, cattle, sheep, goats and chicken.

The agricultural sector also contributes significantly to socio-economic growth and development through forward and backward linkages with other priority sectors of the economy.

5.2.2.5.3. Livestock Husbandry

Siaya and Vihiga CIDPs (2023-2027) outlines that livestock farming and production are some of the key economic generators in these Counties with the objective for livestock and fisheries industry to provide sustainable food security and income generations.

Data from the KNBS Crop and Production Survey Report (2014) indicates that both counties are having Keinyeji chicken as the most common farming activities, Siaya County accounting for 43% and 73% for Vihiga County, this is followed by Cattle meat productions with 26% for Siaya County and 12% for Vihiga County, and Goat meat accounting for 14% in Siaya County as illustrated in Table 5-30. Mining activities require land availability for its operations, and mining infrastructure development which can result in potential relocation of existing activities that can have economic implications in the County.

Table 5-30: County-Level Livestock Husbandry

Livestock	Siaya County	Vihiga County
Broilers	3.4%	0.1%
Cattle dairy	0.3%	4.1%
Cattle meat	26.2%	12.9%
Donkeys	0.4%	0.1%
Ducks	0.0%	0.3%
Geese	0.0%	0.4%
Goat dairy	0.2%	0.7%
Goat meat	13.8%	0.3%
Guinea fowl	0.0%	0.2%
Guinea pigs	0.0%	0.3%
Hives KTBH	0.1%	0.1%
Hives lang	0.4%	0.2%
Hives log	0.0%	0.1%
Kienyeji	42.7%	75.3%
Layers	2.1%	0.9%
Others	1.3%	0.0%
Pigs	0.7%	0.2%
Quails	0.0%	0.4%
Rabbits	0.7%	1.2%
Sheep hair	7.6%	1.8%

Source: KNBS (2019)

Closer to the Project area, households were asked to provide information on livestock within their homestead. As indicated in Table 5-31, animal husbandry is a significant livelihood activity practiced by most of the direct PACs. The household survey data shows that most of the households have chicken, these are more prominent in Siandha B (64.8%) followed by 64.1% of Obwanda B. Cattle is the second highest form of livestock husbandry with PACs, with Siandha B (16.1%) and Naya (15.7%) having the highest compared to other villages.

Table 5-31: Direct PACs Livestock Husbandry

Livestock	Naya	Obwanda A	Obwanda B	Siandha A	Siandha B
Cattle	15.7%	11.6%	13.8%	16.1%	13.1%
Goats	5.6%	6.9%	7.3%	6.2%	6.0%
Sheep	9.3%	6.6%	2.7%	5.6%	4.5%
Chicken	56.4%	62.9%	64.1%	55.0%	64.8%
Duck	0.4%	2.9%	1.6%	2.9%	1.1%
Turkey	0.0%	0.2%	0.0%	0.0%	0.0%
Fowl	0.0%	0.2%	0.0%	0.4%	0.0%
Pigs	1.8%	0.9%	0.7%	2.1%	0.5%
Dogs	4.9%	3.8%	4.1%	5.4%	5.3%
Cats	6.0%	4.1%	5.8%	6.3%	4.5%

Source: Panafcon Household Survey, 2024

5.2.2.5.1. Crop Farming

The Vihiga County CIDP (2023-2027) indicates that the arable land is 404.8 Km^2 being 76% of the County's area coverage. The main crops in the county include tea, coffee, bananas and horticulture crops. Other food crops include maize, beans, cassava, sweet potatoes, vegetables, millet and sorghum. The majority of farmers plant at least two crops for food through intercropping during the long rains (April-June) and short rains (September-November).

Siaya County is characterized by high poverty levels (47.5%) and food insecurity. Agriculture is the main source of livelihood in the County, contributing about 60% of the household income and providing almost 61% of all employment opportunities. According to the Agricultural Sector Development Support Programme (ASDSP), at least 37.3% of households are engaged in crop and/or livestock farming (GoK, 2014). The main food crops include maize, beans, sorghum, millet, cowpeas, sweet potatoes and ground nuts while the main cash crops include cotton, rice, sugarcane, and ground nuts. Both family and hired labour, comprising mainly women and youth, is used at all nodes of each value chain.

5.2.2.5.2. Mining

Mining is a significant industrial sector in Kenya, contributing to the national economy through the extraction of a variety of minerals. The sector encompasses both large-scale and artisanal mining operations. Kenya's mining industry includes metals such as gold, titanium, and iron ore; industrial minerals like soda ash, and limestone; and fuel minerals such as coal. In recent years, there has been a notable increase in mineral exploration and development across various regions, leading to substantial foreign and local investments in the sector (Kenya Mining Investment, 2023).

Artisanal and Small-Scale Mining

Artisanal and Small-Scale Mining (ASM) is particularly widespread in Kenya, providing livelihoods for many. This sector is critical for local economies, especially in regions like Vihiga and Siaya counties, where high-value minerals, primarily gold, are extracted. According to the Kenya Minerals and Mining Policy (2024), ASM is instrumental in income generation but faces challenges such as outdated technology, limited resources, and complex regulations.

Vihiga County

In Vihiga County, according to the Vihiga CIDP (2018-2022), small-scale gold mining is concentrated in Luanda South, Izava/ Lyaduywa, South Maragoli, and Muhudu wards. Gold prospecting also takes place in Kichutu, Viyalo, Chavakali, and Shiru wards. This sector, while vital for the county's economy, faces technological constraints, a lack of modern equipment, and formalization challenges. Local miners rely on middlemen to export granite rocks for processing into building materials. Moreover, unexploited mineral reserves, such as sulphide and photolytic rocks, offer potential for expanding the sector, if adequately exploited.

Siaya County

The Siaya CIDP (2023-2027) identifies deposits of precious minerals, including gold in Bondo, Alego Usonga, Rarieda, Ugunja, and Ramula in Gem Sub-County. In Ramula, ASM is predominantly focused on gold extraction. Although this activity plays a crucial role in providing employment and income to the local population, it remains largely informal and underdeveloped. Other significant resources in Siaya include fluorite, granite, and black sand, which have yet to be fully exploited.

Closer to the project area, the FGD data reveals that most participants involved in ASM in the project area have lived in the area for most of their lives, with many being born locally. Migration into the area is common, especially from neighboring counties like Migori and Kakamega, as well as from countries such as Uganda and Tanzania.

The influx of people seeking opportunities in gold mining and related businesses has changed the local economy, contributing to the development of infrastructure, shopping centers, and enhanced mining skills. However, challenges persist, including increasing conflicts over resources and concerns that local community members, particularly those involved in gold mining, are not adequately consulted when it comes to local employment opportunities.

Artisanal mining, alongside small-scale farming and local businesses, remains the main source of livelihood for the local population. Yet, the artisanal miners point out that the unregulated nature of ASM hinders its growth. Many believe that with appropriate support, especially from the Ministry of Mining, the sector could be formalized, allowing for more efficient and safe operations. Currently, gold is sold to local traders, but there is little awareness among miners about the final destinations of their products. Issues such as exploitation, poverty, insecurity, and exposure to hazardous materials like mercury are common among miners.

Most artisanal miners possess primary education, with a notable number holding secondary school certificates and a few with tertiary education. The community also possesses a range of informal skills that support mining activities, including carpentry, gold detection, and excavation using basic tools. Additionally, there are available skills in farming, fishing, driving, and operating equipment. However, the lack of formal training and modern tools means that the sector remains largely underdeveloped.

Safety concerns in ASM are prevalent, with miners exposed to risks such as accidents, electrocution, and harmful gases without adequate safety measures. While no major conflicts have been reported, the potential for safety issues remains a significant concern as mining activity grows. Additionally, community fears regarding proposed resettlement and relocation plans tied to the mining project underscore the importance of transparent communication and equitable treatment for those affected.

Implications

The Project may affect various livelihood activities which are crucial to the local economy. The region also has significant ASM, particularly in gold extraction, which supports local income and employment. As mining infrastructure develops, it could disrupt these sectors and impact food security and livelihoods. Ensuring that the growth of both formal and artisanal mining is managed effectively, alongside the sustainability of agriculture and livestock, is essential for maximising benefits to the community while minimizing negative effects.

5.2.2.6. Fishing

Fisheries play a vital role in Kenya, supporting the livelihoods of over 700,000 people and making a significant contribution to the country's food security and economy. Kenya's marine fisheries are primarily located along the Indian Ocean coast and include artisanal, industrial, and recreational activities. Inland fisheries are centred around lakes, rivers, and dams, with Lake Victoria being the most prominent.

The Vihiga CIDP indicates that the County has 2,819 farmers engaged in aquaculture activities, most of whom practice semi-intensive farming through fishponds. The fishponds cover a total area of 84.57ha with the main fish species being tilapia and catfish. The county also has one private fish hatchery in Hamisi Sub- County and one private cottage fish feed producer based in Luanda.

Fishing is also a major economic activity in Siaya County, offering significant opportunities for both local consumption and export markets. Located along the shores of Lake Victoria, the county is well-positioned to leverage its resources for fish farming and harvesting (Siaya County CIDP, 2023-2027).

According to the information obtained during the surveys, households reported to be harvesting fish as part of their livelihood activity, although this is not prominent in the direct PACs. Some households indicated using fish product for selling or their own consumption.

5.2.2.7. Small Business

Small businesses play a vital role in the local economy, encompassing a diverse range of enterprises such as tailoring services (including knitting and clothing repairs), welding, motorcycle transportation, mobile money services like M-Pesa, and food services like small restaurants and roadside snacks. From the consultations conducted, the community believes that their businesses significantly contribute to the local economy through job creation and tax revenues, which stimulate overall economic growth.

With the anticipated Project, there is optimism that the demand for essential services, such as food and shelter for project employees, will further propel business growth. However, these businesses face safety concerns, including vandalism of premises, motorcycle theft, and nighttime mugging, which sometimes involve business owners. Despite resources and market competition, there is generally peaceful coexistence among business people. Participants in the focus group discussions (FGDs) emphasized the need for support from Shanta Gold, particularly in areas such as purchasing local materials, contracting local services, and providing capital to enhance their operations.

5.3. Vulnerability

Vulnerability can be defined as: "*The characteristics determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards*" (UNDRR[22], 2022).

Closer to the project area, several vulnerable groups have been identified through Focus Group Discussions (FGDs), including the elderly, disabled, widows, children, and young girls. These groups face a range of socio-economic and health-related challenges, making them more susceptible to risks.

The elderly, according to FGD participants, face multiple challenges due to their weakened immune systems, chronic health conditions, and lack of regular income. These factors limit their access to essential services such as healthcare, food, and shelter. Additionally, elderly individuals may be at risk of displacement due to the project, which could worsen their living conditions unless targeted interventions are implemented.

Disabled individuals are economically disadvantaged, often excluded from employment opportunities, and face significant barriers to accessing services like healthcare and education. FGDs revealed that they frequently encounter discrimination and are rarely involved in decision-making processes. Their vulnerabilities are further compounded by

[22] United Nations Office for Disaster Risk Reduction

security concerns such as theft and vandalism, which exacerbate their difficulties in achieving economic independence.

Widows, as highlighted in FGDs, face social exclusion, particularly regarding land ownership and inheritance rights. Many widows lack title deeds to the land they occupy, making them vulnerable to land disputes and displacement. They also face economic hardships, relying primarily on small-scale farming, artisanal mining, and informal businesses to support their families. Orphans, often cared for by widowed relatives, face similar struggles, including limited access to education and healthcare, which increases their susceptibility to child labor and other risks.

Young girls and children are vulnerable to early pregnancies, school dropouts, and health risks such as malaria, according to both men's and women's FGDs. Girls, in particular, face the added threat of sexual violence, which further marginalizes them and limits their ability to access educational and economic opportunities.

The youth also expressed concerns about exclusion from community decision-making processes and a lack of consideration for their interests. Their vulnerability stems from limited job opportunities, which could be exacerbated by the project if displacement occurs.

To address these vulnerabilities, the FGDs underscored the need for the West Kenya Project to implement specific support measures. These include the provision of health services, job creation opportunities, training in skills development, and scholarships to support the education of orphans and young girls. Furthermore, ensuring that vulnerable groups are actively included in decision-making processes will be essential for mitigating the risks posed by the project and guaranteeing equitable access to its benefits. By undertaking targeted CSR initiatives and fostering inclusive engagement with these communities, the project can play a pivotal role in enhancing the resilience and economic empowerment of vulnerable populations.

5.4. Women and Gender Issues

Kenya has made significant progress in legal frameworks for gender equality, especially in property, inheritance, and political representation. However, cultural norms still limit women’s access to land and leadership roles. For example, women own only 1% of registered land titles, with 95-99% of freehold land owned by men. In many areas, male kinship controls land access.

Traditional norms also restrict women’s participation in decision-making, political roles, and economic opportunities. Gender-based violence (GBV), and early marriage remain widespread. Women face barriers in accessing credit, education, and health services, as men often dominate household decision-making and control assets. Women’s labor force participation is high, but they are largely concentrated in unpaid family labor or low-paying sectors, with fewer opportunities in higher-paying fields like Science, Technology, Engineering, and Mathematics (STEM). Gender gaps in political and corporate leadership also persist, with women holding only 6% of CEO positions in companies listed on the Nairobi Stock Exchange (USAID, 2020).

The Project Social Area of Influence (AoI) within Siaya and Vihiga counties is not exempt from the gender-related issues prevalent in the region. FGD data reveals that women face significant challenges such as early pregnancies among daughters, polygamy-related land disputes, inadequate access to water and sanitary facilities, limited job opportunities, and minimal representation in local leadership, which sidelines them in decision-making, particularly around land and assets. Human rights issues like gender-based violence, child labor in artisanal mining, and early marriages also persist. These issues, combined with the limited participation of women in land ownership, economic activities, and their increased responsibilities in agriculture and household food security, underscore the urgent need for gender-sensitive approaches in the project's implementation to ensure women's inclusion and protection.

Implications

For the Ramula-Mwibona mining project, it is crucial to consider the deeply rooted gender roles in the local communities. While promoting gender equality in employment is important, it must be approached with sensitivity to traditional expectations and practices. Disrupting established gender norms could lead to conflict or gender-based violence. Therefore, a careful monitoring and evaluation process, alongside a labor grievance mechanism, is essential to navigate these complexities and mitigate potential issues.

5.5. Community Needs

Vihiga County grapples with increasing population pressures leading to competition for land and constraints on infrastructure development. Rapid urbanization has strained the county's ability to expand and improve roads, water, and sanitation services. Rural communities also face challenges with inadequate energy supply, impacting their quality of life and economic potential. Additionally, there is a need for enhanced educational provision to address gaps in literacy and skill development.

Similarly, In Siaya County, significant socio-economic challenges include inadequate access to clean water, with many households relying on unimproved sources and basic treatment methods such as adding bleach or chlorine. Sanitation issues persist, with some households using makeshift facilities. Energy distribution remains a significant issue, as rural areas predominantly depend on wood and rudimentary lighting methods. Low education levels, high unemployment, and widespread poverty further exacerbate the difficulties faced by the local population.

6. Stakeholder Engagement Activities

6.1. Introduction

Stakeholder engagement has been undertaken in alignment with the EMCA, amended in 2015 and 2019, as well as Industry good practice guidelines for stakeholder engagement. Consultation with interested and affected stakeholders is a key aspect of the ESIA process and critical to the success of the Project. Therefore, meaningful stakeholder engagement throughout the Project cycle is essential and provides stakeholders an opportunity to comment on the proposed Project as well as on the specialist studies produced. This enables the affected communities to provide local knowledge and be a part of the solutions to mitigate impacts or implement management and monitoring measures.

Engagements have been held with Village elders, landowner/farmers, traditional leaders, representatives of the communities, potential vulnerable groups such as women and youth have been consulted to understand their specific issues and concerns. This enables meaningful participation with all levels in the communities. The findings and recommendations are discussed and disclosed in an open and transparent manner with the affected people to solicit their comments and suggestions in the studies.

The following section outlines the objectives for stakeholder engagement as well as activities undertaken during the scoping phase to announce the Project to interested and affected parties.

Deliverables that were presented in public/community meetings included Microsoft Power Point presentations in local languages(s) with key Project messages including:

- Capacity building (employment, contracting);
- Activities to be undertaken as part of the Project; and
- Infrastructure development.

Shanta Gold has made consented efforts towards engaging stakeholders at the national and county government level and some general engagements through the Environment Health and Safety Committee. The engagements for Ramula Siaya and Vihiga Counties have been related to the following:

- Overview of the feasibility study;
- Planned and ongoing monitoring campaigns for environmental parameters;
- ESIA processes; and
- RAP processes.

6.2. Objectives of Stakeholder Engagement for the EIA

The basic principles of the engagement process was to ensure that the ESIA and engagement process is inclusive, culturally sensitive, and transparent. The aim of effective stakeholder engagement during ESIA process is to provide a platform where stakeholder's considerations (views, issues of concerns and recommendations) are taken into consideration to improve management of the environmental and social sustainability of Projects. Therefore, the objectives of the engagement process are:

- To undertake stakeholder Identification and Analysis of all interested and affected parties;
- To assess the level of stakeholder interest and support for the Project and to enable stakeholders' views to be taken into account in Project design, construction and operation period for enhanced environmental and social safeguard performance;
- To promote and provide means for effective and inclusive engagement with Project-affected parties throughout the Project life cycle on issues that could potentially affect them;
- To disclose appropriate Project information on environmental and social risks and impacts to stakeholders in a timely, understandable, accessible, and appropriate manner and format; and
- To provide Project-affected parties with accessible and inclusive means to raise issues and grievances and allow Shanta Gold to respond to and manage such grievances.

6.3. Publicising the Project

The Project notification process was undertaken by the Stakeholder Engagement team, all interested and affected stakeholders as mapped in the stakeholder engagement plan were informed of planned meetings. The Notifications was delivered in English, Swahili, and local languages as appropriate. Notices were given to stakeholders in compliance with the statutory requirement of 7 days as a minimum. Notifications were implemented using a combination of letters, email, posters in strategic locations and radio advertisements as appropriate. The key notification methods that was used for different types of stakeholder meetings are as follows:

- *National and county levels of engagement*: Formal letters, emails, and telephone follow-up;
- *Parastatals one-on-one meetings*: Formal letters, emails, and telephone follow-up; and
- *Community Barazas*: posters in strategic places such as marketplaces, chief's offices, or churches/mosques; radio advertisements on local radio stations and verbal announcements from chiefs in other local forums.

6.4. Engagement Methods

The following stakeholder engagement methods were used, including, but not necessarily be limited to, the following:

- **Workshops**: These were used for structured meetings at the national and county levels of engagement. They offer an opportunity to inform stakeholders on Project details, respond to queries and receive comments;
- **One-on-One consultations**: These were focused on key resource institutions and individuals with the intention of receiving informed opinions as well as strategic knowledge such as empirical monitoring and other data, community-based knowledge, policy, and programme positions;
- **Public barazas**: These piggybacked on the already existing structures being utilized by SGKL for comfort and easy access. The barazas are typically held in the open air or within appropriate community buildings such as halls or schools and provided a forum for the ESIA team to inform community members of the Project and its attributes as well as to receive community feedback and comments on the Project; and
- **Focus group meetings:** These meetings targeted special interest groups and vulnerable groups identified for by the ESIA team for focused issue-specific consultation.

6.4.1. One on One Meetings

During the stakeholder identification and mapping process, the ESIA consultant identified the following lead agencies, county governments departments and Organizations relevant to the proposed project.

- Kenya National Highways Authority, Nyanza Region;
- Kenya Urban Roads Authority (KURA), Nyanza Region;
- Kenya Power & Lighting Company (KPLC) Kisumu;
- National Environment Management Authority (NEMA), Siaya County;
- State Department of Mining, Kisumu;
- County Planning Office, Siaya County;
- Kenya Rural Roads Authority (KeRRA), Siaya County; and
- Directorate of Occupational Safety and Health Services (DOSHS), Siaya County.

6.4.2. Notification Workshops

Further notification workshops regarding the project were held with Vihiga County Executive Committee Members and with Vihiga & Siaya Local NGO, Civil Society, Faith Based Organization and with Schools Associations.

6.4.3. Public Baraza Meetings

A total of 8 public baraza meetings were held in Siaya and Vihiga Counties from February to August 2024. Community living within 3km radius were informed and invited to the Baraza via the Chief, village elders and public notices placed in the public area. The Consultants (a Sociologist and Environmentalist) together with the proponents team were in attendance to provide information to the public and to receive and address comments. The meeting Agenda included the following:

- Description of the project (project design and location);
- The requirements of the EMCA for new projects in Kenya;
- The Environmental Assessment Process;
- Baseline environmental studies being undertaken as part of the ESIA; and
- Potential environmental and social impacts associated with the proposed project.

After giving presentations on the proposed project, the members of the community were provided an opportunity to comment and give views on their perceptions of the proposed project.

The verbal discussions were conducted in Swahili and the local language, Dholuo, as it was determined through the Chiefs that these would be the most comfortable languages for the audience. A translator was present to facilitate smooth communication and ensure accurate translations throughout the meeting.

The respondents were able to comment on the project, highlight the potential positive and negative impacts of the project and if they are for or against the project. All substantive issues raised with the Firm of Experts during the baraza were noted and responded to. The issues were then recorded in an Issues and Response Report.

6.4.4. Focus Group Discussions

Focus Group Discussions were held during the ESIA consultation process to reach out to various key stakeholders identified in the Stakeholder Engagement Plan for the project (Table 6-4). The groups included the following: men, women, youth, vulnerable and marginalized, elderly, people living with disabilities, business community, artisanal Miners and NGOs and Civil societies groups. The FGD was focused on engaging the above groups to ensure that they are well aware of the project details and associated environmental and social impacts and to capture their collective concerns.

The methodology of undertaking the FGDs was as follows:

- The groups were identified through a comprehensive stakeholder identification process;
- FGD tools were developed by the ESIA team in consultation with the proponent;

- The relevant groups were contacted through the opinion leaders and National Government Administration Officers (NGAO) during site visits and via phone calls;
- The Proponent, ESIA team and NGAOs in the area agreed on the required representatives from each group and the meeting dates;
- The group representatives were invited via phone calls and facilitated to the meetings by the proponent;
- The ESIA team conducted the meetings at the site and only one meeting was held virtually. The meeting agenda was as follows;
  - Introductions;
  - Project details and potential impacts;
  - Overview of the project feasibility studies process;
  - Administration of the FGD tools;
  - Additional views and comments from the groups; and
  - Next action.
- The data was cleaned and analysed

6.5. Documentation of Stakeholder Engagement

A record of all notifications as well as stakeholder engagements activities were kept. The meeting minutes form part of an appendices of the ESIA report. Records of the meetings were include (as appropriate):

- Notification documentations: letters, emails, and News Paper advertisement
- Project Information Document;
- Register of attendance;
- Comments and response sheets;
- Photographs of workshops/meetings; and
- Minutes of meeting.

Table 6-1: Summary of Meetings Conducted

Date	Stakeholder / Institution	Participants	Venue	No. of participants
24 July 2023	NEMA EIA Department	• Deputy Director Compliance; • Head of EIA Section; and • Head of Strategic Environmental Assessment.	NEMA Offices, South C, Nairobi	5
6 December 2023	Parent Ministries, Lead Agencies, NGOs	• Directorate of Occupational Safety & Health Services; • Ministry of Labour & Social Protection; • National Museums of Kenya; • Water Resources Authority; • Kenya Chamber of Mines; • Kenya Revenue Authority; • Kenya Forest Service; • Kenya Nuclear Regulatory Authority; • Ministry of Investment, Trade and Industry; • National Transport Safety Authority; • Ministry of Lands, Public Works, Housing & Urban Development; • University of Nairobi-Department of Geology; • University of Nairobi-Department of Earth & Climate sciences; • Kenya Private Sector Alliance; • Ministry of Petroleum & Mining; • Kenya Wildlife Service; • National Environment Management Authority; and • Ministry of Interior & National Administration.	The Boma Hotel, South C, Nairobi	54
13 December2023	National Government Lead Agencies in Siaya, Kakamega and Vihiga Counties	• Ministry of Interior; • National Environment Management Authority; • Kenya Wildlife Service; • Kenya Rural Roads Authority; • Kenya Urbans Roads Authority; • Kenya National Highways Authority; • Water Resources Authority; • Regional Mining Office; • National Government Administration Officers; • County Executives Committee; • Members of County Assembly;	Ciala Resort, Kisumu City	35

Date	Stakeholder / Institution	Participants	Venue	No. of participants
		• ASM Group Representative;		
24 January 2024	Vihiga County Government Officials, Elected Political leaders & Artisanal Miners.	• County Executive Committee; • Member of County Assembly; and • ASM Group Representative.	Ciala Resort, Kisumu City	34
8 February 2024	East Gem Community Members & Village Elders	• Village Elders & Community Members.	Barkalare Social Hall	131
9 February 2024	East Gem Community Members, Village Elders & Opinion Leaders	• Community Members, Village Elders & Opinion Leaders.	Barkalare Social Hall	154
12 February 2024	East Gem Community Representatives	• Community Representatives.	Barkalare Social Hall	56
12 February 2024	Ebusyibi Village Community Members & Local Administration	• Community Members; • Deputy County Commissioner; and • Assistant County Commissioner.	ACK Diocese of Maseno North-St. Philips Church Ebusyibi	117
11 June 2024	Obwanda B Village Community Members, Community Representatives & Opinion Leaders	• Community Members, Community Representatives & Opinion Leaders.	Sangla Borehole	
12 June 2024	Odundo A Village Community Members & Village Elders	• Village Elders & Community Members.	Odundo A near Apostolic Church	163
13 June 2024	Barkalare Community Members & Village Elders	• Village Elders & Community Members.	Barkalare Social Hall	224
14 June 2024	Kenya National Highways Authority, Nyanza Region	• Regional Director, Nyanza Region	Office of the Regional Director, Kisumu	4
14 June 2024	Kenya Urban Roads Authority (KURA), Nyanza Region	• Regional Director, Nyanza Region • Environmental Officer	Office of the Regional Director, KURA, Kisumu	4
17 June 2024	Vihiga & Siaya Local NGO, Civil Society, Faith Based Organization, Schools Association	• Members, Executive Officers	Triple T Hotel Conference Room	55
27 June 2024	Kenya Power & Lighting Company (KPLC) Kisumu	• Business Manager	Electricity House, Kisumu	4
11 July 2024	National Environment Management Authority (NEMA), Siaya County	• County Director of Environment, Siaya • Environment Officer	NEMA Offices in Siaya	4
11 July 2024	State Department of Mining, Kisumu	• Geologist, Mining Officer & Inspector of Mines	Office of the Regional Mining Officer, Kisumu	5
15 July 2024	County Planning Office, Siaya County	• Physical Planner	Ardhi House, Siaya	3
15 July 2024	National Construction Authority (NCA), Kisumu	• Compliance Officer	NCA Offices, Kisumu	3
16 July 2024	Directorate of Occupational Safety and Health Services, Siaya County	• County Occupational Health & Safety Officer	Virtual Meeting	3
17 July 2024	Artisanal Miners of Siaya County	• Artisanal Miners & Local Administration	Barkalare Social Hall	
18 July 2024	Vihiga County Executive Committee (CEC)	• Members, Legal Counsel and Vihiga County Department Representatives	Vittoria Suites	13
19 July 2024	National Transport Safety Authority (NTSA), Siaya County	• Regional Manager	NTSA Offices in Kisumu	3
19 July 2024	Kenya Rural Roads Authority (KeRRA), Siaya County	• Roads Officer, Roads Engineer	KeRRA Siaya Offices	4

6.5.1. National Level

NEMA Officials from the ESIA Department were engaged on 24 July 2023. Clarity provided during the meeting include but not limited to placement of advertisement in the Kenya Gazette, radio stations, local vernacular stations and its alignment to Kenya Gazette, factoring a public hearing in case there are adverse public comments, the use of NEMA accredited laboratories, clarification on the economic viability of Project and required content of the ESIA. Further details and responses to the concerns are detailed in Appendix D and analysis provided in Table 6-2 of this report.

National Government Lead Agencies in Siaya, Kakamega and Vihiga Counties were engaged on 13 December 2023. Concerns raised during the meeting include but not limited to management of Benefit Sharing Agreement (BSA) between Kakamega and Siaya Counties, destruction of roads by the mining trucks and equipment, potential Seismic impacts associated with mining activities, waste management, impact on the quality and quantity of water, reduction of forest cover in Siaya County, and upgrade of existing roads to support the proposed haulage activities, biodiversity conservation. Further details and responses to the concerns are detailed in Appendix V and analysis provided in Table 6-2 of this report.

6.5.2. Regional (County) Level

The parent's ministries, lead agencies and NGOs were engaged on 6 December 2023. Concerns raised during the meeting include but not limited to influx of workers from other areas, inclusion of radiation measurements, toxic chemicals leaching of from the mine, consideration of GBV and cultural issues into the studies, community benefits, and consideration of vulnerable groups. Further details and responses to the concerns are detailed in Appendix V and analysis provided in Table 6-2 of this report.

6.5.3. Government Authorities and Institutions

Siaya and Vihiga County Government Officials, Elected Political Leaders and Artisanal Miners engaged on 24 January 2024. Concerns raised during the meeting include but not limited to concern regarding the choice of the project name "Ramula," emphasizes that it could lead stakeholders to associate it exclusively with the Siaya region, potential establishment of a Memorandum of Understanding (MoU) among Shanta Gold, Vihiga, and Siaya, impact of the project on the livelihoods of artisanal miners, and formulation of a comprehensive mining policy. Further details and responses to the concerns are detailed in Appendix V and analysis provided in Table 6-2 of this report.

6.5.4. Ward and Village Level

Stakeholder engagements were conducted in various communities listed in Table 6-1 above. Concerns raised during the engagements include but not limited to social, economic and environmental impacts, skills transfer opportunities, the choice of the specific County project name, resettlement concerns, water pollution, alternative infrastructure, the corporate social responsibility, community compensation, the reason for limiting engagement meeting to a specific county, involvement and job opportunities for the locals, women empowerment opportunities, possibilities of using waste rock heaps for road construction, communication and transparency with stakeholders/community, possible social unrest, public approval, and noise levels due to mining processes. Further details and responses to the concerns are detailed in Appendix X and analysis provided in Table 6-2 of this report.

6.6. Analysis of Stakeholder Issues

The specific issues raised by stakeholders through the ESIA process meetings and responses given by the Project team are provided in Table 6-2 below.

Table 6-2: Analysis of Stakeholder Issues

No.	Concern Category	Community Concern	Meeting Response Summary
1.	**Land Acquisition & Resettlement**	**Forceful Evictions**: Apprehension and fear of forceful evictions from ancestral lands	Assurance of no forceful evictions in strict compliance with existing national land laws and international standards. A further explanation was provided clarifying the resettlement and compensation process.
		Lack of Title Deeds & Land Ownership: Concern of lack of title deed as a challenge in negotiations and compensation.	Assurance that Shanta Gold would bear cost in facilitation of succession where necessary to ensure adequate compensation.
2.	**Environmental Management**	**Water Resources**: Concerns were voiced regarding the project's impact on local water resources. Stakeholders want assurances that water abstraction will not lead to depletion or contamination of water sources. They expect adherence to water quality regulations and effective management practices to safeguard community water supply.	Assurance that mitigation measures for chemical use will be included in the ESIA report, and compliance with water quality and waste management regulations will be ensured.
		Mine Rehabilitation: Stakeholders emphasized the need for comprehensive plans to rehabilitate mined areas post-operation. They sought assurances that environmental rehabilitation will be prioritized to mitigate long-term environmental impacts and ensure sustainable land use post-mining.	Commitment to develop and implement comprehensive mine closure plan to ensure environmental restoration post-operation.
		Chemical Use and Water Management: Concerns were expressed over water pollution risks from mining chemicals and the need for detailed mitigation plans compliant with water quality regulations.	Assurance that hydrology studies will be conducted to guide mitigation measures, and compliance with Water Quality Regulations of 2006 will be ensured to prevent water depletion and contamination.

		Dust Management: Questions were raised about dust management strategies during mining activities to protect community health and safety.	Commitment to implement dust management strategies, such as water spraying and air quality monitoring, to protect community health.
		Mercury and Cyanide Usage: Environmental impacts associated with mining activities, particularly the historical use of mercury in ASM and plans to use cyanide in large-scale mining. Stakeholders are keen on understanding the mitigation measures to minimize environmental contamination and health risks.	Clarification that Shanta Gold will use cyanide instead of mercury and will implement mitigation measures to minimize environmental contamination and health risks.
		Noise and Air Quality: Concerns were raised about potential noise pollution and its impact on local communities, particularly during operational phases. Stakeholders expect mitigation strategies to address noise and air quality concerns, ensuring minimal disruption to community life.	Assurance that noise and air quality management plans will be developed and implemented to minimize disruptions to the community.
3.	**Safety Concerns**	**Mining Safety**: Stakeholders expressed concerns about the high incidence of fatal accidents linked to artisanal small-scale mining (ASM) activities in Kakamega County. They sought assurances on how the project will ensure safety during large-scale mining operations.	Assurance that safety measures will be implemented and monitored, and compliance with Occupational Health and Safety Act,2007 to ensure employees safety and health.
4.	**Community Engagement and Transparency**	**Public Participation**: Stakeholders emphasized the importance of inclusive public participation throughout the project lifecycle. They expect transparent communication and opportunities for meaningful engagement to ensure their concerns are heard and addressed.	Assurance that continuous sensitizations and inclusive public participation will be implemented, with transparent communication and opportunities for community feedback.
		Information Disclosure: Transparency in disclosing project details, including land requirements and specific mining	Commitment to conduct disclosure meetings once specialist studies are completed and provide detailed information on

		plans, was highlighted as crucial. Stakeholders want clear and timely information to make informed decisions and provide feedback on project developments.	project developments, land requirements, and mining plans to ensure informed community feedback.
		Understanding of Exploration vs. Mining: There were misunderstandings regarding the distinction between exploration and full-scale mining, emphasizing the need for clear communication on project phases and impacts.	Clarification provided on the difference between exploration and full-scale mining phases and their respective impacts.
		Perceived Lack of Transparency: Concerns were raised about the transparency of project intentions and profitability, leading to fears of potential exploitation without clear community benefits.	Assurance that continuous sensitizations and inclusive public participation will be implemented, with transparent communication and opportunities for community feedback.
		Grievance Mechanism: There were concerns about ack of redress mechanisms for existing grievances (in the exploration stage) between the community and the client. Grievances including lack of local employment for the project & lack of community involvement in the project.	Acknowledgment by the proponent of the grievances raised and a commitment to follow through with the established formal grievance mechanism.
5.	**Community Relations and Livelihoods**	**Co-existence with Artisanal Miners (ASMs):** Stakeholders highlighted the existing presence of artisanal miners in the project area and stressed the importance of co-existing harmoniously with them. They sought clarity on how the project will support and integrate ASM activities without displacing or negatively impacting these groups.	Commitment to support ASM activities and ensure they are not displaced and for those who may be displaced, detailed plans will be developed to integrate them into the project through prioritization in employment opportunities and livelihood restoration.
		Resettlement and Compensation: Questions were raised about potential displacement of landowners due to the project and how compensation will be determined and	Assurance that transparent compensation processes will be followed, including the development of Resettlement Action

		implemented. The community expects transparent processes, including Resettlement Action Plan (RAP) studies, to ensure fair compensation and livelihood restoration for affected persons.	Plans (RAP) to ensure fair compensation and livelihood restoration for affected persons.
6.	**Social Impacts**	**Employment and In-Migration**: There is anticipation of increased employment opportunities due to the project, potentially leading to in-migration. Stakeholders want to ensure that local community members are prioritized for employment and provided with necessary skills through capacity-building initiatives.	Confirmation that local employment will be prioritized as per the Mining Act 2016, and capacity-building initiatives will be included in the project plan.
		Child Labor: Concerns were raised about the prevalence of child labor in mining activities. Stakeholders expect robust measures to be in place to prevent and mitigate child labor risks associated with the project.	Assurance that measures will be implemented to prevent child labor, and compliance with labor regulations will be ensured.
		Vulnerability of Special Groups: Vulnerable groups such as the elderly, disabled, widows, children, and girls face heightened challenges, including poverty, poor health, lack of job opportunities, and social exclusion. Children are exposed to child labor in the mines, while girls are at risk of early pregnancies, sexual abuse, and school dropouts. Widows face marginalization and land disputes, exacerbating their vulnerability. Concerns were raised about how the project may further impact these groups, especially with potential displacement and land tenure issues.	Assurance that the project will incorporate comprehensive measures to prevent exacerbating these vulnerabilities. This includes strict adherence to resettlement guidelines, prevention of child labor, and provision of support to widows in navigating land disputes. Special attention will be given to the needs of these groups to ensure they are not disproportionately affected by project activities, and tailored livelihood restoration and support programs will be developed for them.
		Heritage: Concerns about the potential erosion of cultural practices and community values due to the project were raised. Fears from the community include family	Commitment to respect and preserve cultural heritage by conducting a cultural heritage impact assessment. Measures will be implemented to ensure that traditional practices and

		disintegration, increased immorality, and a shift away from traditional norms.	community values are safeguarded. Shrines and other cultural landmarks will be identified and protected, and ongoing dialogue will be held with community leaders to maintain cultural integrity.
		General Safety and Security: Security concerns were raised with expressed fear of increased drug abuse and crime with the influx of people due to the West Kenya Project.	Assurance that security measures, including coordination with local security agencies, will be implemented to address theft, crime, and the risk of GBV. Special attention will be given to protecting vulnerable groups, including women and girls, through community-based safety initiatives and partnerships with local authorities.
7.	**Gender Issues and Considerations**	**Equitable Employment**: Ensuring equal employment opportunities for women in various roles within the mining project.	Assurance that equal employment opportunities for women will be ensured.
		Capacity Building: Providing training programs to enhance women's skills and employability in mining-related jobs.	Commitment to provide training and capacity-building programs for women to enhance their skills and employability in mining-related jobs.
		Representation: Promoting gender-balanced representation in community committees and stakeholder groups.	Assurance that gender-balanced representation in community committees and stakeholder groups will be promoted.
		Inclusive Consultation: Actively involving women in consultation processes and decision-making, recognizing their leadership roles and specific concerns.	Commitment to actively involve women in consultation processes and decision-making, recognizing their leadership roles and addressing their specific concerns.
		Gender-Based Violence (GBV): Addressing potential GBV risks through preventive measures and support systems.	Assurance that preventive measures and support systems will be established to address and mitigate the risk of gender-based violence (GBV).

		Inequitable Compensation: Concerns were raised about women being sidelined in the compensation process, with fears that they may not receive their fair share, particularly in land ownership and compensation negotiations.	Assurance that the compensation process will be conducted transparently and equitably. Measures will be put in place to ensure that women are actively involved in negotiations and that their rights to compensation are upheld. Specific provisions will be included to protect the interests of women, particularly in cases where land ownership or succession issues arise.
8.	**Youth Issues**	**Employment Opportunities:** Ensuring priority in employment opportunities for local youths in various roles within the mining project.	Commitment by Shanta Gold to prioritize youth inclusion in employment opportunities.
		Capacity Building: Providing training programs to the youths without any form of education to enhance the skills and employability in mining-related jobs.	Commitment by Shanta Gold to offer training programs for youth to acquire essential mining skills, ensuring they are prepared for employment opportunities within the project.
9.	**Corporate Social Responsibility**	**Local Community Benefits**: Stakeholders expressed expectations that the project will contribute positively to local communities through corporate social responsibility initiatives. They seek commitments from the project proponent to support community development projects that enhance livelihoods, programmes to sensitize youths and children on importance of education, priority on health facilities in the area and mine technologies for artisanal miners.	Commitment to develop and implement CSR initiatives that meet the needs of the community.

6.7. Stakeholder Engagement Perceptions and Expectations

Stakeholder engagement is a vital component of the Ramula-Mwibona Project's success, as it ensures that the concerns, perceptions, and expectations of various community members are adequately addressed; hence engagements should be carried out as an on-going process involving the disclosure of information to affected communities and other interested and affected parties.

Detailed stakeholder engagement meetings at different levels were carried out as an integral part of this SIA study. Table 6-3 provides a summary of the key stakeholders consulted and major concerns or expectations raised during these meetings:

Table 6-3: Stakeholder Issues, Concerns and Expectations

Aspects	Issues/Concerns/Expectations
Land acquisition and involuntary resettlement	• The community is concerned about land acquisition and displacement, as well as the potential for land disputes due to the lack of title deeds and women being sidelined in the process. • The community is concerned about economic displacement due to artisanal mining activities, which may lead to increased poverty • The community is also concerned about the proposed resettlement and relocation and requests detailed project information, transparent negotiations, and fair distribution of wealth and justice.
Economic and livelihood activities	• Gold mine workers (ASM), are not being adequately consulted regarding local job opportunities • The project is seen as a potential positive development due to its potential to provide job opportunities. • The project is expected to enhance skills in the local area • The community expects the project to promote business growth by increasing demand for services needed by project employees. Additionally, contracting local businesses for supplies and services is expected to drive local economic growth
Social cohesion and co-existence	• Disruption of cultural values, leading to increased sexual immorality which could lead to early marriages, pregnancies, and higher rates of STDs and HIV/AIDS, increase school dropouts. • Decline of traditional ceremonies and mourning practices as new cultural influences emerge in the area • Increased family disintegration and polygamy due to changes in income and social dynamics • Increased competition for resources

Social services and infrastructure	• The community highlighted the lack of sufficient schools, from primary to tertiary level, as well as inadequate health services. • Most households rely on rivers and springs for water, and many homes are not connected to electricity. Additionally, there are no waste collection services, with households typically using compost pits. • The access roads are in poor condition, affecting transportation, especially for farm products. • Community would appreciate engagement by the Project to help identify areas needing support through CSR initiatives, such as building and equipping social service facilities
General Safety and Security	• There are concerns about increased insecurity and rising crime rates that might contribute to the presence of the project related influx of people • Concerns about theft of livestock and farm produce, mugging and house vandalization • Gender-based violence and sexual exploitation and abuse especially during the festive season.
Ecosystems services	• Reduced space for livestock • Clearing of trees and bushes for settlement has led to a decrease in wild animal populations • There are concerns that the project may threaten traditional practices by clearing areas where medicinal plants are sourced, potentially disrupting access to traditional medicine. • Competition for scarce natural resources
Community participation	• Concerns about the potential lack of transparency and accountability in project execution, with an emphasis on including NGOs in stakeholder consultations to ensure marginalized groups are adequately represented in compensation and resettlement plans. • Disabled people face limited access to health services, few livelihood opportunities, job discrimination, and exclusion from decision-making processes, raising concerns about their human rights. • The community expects the project to collaborate with artisanal miners, provide support through improved equipment, and ensure transparency in project implementation

Table 6-4: Focused Group Discussions conducted

Date	Stakeholder/Institution	No. of Participants	Venue
11/06/2024	Youths from Obwanda B Village	8	Sangla Borehole
11/06/2024	Elders from Obwanda B Village	9	Sangla Borehole
12/06/2024	Women from Odundo A Village	31	Odundo A near Apostolic Church
13/06/2024	Women from Barkalare Social Hall	71	Barkalare Social Hall
9/09/2024	Men from Ramula-Mwibona Villages (Obwanda A&B, Siadha A&B, Naya A & B, Nyangulu)	22	Ramula Health Centre-Social Hall
9/09/2024	Women from Ramula-Mwibona Villages (Obwanda A&B, Naya A&B, Siadha A&B, Nyangulu, Onyoso)	29	Ramula Health Centre-Social Hall
9/09/2024	Youths from Ramula-Mwibona Villages (Obwanda A&B, Naya A&B, Siadha A&B, Nyangulu)	33	Ramula Health Centre-Social Hall
10/09/2024	Artisanal Miners from Ramula-Mwibona Villages (Ramula, Obwanda B, Odundo A, Siadha A&B, Nyangulu, Munungo)	60	Ramula Health Centre-Social Hall
10/09/2024	Elders from Ramula-Mwibona Villages (Obwanda A&B, Naya A&B, Siadha A&B, Nyangulu)	45	Ramula Health Centre-Social Hall
10/09/2024	People living with disabilitites from Ramula-Mwibona Villages (Obwanda A&B, Naya A&B, Siadha A&B)	30	Ramula Health Centre-Social Hall
11/09/2024	Vulnerable (Widows & Representatives of Orphans from Ramula-Mwibona Villages (Obwanda A&B, Naya A&B, Siadha A&B, Onyoso, Ramula, Nyangulu)	60	Ramula Health Centre-Social Hall
11/09/2024	Business Community from Ramula-Mwibona Villages (Obwanda A&B, Naya A&B, Siadha A&B, Nyangulu, Ramula, Barkalare)	61	Ramula Health Centre-Social Hall
12/09/2024	Non-Governmental Organizations & Civil Based Organizations from Siaya & Vihiga Counties	9	Online Meeting via Zoom

7. Project Alternatives

This chapter describes various alternatives assessed as part of this ESIA for the Project. Project alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing a project, considering location or site alternatives, activity alternatives, temporal alternatives or the 'no-go' alternative. Alternatives also help identify the activity with the least environmental and social impact, as well as ensuring project feasibility. The subsections below discuss alternatives considered for the Project with respect to:

- Project design alternative;
- Location alternatives;
- Technology alternatives; and
- The no-go alternative.

7.1. Project Design and Technology Alternatives

7.1.1. Tailings Storgae Facility Site and Technology Options

Epoch was appointed to undertake a comprehensive Multi-Criteria Alternative Assessment (MAA) and provide preferred site option for the construction of the TSF with the support from Digby Wells. A total of nine (11) TSF options based on location, alternatives as TSF options based on the tailings technology and disposal technique have been illustrated in Figure 7-1. These options were evaluated against a pre-determined MAA.

The MAA utilises a structured scoring and weighting system to rank each site and technology option, ultimately identifying Option 7B as the preferred location and employing a dewatered deposition technology. The TSF will comprise of two storage basins:

- A dry-stack tailings facility, and
- A stormwater dam.

The general arrangement of the TSF is shown in Figure 2-6. Further technical details are provided in the technical report attached as Appendix D.

The objective of the identification step in the TSF site and technology wass to develop a list of possible TSF alternatives, considering potential site locations, tailings management technologies, and TSF configurations.

MAA approach used to compare Tailings Storage Facility (TSF) concepts, generally, follows a systematic process including:

- Identification of candidate alternatives;
- Pre-screening assessment of alternatives (no-go zones, fatal flaws etc);
- Characterization of alternatives remaining after pre-screening;

- Development of multiple accounts ledger;
- Application of scores and weights using a value-based decision process;
- Preparation of sensitivity analyses; and
- Documentation of results.

The MAA approach also defined exclusion criteria for the proposed TSF site to ensure that only viable TSF site options are evaluated and those that will not qualify for further assessment are excluded based on the following criteria:

- Proximity to watercourses;
- Permeability of impoundment footprint. (hydro)geology underlying the TSF;
- Total number of people located within 300m of TSF footprint area;
- TSF crossing multiple social-political borders;
- Population at risk;
- Ease of water management;
- Expansion potential (LoM);
- Operational confidence;
- Plant stoppage impact;
- Closure complexity;
- Plant + TSF Capital cost; and
- Operating and sustaining capital cost.

The outcome of the MAA study has recommended to viable site options for consideration by Shanta. Although the 2 options scores were very similar in Base case and all scenarios throughout the MAA; these options include:

- Option 1B; and
- Option 7B

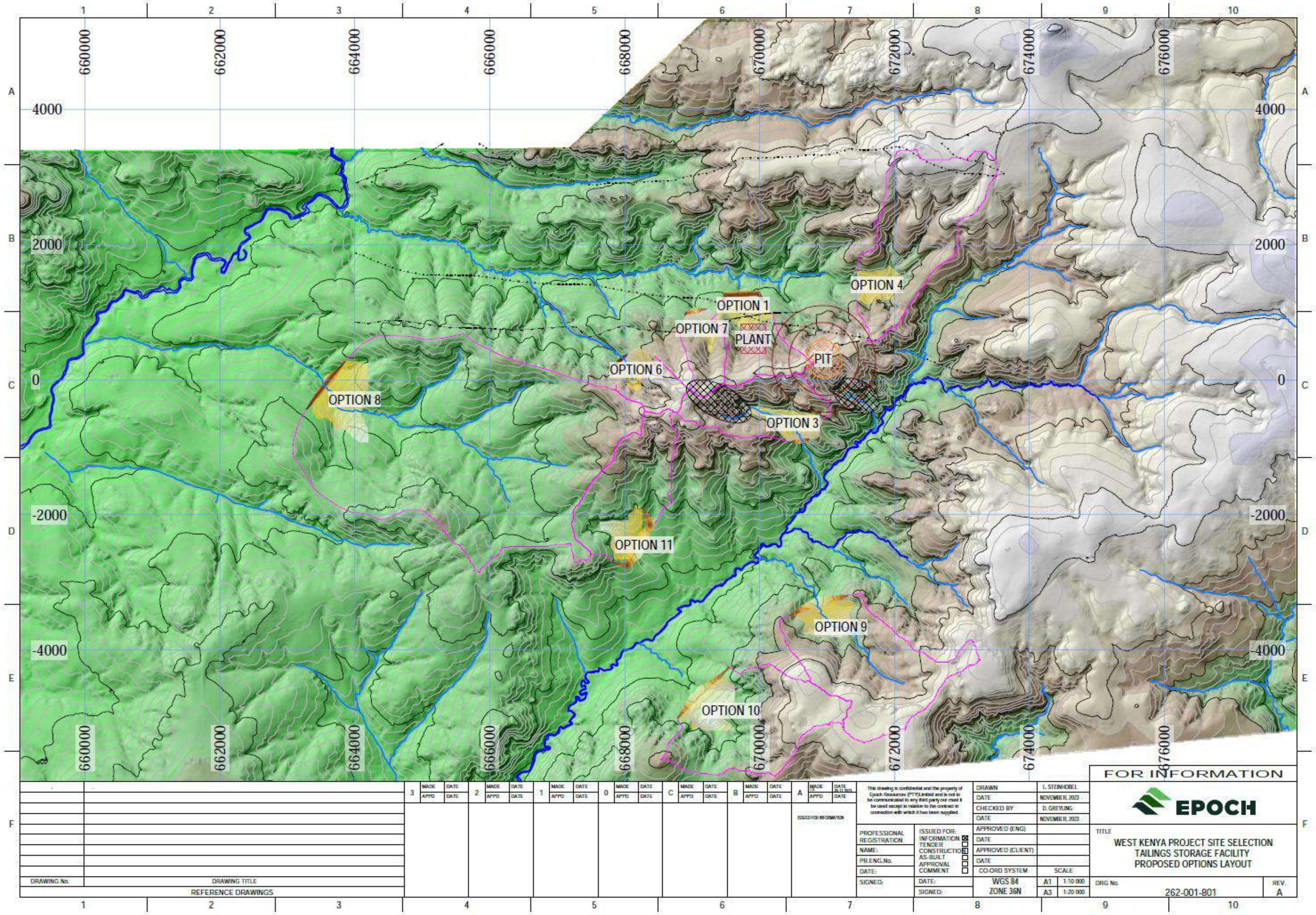


Figure 7-1: Site Selection Options for the Tailings Storage

7.1.2. Water Supply Options

Evaluation of the potential water sources was carried out by Howard Humphreys Consulting Engineers to assess whether the required volume of water will be reliably available for abstraction. A Detailed Technical report for Power supply options has been attached as Appendix W.

The potential water sources are discussed in subsections below.

7.1.2.1. Option 1a: Pumping from River Yala at the Confluence with River Dhene

River Yala rises in the Nandi Escarpment and is one of the largest rivers in Kenya discharging into Lake Victoria. Its headwaters originate from Tinderet Forest in Uasin Gishu, South Nandi Forest in Nandi County and Kakamega Forest in Kakamega and Vihiga Counties. The river falls within WRA drainage sub-basin areas No. 1FA, 1FB, 1FC, 1FD, 1FE, 1FF and 1FG before it drains into Lake Victoria.

The river is permanent with relatively significant flows in relation to the required abstractions and therefore it has been considered as a potential water source to meet the water demand requirements for the mine site. The river flows approx. 7 km to the West of proposed Ramula mine site.

Potential sites for abstraction have been identified and comprise of the following:

- At the confluence with River Dhenena approximately at Survey of Kenya coordinates 663725 m E; 2575m N, with approx. elevation 1248m amsl; and
- At existing Siaya-Bondo Water and Sanitation Company Limited (SIBOWASCO) intake works located at approximately at Survey of Kenya coordinates 670252 m E; 9121 m N, with approx. elevation 1381 m amsl.

Figure 7-2 shows the catchment area for the potential intake works site at the confluence with River Dhenena. The catchment area at the proposed intake works site is approx. 2,430 Km^2.

The river is gauged upstream of the proposed intake site at River Gauging Stations (RGS) 1FG01 located at approx. 12 km upstream at the Railway Bridge close to Yala town, at RGS 1FE01 located approx. 19 km upstream and 1FE02 located at approx. 68 km upstream at Tindinyo market.

Downstream, the river is gauged at RGS 1FG02 located at approx. 26 km downstream of the proposed intake works. River Edzawa is major tributary joining River Yala upstream of the intake site close to Yala town and is gauged at RGS 1FF03 approx. 12 km upstream of the proposed intake works site.

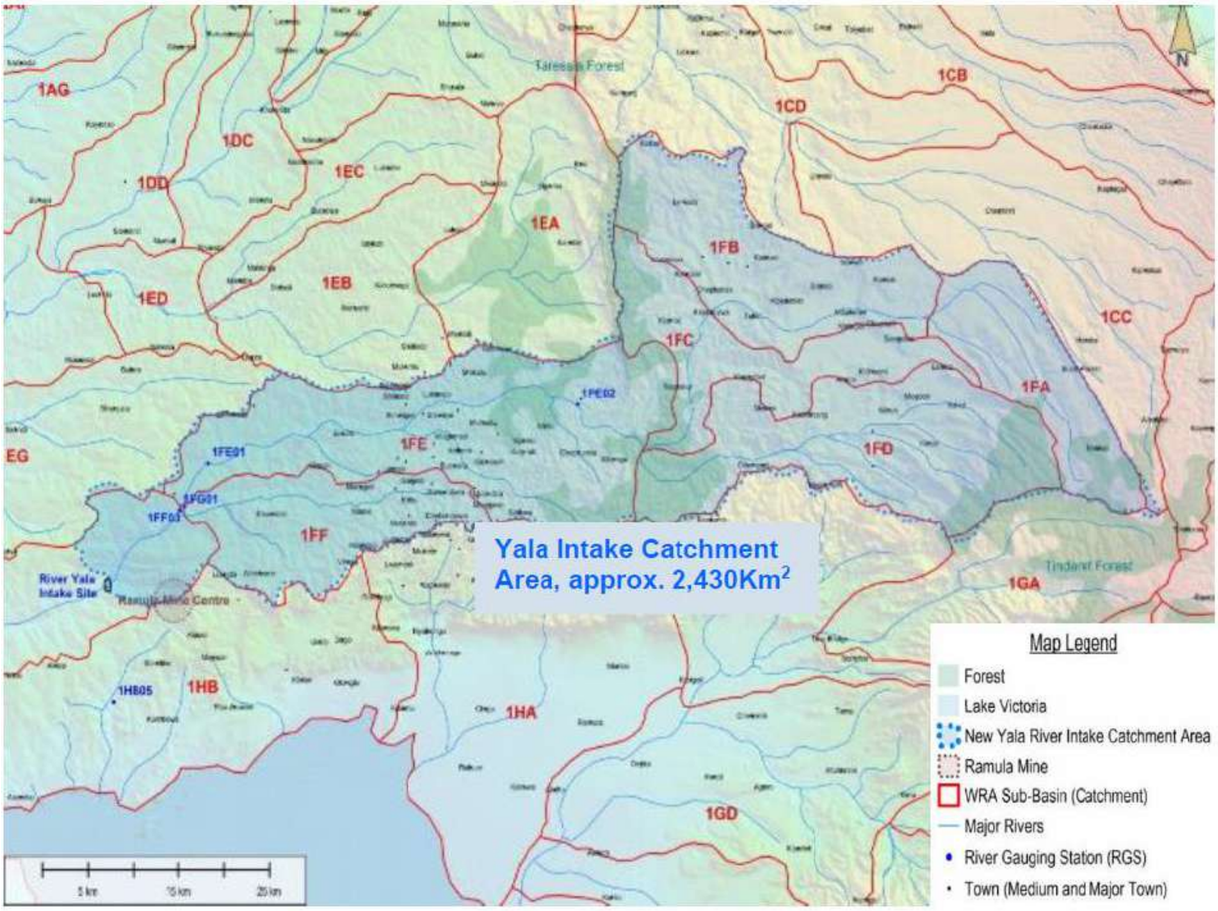


Figure 7-2: Yala Intake Catchement Area (Horward Humphreys Consulting Engineers,2024)

Raw water will be abstracted from River Yala immediately downstream of the confluence with River Dhenena. The intake works is expected to be sited at an elevation of approximately 1250m amsl. Abstracted raw water will then be pumped from the intake works site to the water treatment works site which will be located within the Project area. A pumping station comprising of a pump house with pump sump and containing electrical motors and associated equipment will be constructed adjacent to the intake site.

From the pumping station, raw water will be pumped through a pipeline of approximate length 6.5 km to be laid adjacent to River Dhenena. The pipeline will terminate at the water treatment works within the Project area at 1420 m amsl.

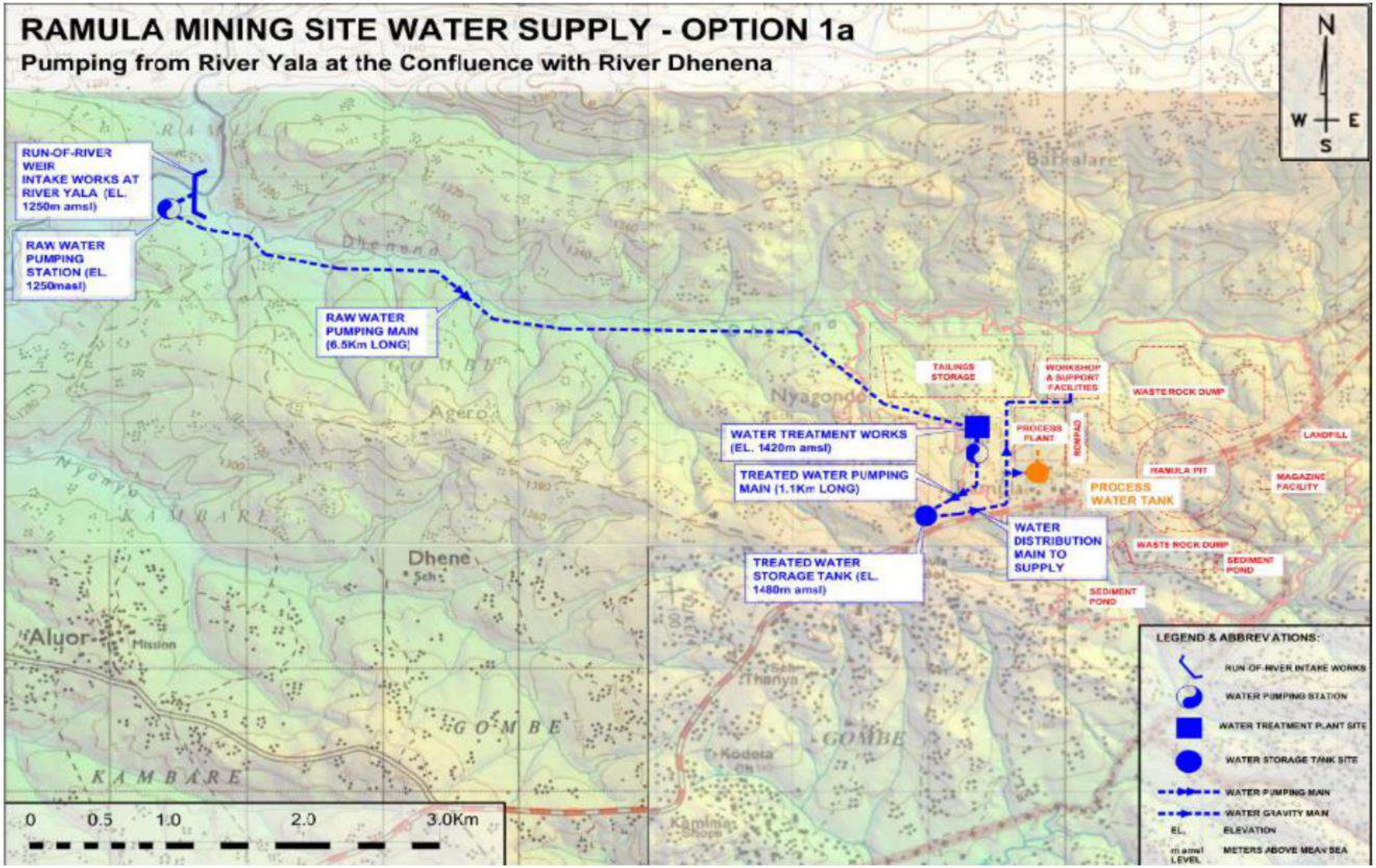


Figure 7-3: Layout Plan for Option 1a (Horward Humphreys Consulting Engineers, 2024)

7.1.2.2. Option 1b: Pumping from River Yala through Hydropower

Similar to Option 1a, this alternative will involve development of a water source at River Yala upstream of the proposed intake site under Option 1a. The intake works will be sited adjacent to the existing Siaya-Bondo Water and Sanitation Company Limited (SIBOWASCO) intake works on the opposite riverbank at an elevation of approx. 1380m amsl.

This option will incorporate the use of hydropower to pump raw water for treatment at the Project area. River Awach Seme

River Awach Seme rises from the Maseno highlands and flows south-east of the proposed Project area before it drains into Lake Victoria. The river is permanent although it is characterised by low flow volumes in most times of the year.

Due to its low flow volumes, the river is proposed to be impounded at approx. Survey of Kenya coordinates 671328 m E; 1054 m S, of approx. elevation 1330m amsl. The river is gauged at RGS 1HB05 close to Awach market centre and approx. 5km downstream of the proposed Awach dam site.

The catchment area at the proposed dam site is approximately 30 km^2 and is shown in Figure 7-4. The catchment area receives bimodal rainfall with one short season from October to December and a long rainy season from March to July. Rainfall varies from 258.0 to 816.0 mm annually. During periods of heavy rainfall, the catchment experiences exceedingly high rainfall causing the river to flood, breaking off its banks and inundating low-lying farmlands. These flood flows can therefore be impounded at Awach dam for abstraction during periods of low flows.

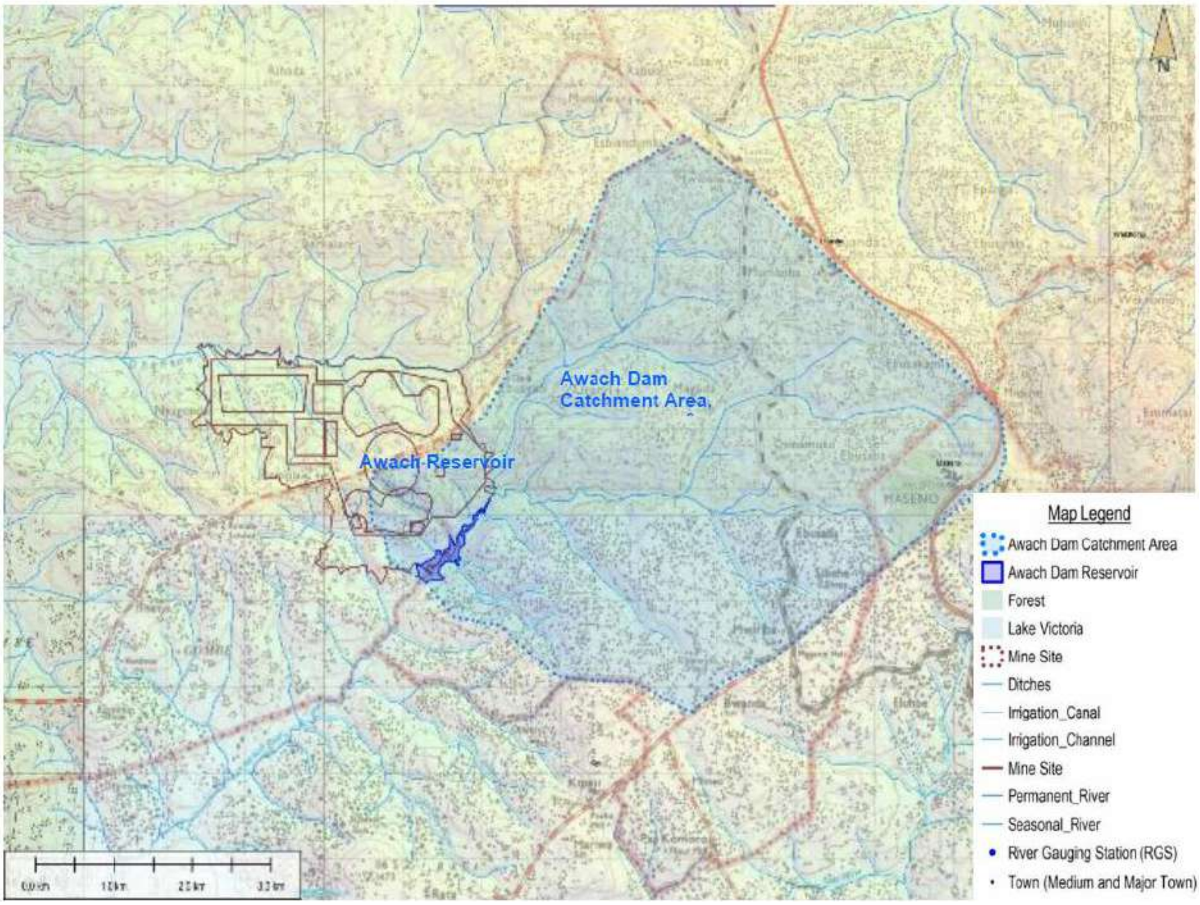


Figure 7-4: Awach Dam Catchment Area (Horward Humphreys Consulting Engineers,2024)

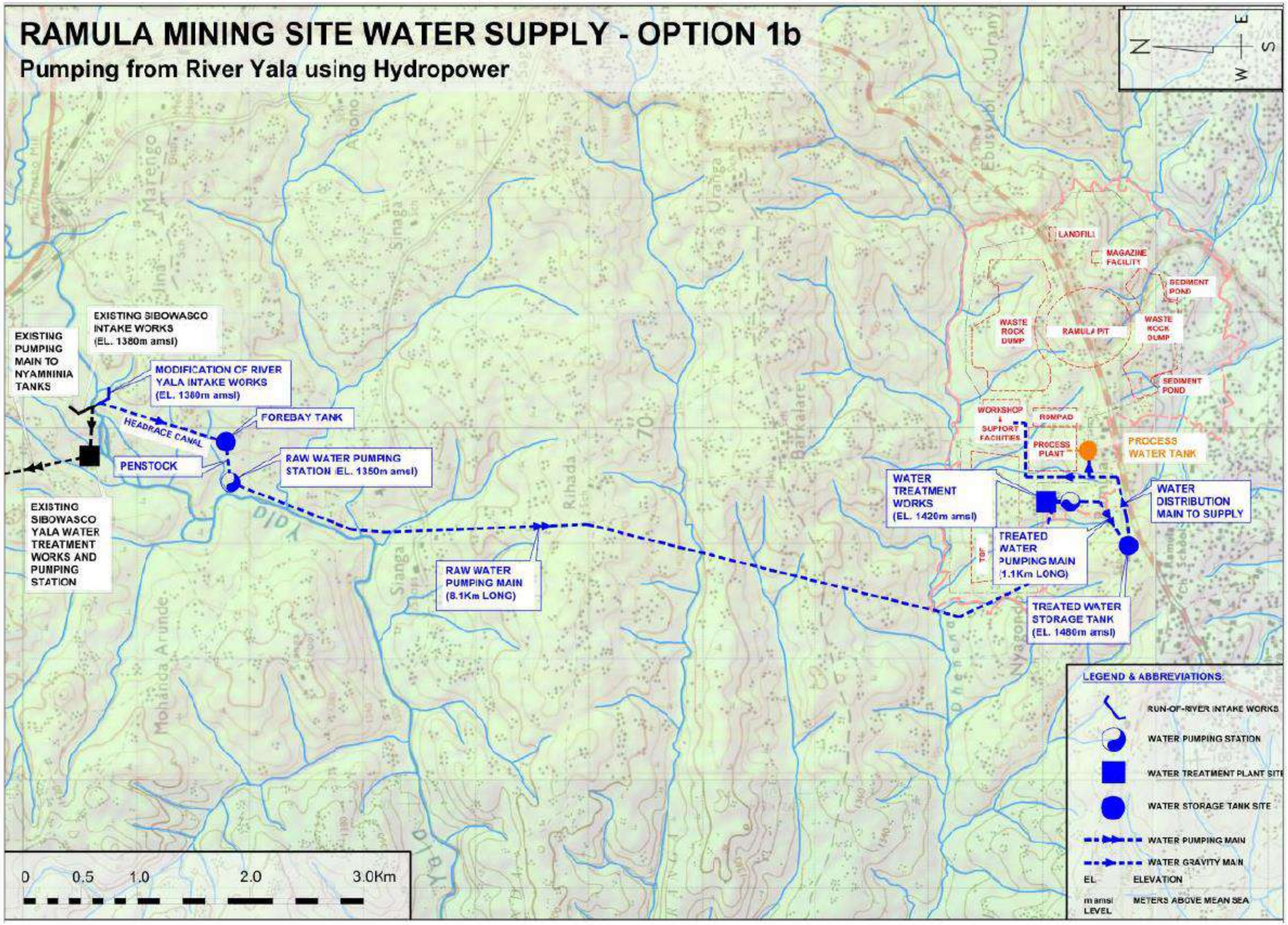


Figure 7-5: Option 1b Layout Plan (Howard Humphreys Consulting Engineers,2024)

7.1.2.3. Option 2: Water Supply by SIBOWASCO through Existing Yala Water Treatment Works

According to discussions held by Howard Humphreys Consulting Engineers and SIBOWASCO staff, the existing Siaya-Bondo water supply scheme which draws water from River Yala for treatment at the Yala water treatment works has an unutilised capacity of approximately 10,000 m^3/day. SIBOWASCO expressed desire for a partnership with SGKL for upgrading of the existing system to its design capacity upon which SIBOWASCO shall supply water for the Project.

If this Option is adopted, it is assumed that SGKL will rehabilitate the existing water treatment works and augment the treated water pumping system by about 9,000 m^3/day. SGKL will then construct a new treated water gravity main of approximately length 14.5 km from Nyamninia tanks located at 1490 m amsl to water boosting (pumping) station at Ramula mine site at approx. elevation of 1420 m amsl.

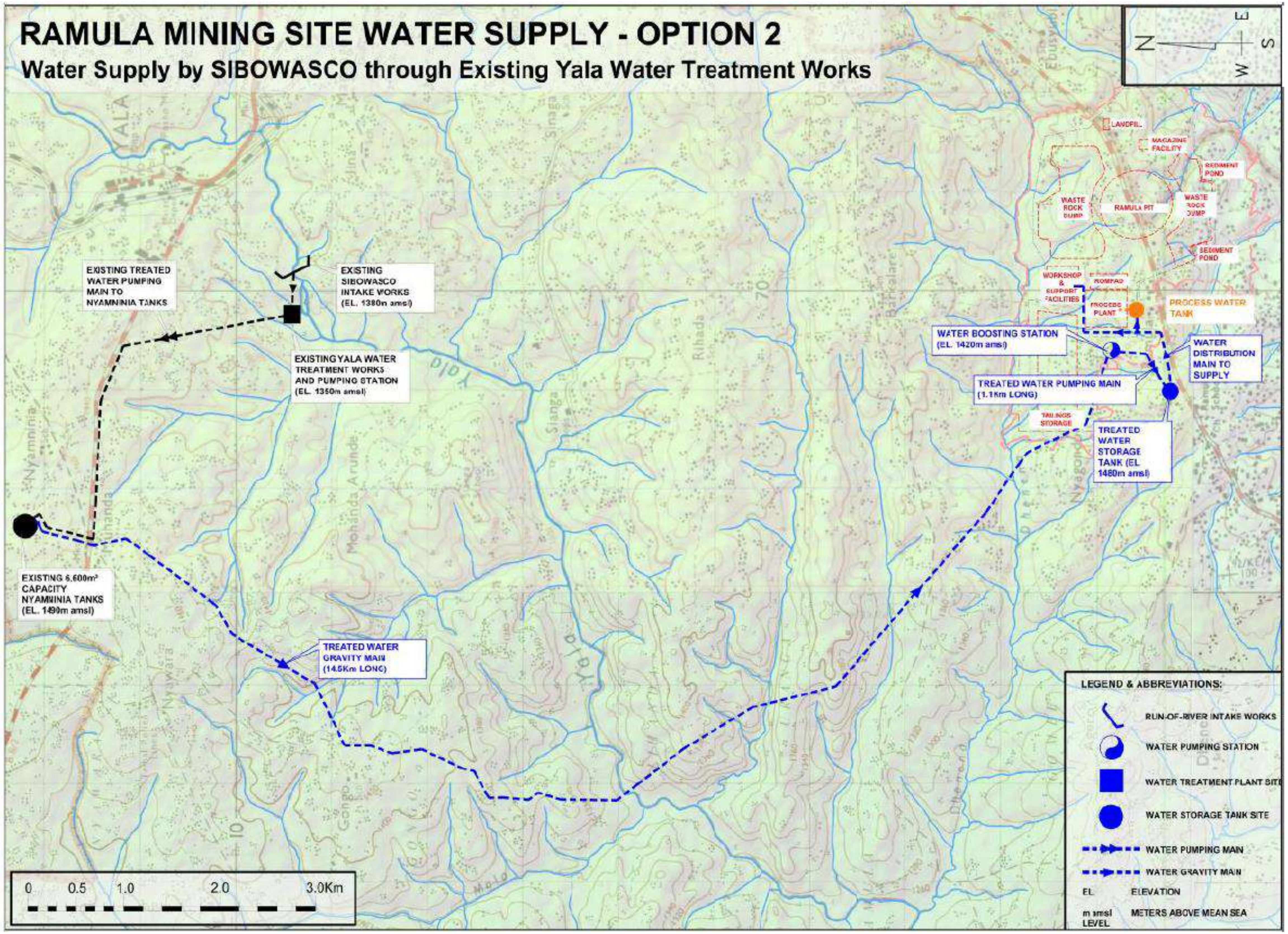


Figure 7-6: Option 2 Layout Plan (Howard Humphreys Consulting Engineers,2024)

7.1.2.4. Option 3: Pumping from an Impoundment at River Awach Seme

River Awach Seme is a permanent river which is characterized by low flow volumes in most times of the year. As a result, it is proposed that the river be impounded to store flood flows during the rainy seasons for use during low flow periods. Water from the impounded reservoir will then be pumped for treatment at the Project area. The preliminary site for impoundment of Awach River has been identified south-east of the proposed Project area.

It is proposed that the dam be constructed using earth fill material which will be obtained from the mine. Use of such materials would usually be economically and environmentally preferred and the resulting dam would be compatible with the foundations, which are likely to be of similar materials. Water will be abstracted from the reservoir through a gravity offtake to a pumping station adjacent to the dam.

The raw water pumping station is proposed to be sited at an elevation of approx. 1325 m amsl based on the estimated lowest supply level from the dam. The water treatment works will be located within the Ramula mine site at approx. elevation of 1420 m amsl. However, there is a high point within the pipeline route at an approx. elevation of 1455 amsl. This results in a static lift of approx. 130 m. The water will be pumped using multistage centrifugal pumps.

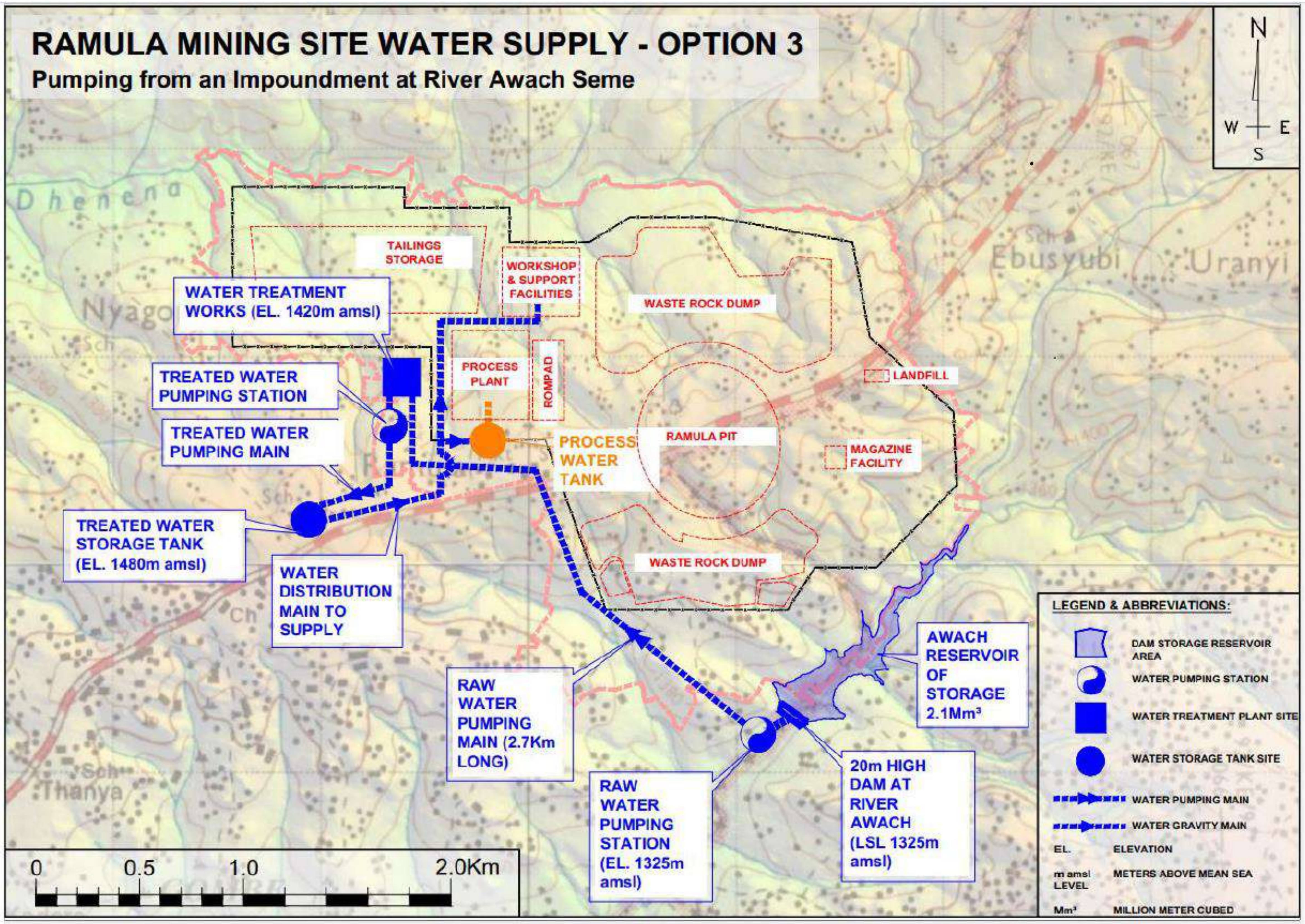


Figure 7-7: Option 3 -Layout Plan (Howard Humphreys Consulting Engineers,2024)

7.1.2.5. Option 4: Development of Groundwater Sources (Boreholes)

Preliminary desk studies done by Howard Humphreys Consulting Engineers's indicate that 90% of Siaya County is underlain by hard rocks of mainly volcanic and volcano sedimentary origin with the remaining 10% covered with recent alluvial sedimentary deposits. Consequently, ground water can be present in the weathered layers, faults and fractured zones, as well as sedimentary deposits. Rainfall, runoff and evaporation data from other studies show that ground water recharge takes place mainly in the northern and northeastern parts of the county. The proposed Project area is located within this region, therefore indicating ground water potential.

However, these are only preliminary findings and hydrogeological studies will need to be carried out to determine actual groundwater potential of the study area.

It is Howard Humphreys Consulting Engineers's understanding that Shanta has gathered extensive data and information during mine prospecting which can be useful in the assessment of groundwater potential of the Project area. This primarily relates to geophysical survey and drilling data of the mine area. This data can be used in the assessment of groundwater potential for water supply to the mine.

Additional information will be obtained from Water Resources Authority (WRA) comprising of details of nearby boreholes, including location, borehole numbers and construction details, age, current status and use, current abstraction and use, etc.

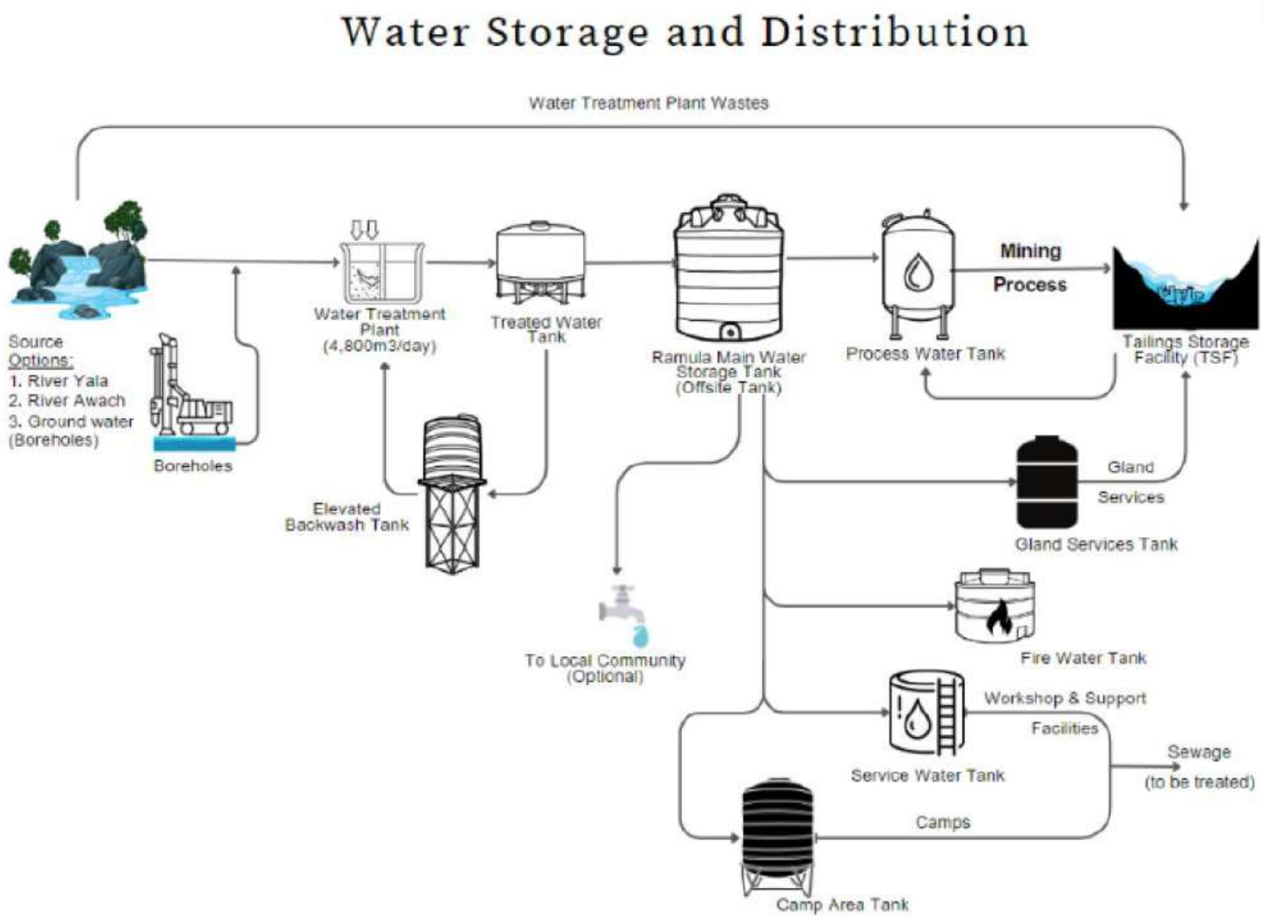


Figure 7-8: Potential Water Storage and Distribution (Howard Humphreys Consulting Engineers,2024)

7.2. Project Location Options

An internal conceptual Property Risk Evaluation / Preliminary Analysis of Minesite Footprint Options was carried out, with the primary purpose of estimating conceptual resettlement Capex as well as quantifying risks to guide further evaluation of the properties, and with the following objectives:

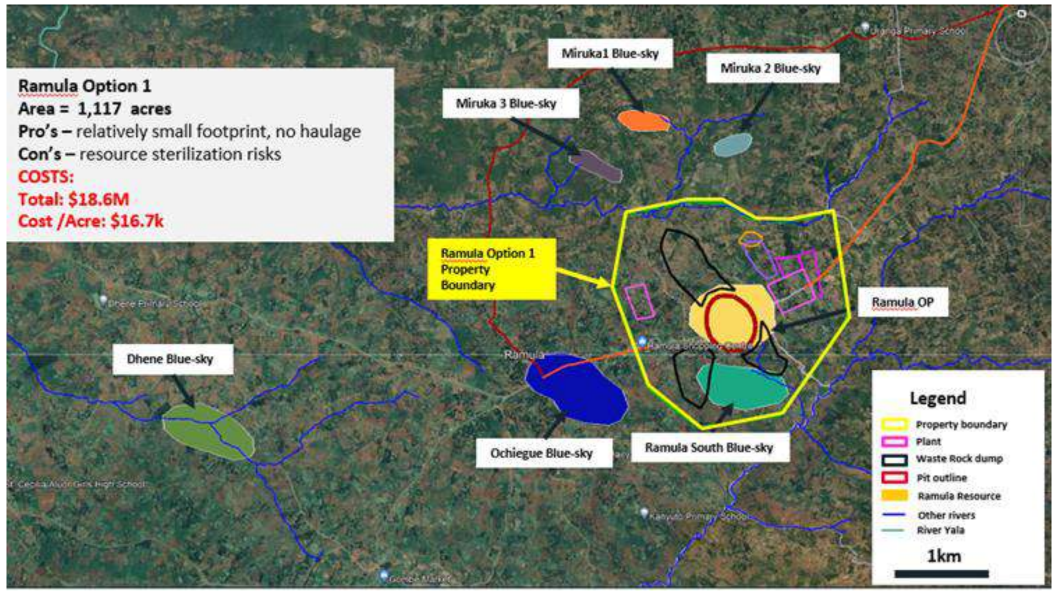
- Conceptual assessment of Ramula property footprint options, including cost estimate for property acquisition, compensation, and resettlement;
- Scoring applied to each property footprint option including factors associated with costs, social risks, environmental risks, geology risks, and other constructability factors; and
- Outcomes from the assessment are being used in financial models, and to guide future evaluation efforts.

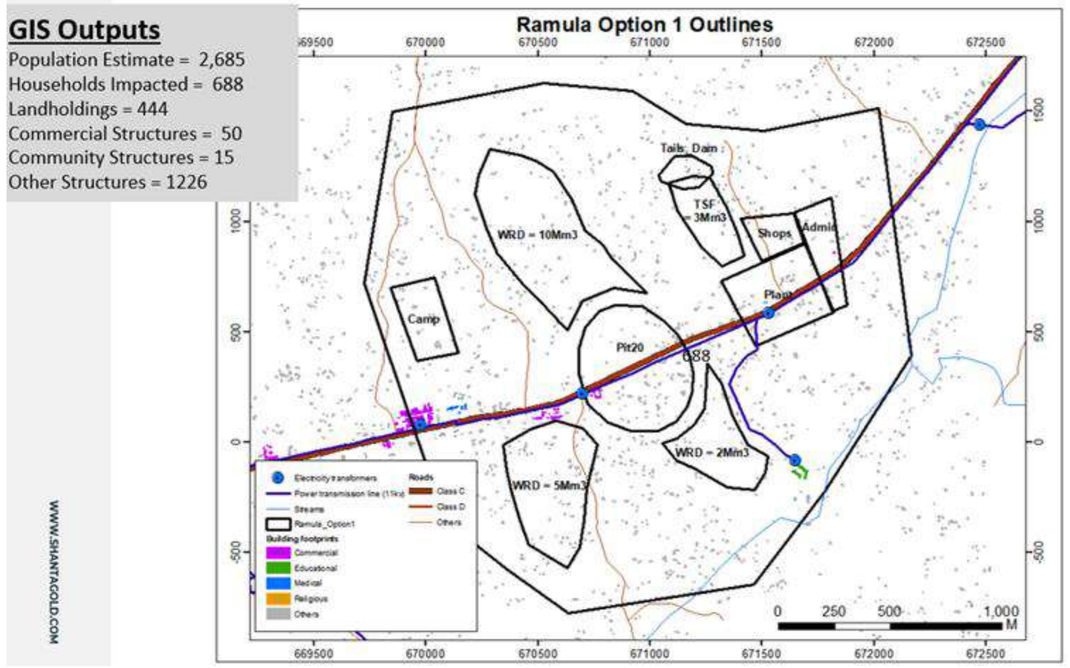
The study was based on the following Property Boundary Design Criteria:

- Minimum 500m OP clearance for blast and vibration;
- Minimum 200m WRD/TSF/Plant clearance for noise and dust;
- Minimum 500m Magazine clearance from all fixed infrastructure;
- Avoid infrastructure placed over mineral targets as practical;
- Avoid community, commercial, and roads as practical;
- Preference to areas with lower population density as practical;
- Position infrastructure to avoid excessive earthworks as practical;
- Assume future “phasing” for property acquisition and resettlement; and
- Sediment/water control structures will be required between infrastructure and water bodies.

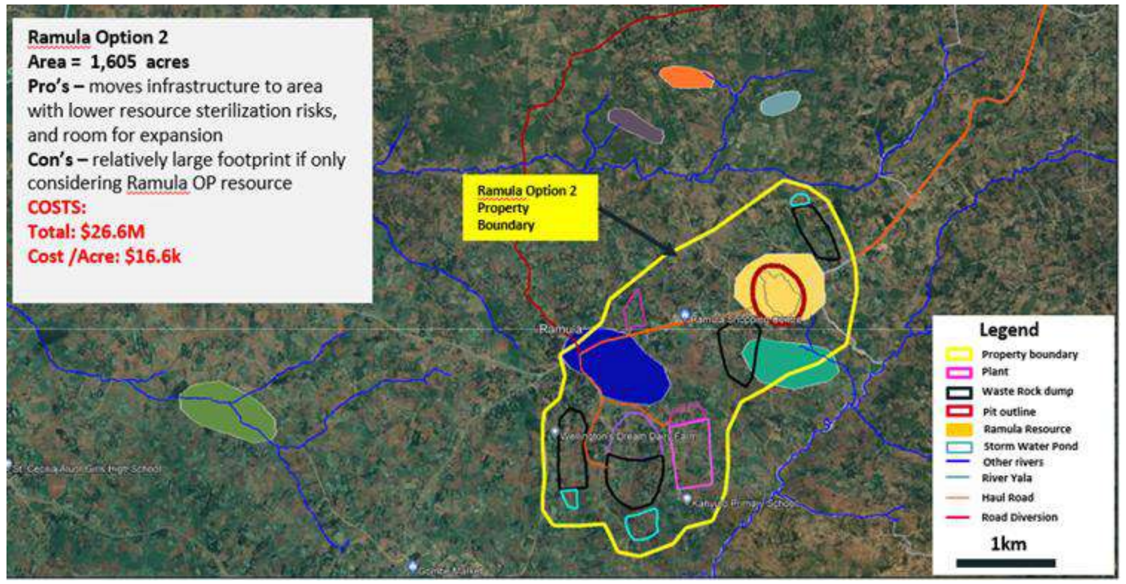
Four options were considered, three in the vicinity of the Ramula- Mwibona orebody, and one 5 km distant at Dhene. Based on the evaluation Option 3 B was confirmed to be the preferred option. The site and infrastructure layout have been summarised and illustrated in Section 2.2 and Figure 2-5.The options are presented in Figure 7-9 below.

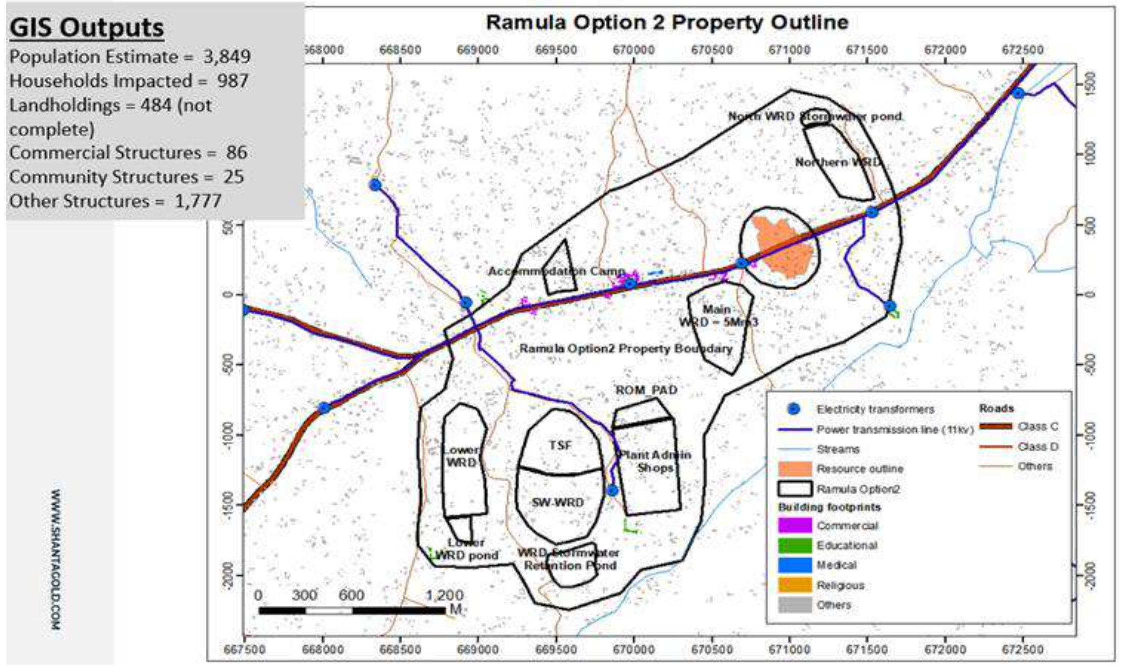
Ramula Option 1





Ramula Option 2

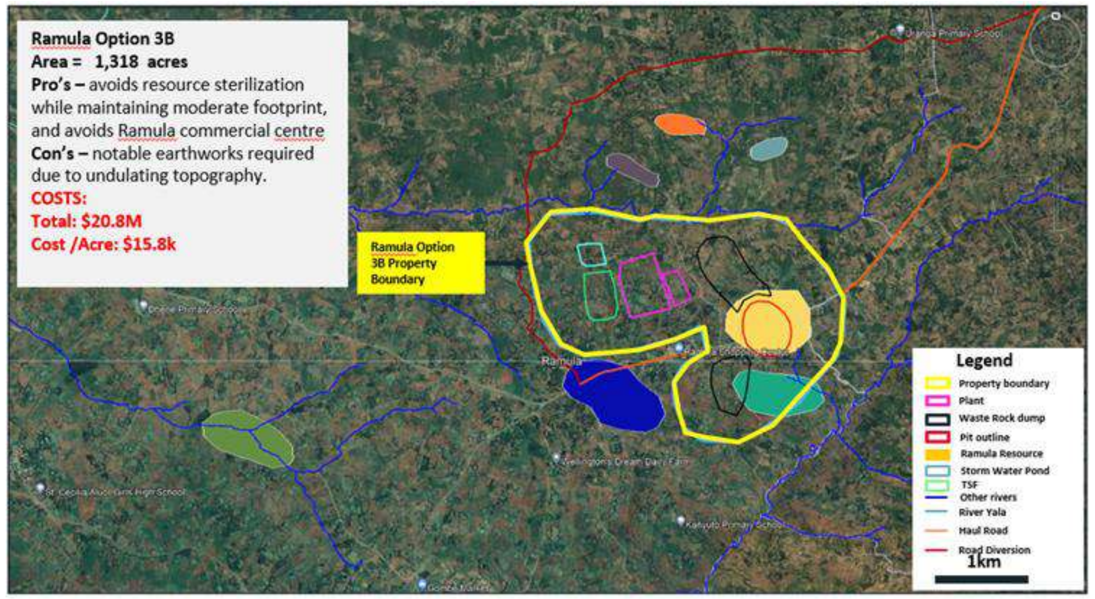


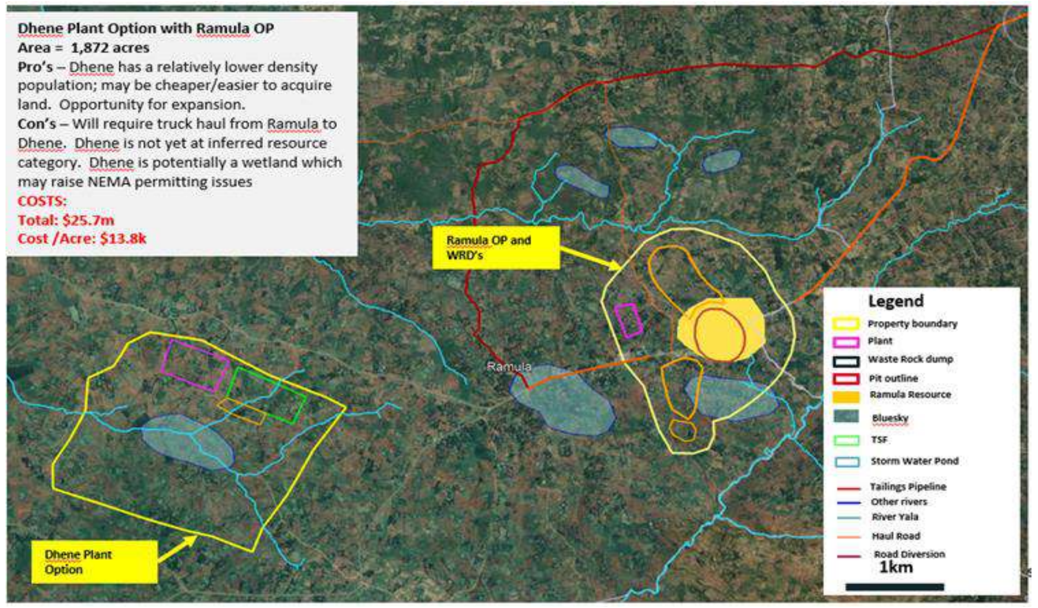


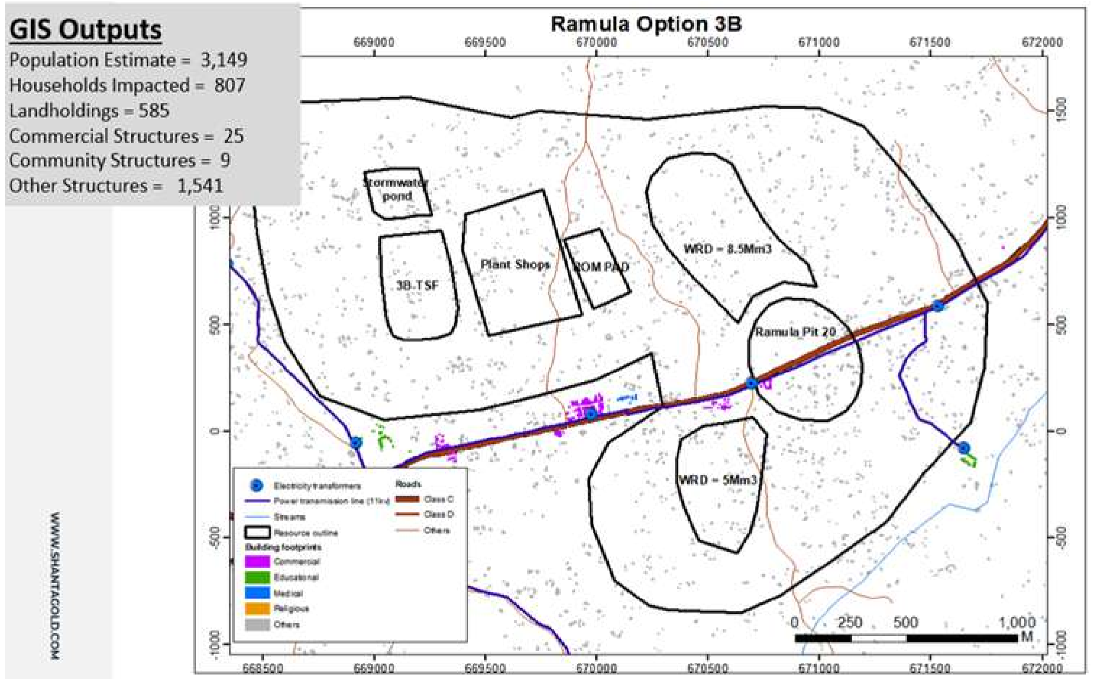
Ramula Option 3b

In addition to three alternative minesite configurations in the immediate vicinity of the Ramula-Mwibona orebody, an alternative site for the plant infrastructure and TSF was also identified at Dhene North, 5-7 km from the Ramula orebody, in an area of less dense population.

Dhene Main:







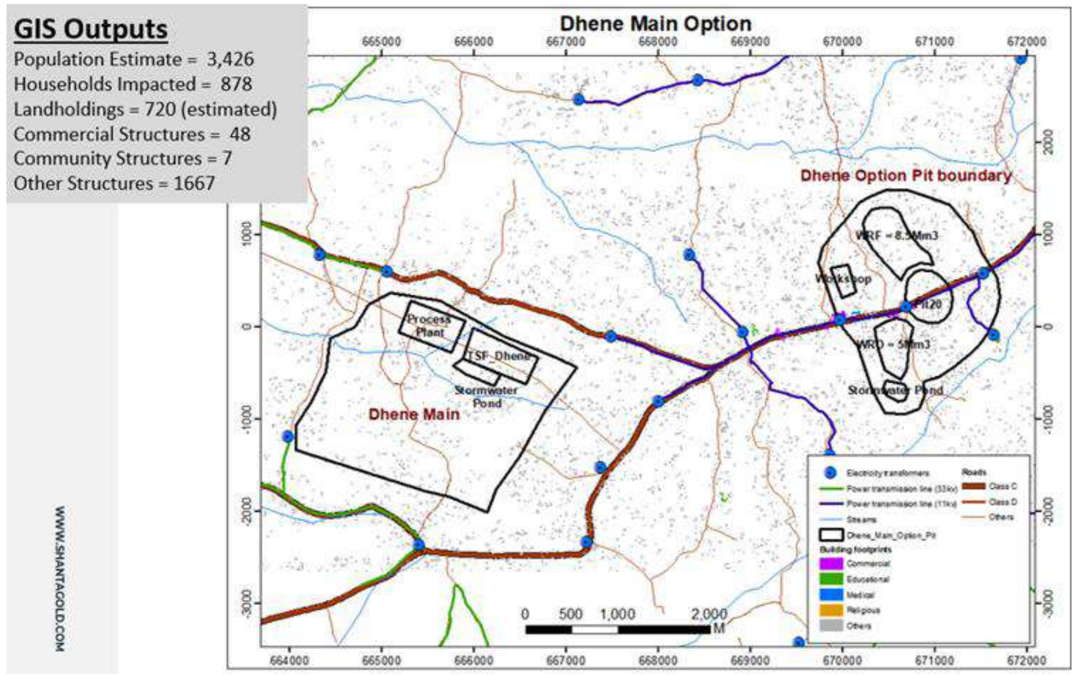


Figure 7-9: Location Alternatives

7.3. Technology Alternatives

7.3.1. A Technology Option for Power Supply

Four power supply options were considered to supply power for the Project. The areas were considered based on distance from the proposed power supply source substation to the Project area, substation capacity to meet the required power requirements in Mega Volt-Amp (MVA) and delivery Voltage Level and the stability and reliability of the identified power supply options.

The following substations were considered:

- Maseno 33/11 Kilovolt (KV) Substation;
- Nyamninia 33/11 KV Substation;
- Rangála 132/33 KV Substation; and
- Mamboleo 132/33 KV Substation.

Based on the analysis of the above four power supply options done by Howard Humphreys Consulting Engineers, it was concluded that it is technically possible to meet the Project's power supply requirements with moderate modifications to any of the options considered. This could be achieved by tapping from the existing 33 KV Bus at any one of the substations. However, supply from Mamboleo could be more expensive overall. Mamboleo is the farthest from Ramula with no network connection within the Project area. The substation, unlike Nyamninia feeder does not have readily available space to construct a dedicated supply line unlike Rangála which has two empty bays which could be used to provide a dedicated supply feeder to the Project area.

The 33KV Bus available at Nyamninia and Maseno KPLC Substations are both an extension of the Rangála 33 KV Feeder and could be tapped to supply the Project. This would effectively reduce cost and construction time.

However, the final recommendation will be made after considering the results of load flow and network stability analysis and inform any required network modifications and reinforcement.

The Maseno 33/11KV and Nyamninia 33/11KV remain viable supply options in addition to the Rangála and Mamboleo Substations. The associated costs with implementing any of the four options will be decided based on the results from the ongoing load flow and network stability analysis and subsequent quantification of the required system reinforcement and modification, if any. A Detailed Technical report for Power supply options has been attached as Appendix X

7.4. The No- Go Alternatives

Under this alternative, consideration is given to a case where no open pit mining activities are assumed. The advantages of this alternative include the fact that the proposed Project area will remain undisturbed. However, it is noted that ASM is prevalent in the area and therefore it is likely that the resource would be exploited in future by ASM. In this event, this would likely mean that the full extent of the viable resource will be underdeveloped and ASM activity would likely be conducted in an unsustainable manner compared to the formalised mining practices proposed by this Project.

Another advantage of this option is that additional impacts that have the potential to result from the proposed Project, e.g., impacts on water resources, community health, safety and security will not even be a subject for assessment.

However, the no mining option means that the conventional open pit mining at the proposed Ramula pit cannot continue. This would certainly drastically reduce mine life and lead to the cessation of the WKFSP. Consultations with county and local communities show that most people look to SGKL to aid development - as a source of employment, improved services and facilities and general contribution to socio-economic well-being. SGKL will contribute significantly to infrastructure, power supply, improvement of roads, health and education services, environmental management and other services to the communities, which would be missed.

SGKL operation will also contribute to revenue earnings of the country through payment of taxes that would be lost if mining stops.

As such, the no mining option will lead to no development of Ramula pit and will result in the following:

- Avoid disturbances and hence no additional pressure on the natural resource besides those already associated with the pre-mining land-use;
- Avoid possible impacts to surrounding environment, workers and communities;
- No additional job opportunities and improvement of the economic status of the communities;
- Limited improvement of the social services in the area; and
- Limited revenue earnings to the Kenya and within the Vihiga and Siaya counties.

Based on the above analysis and the associated impacts, this alternative will lead to more negative socio-economic impacts, and it is hence not recommended as an appropriate option for further consideration

8. Assessment of Project Impacts

This chapter presents the identified environmental and socio-economic impacts (positive and negative) that could occur because of the Project. The potential impacts from the proposed activities have been identified and quantified based on the project description (Chapter 2) and an understanding of the environmental and socio-economic attributes of the Project area (Chapter 4 and Chapter 5 respectively).

8.1. Methodology

The methodology utilised to assess the significance of potential biophysical and socio-economic impacts is discussed in detail below. The significance rating formula is as follows:

Significance = Consequence x Probability

Whereby

Consequence = Type of Impact x (Intensity + Spatial Scale + Duration)

And

Probability = Likelihood of an Impact Occurring

In addition, the formula for calculating consequence:

Type of Impact *(Nature) =* ***+1*** *(Positive Impact) or* ***-1*** *(Negative Impact)*

The weight assigned to the various parameters for positive and negative environmental, social and cultural heritage impacts is provided for in the formula and is presented in Table 8-1. The probability consequence matrix for impacts is displayed in Table 8-2, with the impact significance rating described in Table 8-3.

Table 8-1: Impact Assessment Parameter Ratings

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
7	Very significant impact on the environment. Irreparable and irreplaceable damage to highly valued species, habitat or ecosystem. Persistent severe damage. Irreparable and irreplaceable damage to highly valued items of great cultural significance or complete breakdown of social order.	Noticeable, on-going social and environmental benefits which have improved the livelihoods and living standards of the local community in general and the environmental features.	International The effect will occur across international borders.	Permanent: No Mitigation The impact will remain long after the life of the Project. The impacts are irreversible.	Certain/ Definite. There are sound evidence based reasons to expect that the impact will definitely occur.
6	Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures required to prevent irreversible impacts. Irreparable damage to highly valued items of cultural significance or breakdown of social order.	Great improvement to livelihoods and living standards of a large percentage of population, as well as significant increase in the quality of the receiving environment.	National Will affect the entire country.	Beyond Project Life The impact will remain for some time after the life of the Project.	Almost certain/Highly probable It is most likely that the impact will occur.

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread positive benefits to local communities which improves livelihoods, as well as a positive improvement to the receiving environment.	Province/ Region Will affect the entire province or region.	Project Life The impact will cease after the operational life span of the Project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of significance.	Average to intense social benefits to some people. Average to intense environmental enhancements.	Municipal Area Will affect the whole municipal area.	Long term 6-15 years to reverse impacts.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of significance.	Average, on-going positive benefits, not widespread but felt by some.	Local Extending across the site and to nearby settlements.	Medium term 1-5 years to reverse impacts.	Unlikely Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur.

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly repairable. Functions and processes not affected.	Low positive impacts experience by very few of population.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year to completely reverse the impact.	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the Project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance that will have no impact on the environment. No irreplaceable loss of a significant aspect to the environment. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level social and environmental benefits felt by very few of the population.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month to completely reverse the impact.	Highly unlikely/None Expected never to happen.

Table 8-2: Probability Consequence Matrix for Impacts

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	**-20**	**-19**	**-18**	**-17**	**-16**	**-15**	**-14**	**-13**	**-12**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Consequence																																						

Table 8-3: Significance Threshold Limits

Score	Description	Rating
109 to 147	A very beneficial impact which may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change.	Major (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the Project. These impacts would be considered as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	Moderate (positive)
36 to 72	An important positive impact. The impact is insufficient by itself to justify the implementation of the Project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment.	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the social and/or natural environment.	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the social and/or natural environment. The impacts are reversible and will not result in the loss of irreplaceable aspects.	Negligible (negative)
-36 to -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the social and/or natural environment.	Minor (negative)
-73 to -108	A serious negative impact which may prevent the implementation of the Project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects. The impacts may result in the irreversible damage to irreplaceable environmental or social aspects should mitigation measures not be implemented.	Moderate (negative)
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts will result in irreversible damage to irreplaceable environmental or social aspects should adequate mitigation and management measures not be successfully implemented.	Major (negative)

8.2. Identified Potential Impacts

The potential impacts for environmental and socio-economic aspects are discussed separately in the subsections below according to each phase of the Project, i.e., the

Construction, Operational, Decommissioning, Rehabilitation and Closure and Post Closure Phases.

The specialist reports (Appendix E to Appendix U) informed this chapter. However, impact ratings may differ based on the Environmental Assessment Practitioner's holistic evaluation of the significance to the baseline environment. Consequently, only the management measures specified in this EIA Report will become the binding commitments for SGKL.

8.2.1. Construction Phase

The main activities detailed in Table 8-4 will be carried out during the Construction Phase.

Table 8-4: Construction Phase Activities

Phase	Activity
Construction	Vegetation clearance for the placement of the infrastructure including the TSF, WRDs, Ramula Open Pit, processing plant and associated facilities, administration unit and camp area, ore stockpile, and the Heavy Mechanical/ Machinery Equipment (HME) workshop.
	General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material.
	Construction of surface infrastructure including the processing plant and associated facilities, haul and access roads, HME workshop, explosive magazine and administration facility.
	Land acquisition in the extended exclusion zone.

8.2.1.1. Soils and Land Use

Site clearance, removal of vegetation, soil stripping (where applicable) and stockpiling will result in the loss of soil resources. Soils will be stripped during which the physical and chemical properties will be altered, compacted and soils will be subject to degradation. The land capability changes from arable (where applicable) and grazeland to no land capability.

Increased flow velocity from hardened surfaces, stockpiles and concentrated flow will enhance the onset of erosion and creation of preferential flow paths/erosion gullies. Among the impacts associated with the construction phase are potential impacts to soil quality resulting from the ingress of potential hydrocarbons. The soil contamination will in turn affect biodiversity and human health. Exposed surfaces may result in dust, erosion and sedimentation in low-lying areas. Vehicle and machinery movement may lead to soil compaction, increased surface runoff, erosion and loss of vegetation (organic material). This reduces infiltration rates, and the ability of plant roots and water to penetrate the soil. Once the soil is eroded it reduces the overall soil depth, soil fertility and as a result the land capability.

During construction and stockpiling activities, the soil's seed bank and natural fertility balance could be depleted. This will affect the regrowth of vegetation. Soils should be handled with care throughout the construction phase. Topsoil and subsoil (where subsoil is applicable) need to be separated and stockpiled to avoid mixing and losses.

8.2.1.1.1. Impact Ratings

The pre-mitigation impact ratings during the construction phase range from “Moderate-Negative” to “Major-Negative”. These scores are expected to decrease with the implementation of recommended mitigation and management measures with the highest post-mitigation significance rating scored “Moderate-Negative”. The lowest significance ratings are associated with general construction activities with the highest of impacts associated with clearance of vegetation and stripping of soil inside which will result in a direct loss of soil resources.

Table 8-5: Construction Phase Impact for Site/Vegetation Clearance for the Placement of theSurface Infrastructure

<table>
<tr><td colspan="10">Activity: Site/vegetation clearance for the placement of the main infrastructure including TSF, WRDs, Open Pit, processing plant and associated facilities, administration unit and camp area, ore stockpile and the HME workshop</td></tr>
<tr><td colspan="10">Impact Description: The site clearance, removal of vegetation, soil stripping (where applicable) and stockpiling will result in the loss of arable and grazeland. The topsoil will be stripped, resulting in the footprint areas being characterised by no land capability.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Permanent
(7)</td><td>The impact will remain long after the life of the Project. The impacts are irreversible.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Beyond Project Life
(6)</td><td>The impact will remain for some time after the life of the Project.</td></tr>
<tr><td>Extent</td><td>Local
(2)</td><td>Limited to the Project footprint.</td><td>Extent</td><td>Limited
(2)</td><td>Limited to the site and its immediate surroundings.</td></tr>
<tr><td>Intensity</td><td>Very Serious
(7)</td><td>Very significant impact on the environment. Irreparable and irreplaceable damage to highly valued species, habitat or ecosystem. Persistent severe damage.
Irreparable and irreplaceable damage to highly valued items of great cultural significance or complete breakdown of social order.</td><td>Intensity</td><td>Serious (6)</td><td>Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures are required to prevent irreversible impacts.
Irreparable damage to highly valued items of cultural significance or breakdown of social order.</td></tr>
<tr><td>Probability</td><td>Certain / Definite
(7)</td><td>There are sound evidence based reasons to expect that the impact will definitely occur.</td><td>Probability</td><td>Definite
(7)</td><td>There are sound evidence based reasons to expect that the impact will definitely occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Major (negative)
-119</td><td colspan="5">Moderate (negative)
-98</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">
• Plan site clearance and alteration activities for the dry season (November to May) where possible;
• Restrict the extent of disturbance within the footprint area and minimise activity within designated areas of disturbance;
• Minimise the period of exposure of soil surfaces through dedicated planning;
• If the loss of arable soils is unavoidable, the disturbance must be minimised and appropriately rehabilitated;
• Topsoil (first 0.3 m of the soil profile) must be stripped first and stockpiled separately from subsoil as the topsoil contains the seed bank and natural fertility. For shallow soils (shallower than 300 mm), the entire topsoil layer should be stripped and stockpiled separately;
• Handling of the stripped topsoil should be minimised to ensure the soil’s structure does not deteriorate significantly;
• Topsoil stockpiles must be vegetated with indigenous grass to reduce the risk of erosion, and to reinstitute the ecological processes within the soil;
• The soil management and soil stripping guidelines detailed in Section 9 must be adhered to;
</td></tr>
</table>

- A Stormwater Management Plan (SWMP) should be implemented from the vegetation clearing stage to prevent increased runoff, erosion and the loss of soil resources;
- If any erosion occurs on site and adjacent to the footprint area, corrective actions (erosion berms) must be implemented to minimise any further erosion from taking place; and
- Only the designated access routes are to be used to reduce any unnecessary compaction.

Table 8-6: Construction Phase Impact for General Construction Activities

Activity: General construction activities including the use of vehicles and machinery as well as storage and handling of waste and hazardous material.									
Impact Description: Potential impacts to soil and groundwater quality as a result of the ingress of potential hydrocarbon spillages as well as contaminants from handling waste and hazardous material									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	**Dimension**	Duration	**Rating**	Project Life (5)	The impact will cease after the operational life span of the Project.
	Extent		Limited (2)	Limited to the site and its immediate surroundings.		Extent		Very Limited (1)	Limited to specific isolated parts of the site.
	Intensity		Significant (6)	Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures are required to prevent irreversible impacts. Irreparable damage to highly valued items of cultural significance or breakdown of social order.		Intensity		Very Serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.
	Probability		Certain/ Definite (7)	There are sound evidence based reasons to expect that the impact will definitely occur.		Probability		Likely (5)	The impact may occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Moderate (negative) -90					**Minor (negative) -55**				
Mitigation/Management Actions									

- Where the loss of arable soils is unavoidable, the disturbance must be minimised and appropriately rehabilitated;
- Bare land surfaces must be vegetated should natural re-vegetation not occur within three months to limit erosion from surface runoff associated with infrastructure areas;
- Monitor infrastructure, stockpiles and the linear infrastructure to prevent increased runoff leading to erosion and sedimentation of the downstream envrionment and therefore decreased land capability;
- If any erosion occurs on site and adjacent to the footprint area, corrective actions (erosion berms, silt traps, re-vegetation) must be implemented to minimise any further erosion from taking place;
- Spill containment and clean-up kits must be available on-site and clean-up from any spill must be in place and executed at the time of spillage with appropriate disposal as necessary;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Vehicles and equipment should be serviced as per the maintenance schedule ans Service and parking areas must be paved;
- Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities;
- Dispose of hazardous material at a registered landfill site or investigate developing a hydrocarbon treatment facility to remediate soils and reuse reclaimed soils; and
- Re-fuelling and maintenance must take place on a sealed surface area to prevent the ingress of hydrocarbons into topsoil.

8.2.1.2. Surface Water

Site clearing, earthworks activities and the compaction of the soil may increase the risk of potential soil erosion by water and wind during the wet season and dry season, respectively. Any construction works during the transitional or wet season months, if left unmanaged, would result in increased sediment loads in the nearest watercourses. This also includes excavation for the establishment of foundations, installation of the pipelines and construction of supporting infrastructure.

Land preparation for the proposed infrastructure and pipelines will cause the alteration of channel geometry which may likely lead to reduced flow regimes.

8.2.1.2.1. Impact Ratings

The impact ratings for the construction phase is presented in Table 8-7, Table 8-8 and Table 8-9 below.

Table 8-7: Construction Phase Impacts Ratings (Before and After Mitigation Measures) for Vegetation Clearance and General Construction

Activity: Site/vegetation clearance for the placement of the main infrastructure and other general construction.									
Impact Description: Siltation and Sedimentation of nearby watercourses.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	3	Medium term: 1-5 years to reverse impacts.	**Dimension**	Duration	**Rating**	2	Short term: Less than 1 year to completely reverse the impact.
	Extent		3	Local: Extending across the site and to nearby settlements.		Extent		2	Limited: Limited to the site and its immediate surroundings
	Intensity		4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		6	Almost certain / Highly probable: It is most likely that the impact will occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative)-60					**Negligible (negative)-28**				
Mitigation/Management Actions									

- Minimise the footprint of disturbance, as far as practicable. Demarcate the proposed areas for land clearance and earthworks to minimise the unnecessary expansion of the footprint of disturbance;
- Where practical, land clearance and earthwork activities must be undertaken during the dry period when proximal watercourses are dry;
- Keep the topsoil stockpile with a vertical slope of 1:3 to minimise chances of erosion through visual inspections;
- Provide suitable sanitary facilities and remove waste to an appropriate waste facility;
- Install effective sediment and erosion control measures before starting work to minimise entry of sediment into the watercourse, e.g., erosion berms or silt traps;
- Disturbed areas remaining after construction activities are completed should be rehabilitated timeously, i.e. rip soils and revegetate (if required); and
- Undertake regular monitoring of total suspended solids (TSS), TDS and turbidity in surface waters upstream and downstream of construction activities to facilitate the prompt implementation of remedial actions, if necessary.

Table 8-8: Construction Phase Impacts Ratings (Before and After Mitigation Measures) for Vegetation Clearance, Excavation and Backfilling

Activity: Vegetation clearance, excavation and backfilling of substrate.									
Impact Description: Alteration of Channel Geometry.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	6	Beyond Project Life: The impact will remain for some time after the life of the Project.	**Dimension**	Duration	**Rating**	6	Beyond Project Life: The impact will remain for some time after the life of the Project.
	Extent		2	Limited: Limited to the site and its immediate surroundings.		Extent		2	Limited: Limited to the site and its immediate surroundings.
	Intensity		4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		7	Certain / Definite: There are sound evidence based reasons to expect that the impact will definitely occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Moderate (negative) -84					**Minor (negative) -44**				
Mitigation/Management Actions									

- Site preparation for the installation of the proposed pipeline and other infrastructure should be confined to the proposed development footprint area to minimise disturbance of soils and the probability of sedimentation and siltation of nearby watercourses;
- During construction, where the pipeline will be buried (except at larger river crossings), it is recommended that it is done in sections and immediately restore/reprofile the disturbed soil to allow free drainage, hence avoiding the possibility of erosion;
- Drainage infrastructure such as culverts should be placed at all river crossings;
- River diversions should be limited to the affected footprint;
- Channel bed and banks should be re-profiled after installation of linear infrastructure to enable flows to continue undisturbed; and
- The natural channel slopes should be maintained to limit or prevent increased flow velocity.

Table 8-9: Construction Phase Impacts Ratings (Before and After Mitigation Measures) for Vehicle Movements and the Usage and Storage of Hydrocarbons

Activity: Movement of vehicles during construction, as well as the storage and use of hydrocarbons									
Impact Description: Spills or leaks thus potentially contaminating surface water resources									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	4	Long term: 6-15 years to reverse impacts.	**Dimension**	Duration	**Rating**	2	Short term: Less than 1 year to completely reverse the impact.
	Extent		3	Local: Extending across the site and to nearby settlements		Extent		1	Very limited: Limited to specific isolated parts of the site
	Intensity		5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		6	Almost certain / Highly probable: It is most likely that the impact will occur.		Probability		5	Likely: The impact may occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) -72					**Negligible (negative) -30**				
Mitigation/Management Actions									

- Construction workers should be trained on standard procedures for the transport, handling, use and disposal of hydrocarbons;
- Construction workers should be trained on spill management procedures;
- Spill kits should be maintained in all locations where hydrocarbons are used or stored;
- All vehicles should be properly maintained and inspected regularly to avoid leakages;
- Washing and servicing of vehicles and machinery should be undertaken at designated, appropriately designed areas;
- Vehicles and machinery must be used on demarcated roads and kept at designated parking area;
- All storage areas for fuels and oils used during the construction phase should be appropriately bunded and spill kits should be in place. Onsite personnel should be trained to use spill kits, for containing and cleaning up any leakages or spills of fuels, oils and grease; and
- Water quality monitoring should be continuously be conducted to determine post-development quality, especially in terms of TSS, TDS, Turbidity, oils and grease.

8.2.1.3. Groundwater

Activities during the Construction Phase that may have potential impacts are captured in Table 8-10

Table 8-10: Construction Interactions and Impacts of Activity

Interaction	Impact
Site/vegetation clearance for the placement of the main infrastructure including (low-grade ore stockpile, Heavy Mining Equipment (HME) workshop and camp).	• increased recharge within the cleared footprints
Demolition and relocation of housing infrastructure.	• Accidental spillages
Establishment of surface infrastructure and facilities including workshops, camp, magazine, and linear infrastructure (security fence, power lines, internal haul and access roads).	• Accidental spillages
Establishment of the Processing Plant and associated facilities.	• Accidental spillages
General construction activities including the use of vehicles and machinery as well as the storage and handling of waste and hazardous material.	• Accidental spillages

- **Impact Description: Accidental Spillages**

Activities that take place during the construction phase could potentially result in accidental spills of hydrocarbons or chemicals, which can infiltrate and contaminate the aquifers. Accidental spills are considered as unplanned and low risk events and have therefore been discussed under Section 8.4

- **Impact Description: Increased Recharge to Cleared Footprints**

Clearing vegetation and removing top soil for the development of infrastructure could potentially lead to increased infiltration of rainfall within that footprint area, subsequently increasing the potential recharge to the groundwater resource. The risk for increased recharge as a result of vegetation clearance is expected to be negligible and will be dependent on the size of the cleared footprint and for how long the footprint will be cleared.

- **Management Objectives**

The objective of the management measures is to ensure that groundwater impacts associated with vegetation clearance are avoided, minimised and/or managed.

- **Impact Ratings and Management Actions**

The impact ratings (before and after mitigation measures) as well as the recommended mitigation measures are provided in Table 8-11.

Table 8-11: Construction Impact for Reduced Recharge from Cleared Footprints

<table>
<tr><td colspan="10">Activity: Site/Vegetation Clearance</td></tr>
<tr><td colspan="10">Impact Description:
During the construction phase, the site will be cleared for the development of the project infrastructure. Site clearance includes the removal of vegetation. Removal of vegetation will cause rainfall to preferentially run-off, reducing the potential recharge to the groundwater system.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>2</td><td>Short term</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>2</td><td>Short term</td></tr>
<tr><td>Extent</td><td>1</td><td>Very limited</td><td>Extent</td><td>1</td><td>Very limited</td></tr>
<tr><td>Intensity</td><td>1</td><td>Limited damage to minimal area of low significance</td><td>Intensity</td><td>1</td><td>Limited damage to minimal area of low significance</td></tr>
<tr><td>Probability</td><td>4</td><td>Probable</td><td>Probability</td><td>3</td><td>Unlikely</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Negligible (negative) 16</td><td colspan="5">Negligible (negative) 12</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">Keep vegetation clearance to the minimum required footprint required for the development of infrastructure;
Divert storm water runoff around and away from cleared footprints. Storm water collected in the contact water footprint must be directed to designated water storage facilities; and
Rehabilitate disturbed footprints at the earliest available opportunity.</td></tr>
</table>

8.2.1.4. Wetlands

The site clearance, removal of vegetation, soil stripping (where applicable) and stockpiling of topsoil, subsoil and waste rock will lead to the loss of wetland habitat.

Increased flow velocity from hardened surfaces and concentrated flow may enhance the onset of erosion, sedimentation of water resources and creation of preferential flow paths. Soil stockpiles, pits, WRDs and infrastructure areas might erode and lead to sedimentation and contamination of downstream and adjacent wetlands as well as lead to water contamination. There is a risk of contaminants, associated with the construction activities and machinery, entering wetlands from the access roads and the construction footprint, as well as organic waste and domestic litter, which has the potential to result in water quality impacts.

Exposed surfaces may result in increased dust levels, erosion and sedimentation into the low-lying areas and wetlands. Vehicles and machinery will lead to soil compaction, increased surface runoff, erosion and loss of vegetation (organic material). This reduces infiltration rates, and the ability for plant roots and water to penetrate the soil.

The construction phase associated with the open pit mining will include blasting several metres deep to create a natural slope for natural runoff. Blasting and construction may lead to increased dust levels, erosion and sedimentation as well as the destruction of the wetlands downstream.

8.2.1.4.1. Impact Ratings

The pre-mitigation impact ratings during the construction phase have all been scored "Moderate-Negative". The post-significance ratings range from "Minor-Negative" to "Moderate-Negative" considering the implementation of mitigation and management measures". The lowest significance ratings are associated with general construction activities including the use of vehicles and machinery as well as storage and handling of waste and hazardous material. The highest impacts are associated with the clearance of vegetation and stripping of soil associated with the preparations for the open cast pit, WRD and TSF (most notably) which will result in a direct loss of wetland areas.

Table 8-12: Construction Impact for Site/Vegetation Clearance for the Placement of the Main Infrastructure

<table>
<tr><td colspan="10">Activity: Site/vegetation clearance for the placement of the main infrastructure including TSF, WRDs, Ramula Open Pit, processing plant and associated facilities, administration unit and camp area, ore stockpile and the HME workshop</td></tr>
<tr><td colspan="10">Impact Description: During this activity, vegetation will be cleared, and topsoil will be stripped. This will entail a complete loss of wetland habitat where the proposed activities impede wetland systems. This will have a further indirect knock-on effect on downstream wetlands.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Permanent (7)</td><td>The impact will remain long after the life of the Project. The impacts are irreversible.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Permanent (7)</td><td>The impact will remain long after the life of the Project. The impacts are irreversible.</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Extending across the site and to nearby settlements.</td><td>Extent</td><td>Limited (2)</td><td>Limited to the site and its immediate surroundings.</td></tr>
<tr><td>Intensity</td><td>Very Serious (5)</td><td>Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.
Very serious widespread social impacts. Irreparable damage to highly valued items.</td><td>Intensity</td><td>Serious (4)</td><td>Serious medium term environmental effects. Environmental damage can be reversed in less than a year.
On-going serious social issues. Significant damage to structures / items of significance.</td></tr>
<tr><td>Probability</td><td>Certain / Definite (7)</td><td>There are sound evidence based reasons to expect that the impact will definitely occur.</td><td>Probability</td><td>Certain / Definite (7)</td><td>There are sound evidence based reasons to expect that the impact will definitely occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Moderate (negative)
-105</td><td colspan="5">Moderate (negative)
-91</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
</table>

- No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the rehabilitation footprint and access roads;
- Spill containment and clean up kits should be available on-site and clean-up from any spill must be in place and executed at the time of spillage with appropriate disposal as necessary;
- All vehicles must be regularly inspected for leaks and re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons;
- The monitoring plan should be followed from the onset of the construction phase;
- Dispose of hazardous material at an appropriate landfill site;
- Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities outside wetlands and water courses;
- At areas where road crossings and linear infrastructure have been designed to cross wetlands, these roads should cross wetland or river features at the narrowest point and a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing;
- Stormwater management must be implemented at the onset of the construction phase to avoid dirty water being channelled into undisturbed areas and/or wetlands;
- Implement concurrent rehabilitation to prevent and minimise impacts to the wetland systems; and
- Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.

Table 8-13: Construction Impact for General Construction Activities

<table>
<tr><td colspan="10">Activity: General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material.</td></tr>
<tr><td colspan="10">Impact Description: During this activity, material will be transported, during which heavy vehicles could lead to increased compaction and potential oil spills. An increase in vehicle movement will result in compaction, increased overland flow and potential erosion within wetland areas. This will lead to sedimentation of downstream systems.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Permanent (7)</td><td>The impact will remain long after the life of the Project. The impacts are irreversible.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Beyond Project Life (6)</td><td>The impact will remain for some time after the life of the Project.</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Limited to the site and its immediate surroundings.</td><td>Extent</td><td>Limited (2)</td><td>Limited to the site and its immediate surroundings.</td></tr>
<tr><td>Intensity</td><td>Serious (4)</td><td>Serious medium term environmental effects. Environmental damage can be reversed in less than a year.
On-going serious social issues. Significant damage to structures / items of significance.</td><td>Intensity</td><td>Moderate (3)</td><td>Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires the intervention of external specialists and can be done in less than a month.
On-going social issues. Damage to items of significance.</td></tr>
<tr><td>Probability</td><td>Certain/ Definite (7)</td><td>There are sound evidence based reasons to expect that the impact will definitely occur.</td><td>Probability</td><td>Almost Certain / Highly Probable (6)</td><td>It is most likely that the impact will occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Moderate (negative)
-91</td><td colspan="5">Minor (negative)
-66</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">
• Adequate blasting techniques during the construction of pits need to take place to avoid uncontrolled debris ending up in wetlands;
• No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the rehabilitation footprint and access roads;
• Spill containment and clean up kits should be available on-site and clean-up from any spill must be in place and executed at the time of spillage with appropriate disposal as necessary;
• All vehicles must be regularly inspected for leaks and re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons;
• Monitor infrastructure to ensure no runoff, erosion, preferential flow paths and sedimentation;
• Dispose of hazardous material at an appropriate landfill site;
• Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities outside wetlands and water courses;
• Stormwater management should be implemented at the onset of the construction phase to avoid dirty water being channeled into undisturbed areas and/or wetlands. Clean surface water should be directed back into adjacent wetland systems in a diffuse manner;
• Implement concurrent rehabilitation to prevent and minimise impacts to the wetland systems; and
• Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.
</td></tr>
</table>

8.2.1.5. Terrestrial Ecology

The establishment of the proposed infrastructure will lead to the direct loss of natural habitats within the project site. Given that the remaining natural habitats in the area are already limited in size, any additional loss or fragmentation will have significant ecological consequences. This further reduction in habitat size will result in a decline in biodiversity, as many species depend on these remaining areas for survival. Fragmentation disrupts ecological connectivity, which is essential for species movement, genetic exchange, and the maintenance of healthy populations.

Moreover, the loss of these natural habitats will diminish the ecosystem services they provide, such as water purification, flood regulation, soil stabilization, and carbon sequestration. These services are crucial not only for maintaining environmental health but also for supporting local communities who rely on them for clean water, fertile soils, and climate regulation. The degradation of these habitats would therefore lead to both ecological and socio-economic impacts, emphasizing the need to mitigate habitat destruction and consider conservation strategies to protect remaining biodiversity and ecosystem functions.

The increasing influx of people into natural areas as a result of the proposed activities poses significant challenges, with potentially far-reaching impacts on wildlife and biodiversity. As human activity expands into natural environments, the potential for human-wildlife conflicts escalates, posing risks to both humans and animals. Moreover, the surge in human presence also facilitates the exploitation of fauna and flora species. Unregulated hunting, poaching, and illegal trade of wildlife for various purposes, such as traditional medicine, exotic pets, and luxury goods, can lead to severe declines in animal and plant populations. This may have direct impacts on sensitive species in the region, such as those listed on CITES which were recorded during the field surveys, and are considered the most at risk due to exploitation.

8.2.1.5.1. Impact Ratings

Table 8-14, below, presents the anticipated impact ratings associated with the construction phase of the Project

Table 8-14: Impact Assessment for the Construction Phase (Vegetation Clearance)

<table>
<tr><td colspan="10">Activity: Vegetation clearance for the establishment of infrastructure, ancillary infrastructure and soil stripping.</td></tr>
<tr><td colspan="10">Impact Description:
The site preparation activities will lead to the complete removal or loss of the vegetation communities delineated within the proposed infrastructure layout. This will have significant implications, including the loss of local biodiversity and disruption of ecosystem functioning. Furthermore, the disturbance caused by site preparation will promote edge effects and fragmentation, further exacerbating the impacts on biodiversity. Edge effects occur at the boundary between different habitat types and can lead to altered environmental conditions, increased vulnerability to invasive species, and reduced habitat quality for sensitive species. Additionally, the degradation of the area through vegetation removal will create favourable conditions for the proliferation of alien invasive plants (AIPs).</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Permanent (7)</td><td>The vegetation will be permanently removed.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Project Life (5)</td><td>Impacts can be reversed with suitable mitigation.</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Limited to the site and immediate surroundings.</td><td>Extent</td><td>Limited (2)</td><td>Same as pre-mitigation</td></tr>
<tr><td>Intensity</td><td>Serious Loss (4)</td><td>Serious loss or damage to sensitive habitats which will be removed for the pit construction.</td><td>Intensity</td><td>Minor Loss (2)</td><td>Minor loss or damage to sensitive habitats which will be removed for the pit construction.</td></tr>
<tr><td>Probability</td><td>Definite (7)</td><td>The impact will definitely occur without mitigation</td><td>Probability</td><td>Likely (5)</td><td>Likely the impact will occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">-91 Moderate (negative)</td><td colspan="5">-40 Minor (negative)</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">• Sensitive vegetation units within the areas demarcated for clearing, should be avoided wherever possible.
• Application of the mitigation hierarchy to ensure compensation for the loss of sensitive habitat units, critical habitat (if any) and threatened flora must be incorporated in the rehabilitation process that aligns with the company's Biodiversity Action Plan (BAP) or Biodiversity Offset strategies.
• Keep site clearing to a minimum extent and to what is absolutely necessary, and restrict vehicle movement to existing roads, avoiding unnecessary creation of new roads.
• A pre-screening search and rescue of slow-moving, nesting faunal species and /or plants with National Conservation Significance (endemics), where relevant with professional justification must be done prior to site clearance.
• Make use of existing roads to encourage minimal impacts/footprint.
• No temporary storage or placement of infrastructure should take place in natural or sensitive areas. Therefore, it is advised that disturbed areas are to be used.
• Implement an AIP management and control strategy to prevent establishment and encroachment.
• Monitor and maintain stockpiles and dumps to ensure no runoff, erosion or sedimentation into the adjacent areas occur.
• Stripped topsoil stockpiles must be vegetated and situated in areas where no leaching of contaminants may occur.</td></tr>
</table>

Table 8-15: Impact Assessment for Construction (General Construction)

<table>
<tr><td colspan="10">Activity: General Construction Activities</td></tr>
<tr><td colspan="10">Impact Description:
• Colonization of exposed and bare soils by invasive species.
• Contamination and / or dumping of waste material into the surrounding landscape.
• Influx of people into natural areas, exposing sensitive species to potential human exploitation.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="2">Dimensio n</td><td>Duration</td><td rowspan="2">Rating</td><td>Beyond Project Life (6)</td><td>Impacts may extend beyond the project life.</td><td rowspan="2">Dimen sion</td><td>Duration</td><td rowspan="2">Rating</td><td>Project Life (5)</td><td>Impacts may cease and can be revered with mitigation measures.</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Local, extending as far as the development project</td><td>Extent</td><td>Limited (2)</td><td>Limited to the general construction areas.</td></tr>
</table>

	Intensity		Irreplaceable Loss (6)	Can be irreplaceable loss if not mitigated correctly.		Intensity		Serious Loss (4)	Serious losses can be minimised with effective mitigation.
	Probability		Almost Certain (6)	Almost certain that these impacts will occur		Probability		Probable (4)	Impacts are probable,<50% probability.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
- 90 Moderate (negative)					**- 48 Minor (negative) –**				
Mitigation/Management Actions									

- Implement rapid re-vegetation efforts with native plant species to prevent invasive species colonization.
- Apply erosion control measures such as installing erosion blankets or jute netting to stabilize the soil and reduce erosion.
- Conduct regular monitoring and maintenance to detect and control invasive species before they become established.
- Erect physical barriers or fencing around construction sites to prevent unauthorized access and illegal dumping.
- Implement strict waste management protocols to ensure proper disposal of construction materials and prevent contamination.
- Develop and implement public awareness campaigns to educate visitors about the importance of conserving biodiversity and respecting wildlife.
- Establish clearly marked trails and recreational zones to direct human activities away from sensitive habitats.
- Enforce strict regulations and penalties for illegal activities such as hunting, poaching, and collection of wildlife or plants.

8.2.1.6. Visual

The activities associated with the construction phase (earthworks, installation of infrastructure etc.) of the Project will lead to the alteration of the natural landscape and will impact the visual character and sense of place of the receiving environment. The removal of the vegetation alters the visual character of the immediate area and creates a contrast between the cleared area and the surrounding vegetation. In addition, the removal of vegetation will lead to dust generation which can be a nuisance to nearby visual receptors. The presence of heavy equipment such as dozers and haul trucks will not only be visible to the nearby visual receptors but will also create a contrast between the natural environment and the mine site. General construction activities (construction of the various facilities) may also alter the visual character of the immediate area, resulting in a contrast between the newly constructed infrastructure and the surrounding environment.

The activities associated with this phase will occur in phases and will be short term in nature.

8.2.1.6.1. Impact Ratings

The noise impact during the construction phase of the Project has been assessed and is provided in Table 8-16.

Table 8-16: Impact Assessment for the Construction Phase

Activity:

- Site/vegetation clearance for the placement of the main infrastructure including TSF, WRDs, Ramula Open Pit, processing plant and associated facilities, administration unit and camp area, ore stockpile and the Heavy Machinery Equipment (HME) workshop; and
- General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material.

Impact Description: Removal of vegetation, presence of mining equipment and general construction activities will alter the visual character of the receiving environment creating a contrast between the mine site and the natural environment

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Short-term (2)	Activities associated with this phase will be short-term in nature therefore the duration of impact will also be short term.	**Dimension**	Duration	**Rating**	Short-term (2)	Activities associated with this phase will be short-term in nature therefore the duration of impact will also be short term.
	Spatial scale		Limited (2)	Construction phase impacts will be limited to the site and its immediate surroundings.		Spatial scale		Very Limited (1)	Construction phase impacts will be Limited to specific isolated parts of the site.
	Intensity		Serious (4)	Receptors within 5km of the Project area will experience mainly high - to very high visual impacts. However the screening effect of vegetation and the partially degraded nature of the receiving environment may further reduce the visual impact at the nearest receptor.		Intensity		Moderate (3)	Proposed mitigation measures may further reduce the impact..
	Probability		Likely (5)	The transformation of the current land use to mining will definitely occur. Altering the natural landscape and sense of place. Thus, resulting in significant visual impact. However the screening effect of vegetation and topography may reduce the visual impact at the nearest receptor. In addition, the transformed of the receiving environment will also reduce this impact.		Probability		Likely (5)	No change post mitigation
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) - 40					**Minor (negative) – 40**				

Mitigation/Management Actions

- Limit the removal of vegetation to the infrastructure footprint to take advantage of the vegetations screening effect.
- Implement a dust suppression programme.
- Where practical, locate Project related infrastructure in the valley to take advantage of the screening effect of topography.
- Use of neutral colours so that infrastructure blends in with the natural environment.
- Concurrent rehabilitation of prominent features such as TSF and WRD to minimise the visual exposure of the features.

8.2.1.7. Noise

The construction phase activities of the Project will result in noise emissions to the environment with the potential for a significant negative impact on the nearby NSRs. However, these activities will be short-term and will occur in phases leading to a further reduction in noise emissions i.e., less equipment will be required per phase thus resulting in less noise emissions. While certain construction activities occur 24 hours, the limitation to daylight hours for other construction activities will aid in reducing noise impacts. In addition, the scattered and isolated nature of activities across the Project area footprints further aids in noise reduction, minimising the overall impact. The developing waste rock dumps will also serve as man-made noise barriers which will also aid in noise reductions not to mention the reduction in noise emissions as mining commences deeper into the pit, the pit walls will serve as man-made barriers, limiting the amount of noise that reaches the surface.

The screening effect of topography based on model simulations has aided in reducing the anticipated noise impacts as well as elevated baseline ambient noise levels which have masked the noise impacts associated with Project related activities emissions.

8.2.1.7.1. Impact Ratings

The noise impact during the construction phase of the Project has been assessed and is provided in Table 8-16

Table 8-17: Impact Assessment for the Construction Phase

Activity:

- Site/vegetation clearance for the placement of the main infrastructure including TSF, WRDs, Ramula Open Pit, processing plant and associated facilities, administration unit and camp area, ore stockpile and the Heavy Machinery Equipment (HME) workshop.
- General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material.

Impact Description: Noise will emanate from the machinery, equipment and vehicles used for undertaking activities associated with construction phase.

	Pre-Mitigation/Management					**With Mitigation/Management**			
Dimension	Duration	**Rating**	Short-term (2)	Activities associated with this phase will be short-term in nature therefore the duration of impact will also be short term.	**Dimension**	Duration	**Rating**	Short-term (2)	Activities associated with this phase will be short-term in nature therefore the duration of impact will also be short term.
	Spatial scale		Local (3)	Based on the noise dispersion model, impacts will extend across the site and to nearby settlements..		Spatial scale		Limited (1)	Noise emissions will be limited to specific isolated parts of the site post mitigation.
	Intensity		Minor (2)	The majority of the NSRs will experience little changes to the baseline environment. Only four NSRs are expected to experience serious (high to very high) noise impacts		Intensity		Minimal (1)	Minimal implications anticipated post-mitigation.
	Probability		Unlikely (3)	Four NSRs are predicted to experience significant (high to very high) noise impacts. Therefore, the probability of noise impacts occurring at the NSRs is unlikely.		Probability		Rarer / Improbable (2)	The possibility of noise impacts materialising post-mitigation is rare.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Negligible (negative) - 21					**Negligible (negative) – 8**				

Mitigation/Management Actions

- Construction activities (usage of heavy equipment / machinery) should be restricted to daylight hours where feasible.
- Construction should be carried out in phases.
- Construction machinery, equipment and vehicles should be switched off when not in use and not left idling unnecessarily.
- Where practicable, utilise low frequency / low sound reverse beepers on construction vehicles.
- Construction machinery, equipment and vehicles are to be serviced as per the Original Equipment Manufacturers (OEM's) requirements to limit noise emissions.
- Install exhaust mufflers (where applicable) on construction vehicles engine exhausts.
- Re-locate NSRs located within the Project / Study area footprint.
- Noise monitoring and the development of a mechanism to record and respond to noise complaints.

8.2.1.8. Air Quality

Construction activities will occur in phases and will be short-term in nature. Although activities associated with this phase will result in the emission of fugitive dust comprising TSP, PM_{10} and $PM_{2.5}$, related impacts will be negligible due to the short-term nature. Also, anticipated impacts will most likely be limited to the site.

The management objectives are aimed at ensuring that emission levels on-site and at off-site locations are not in exceedance of the WHO guideline limits, that are protective of the environment, human health and wellbeing.

All construction-related activities have been grouped for rating as their management requires the implementation of similar mitigation measures. Construction activity impacts are described in Table 8-18.

Table 8-18: Significance Ratings for Site Clearing and General Construction of Surface Infrastructure

<table>
<tr><td colspan="10">Activity: Site Clearing and General Construction of Surface Infrastructures (vegetation clearing, Topsoil stripping and Stockpiling, Earthwork and Establishment of Infrastructure, General Construction Activities</td></tr>
<tr><td colspan="10">Impact Description: Poor ambient air quality</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Short-term (2)</td><td>Dust generation will be short-term</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Short-term (2)</td><td>Dust generation will be short-term</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>The emission of pollutants will be limited to each activity and immediate surroundings.</td><td>Extent</td><td>Very Limited (1)</td><td>After mitigation measures, It is expected that emissions will be limited to isolated parts of the site.</td></tr>
<tr><td>Intensity</td><td>Minor (2)</td><td>Minor implications on the air quality</td><td>Intensity</td><td>Minimal (1))</td><td>Generated dust will have minimal impacts on the ambient air quality after mitigation.</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>Probable that impact may occur</td><td>Probability</td><td>Unlikely (3)</td><td>Unlikely that an impact on the ambient air quality will occur after mitigation.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Negligible (negative) – 24</td><td colspan="5">Negligible (negative) – 12</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">

Implement localised / activity-specific surface watering to minimise emissions;
Apply dust suppressants on exposed surface areas, access and haul roads, where practicable;
Limit high dust-generating activities (i.e. land clearing and topsoil stripping) to periods of low wind where possible (wind speed less than 5.4 m/s);
Set maximum speed limits on-site and have these limits enforced;
Minimise the footprint of disturbance as far as practicable; and
Minimise the drop heights when loading onto trucks and at tipping points.

</td></tr>
</table>

8.2.1.9. Heritage

The following impacts can be anticipated for the Construction Phase of the proposed Project:

- Impact on subsurface archaeological and cultural heritage resources which may be accidentally exposed, damaged/ destroyed by mining operational activities (replicable);
- Impact on heritage sites such graves, natural features of cultural significance (e.g. ponds and objects) as result of mining activities if no appropriate measures are implemented. Known cultural heritage resources may be accidentally damaged, destroyed or polluted during mine operations if not mitigated; and

Displacement of communities and disruption of way of life.

Table 8-19: Impact Assessment Relating to Replicable Tangible Heritage Encountered During the Project's Construction Phase

Activity:

- Site/vegetation clearance for the placement of the main infrastructure;
- General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material; and
- Land acquisition in the extended exclusion zone.

Impact Description:

- Damage/destruction of unidentified tangible heritage resources (i.e., accidentally exposed, damaged or destroyed);
- Damage/destruction of graves;
- Damage/destruction of places of worship;
- Pollution of known cultural heritage sites from topsoil stripping and stockpiling; and
- Restriction of access to sites of cultural/ritualistic and spiritual beliefs and practice.

Pre-Mitigation/Management					With Mitigation/Management				
Dimension	Duration	Rating	7	The impact is irreversible, once tangible cultural heritage is exposed, it may not be reburied or restored to its original state as the site will continue being worked on and leaving them on site may lead to exposure and potential damage	Dimension	Duration	Rating	2	Less than 1 year to completely reverse the impact.
	Extent		3	Extending across the site and to nearby settlements.		Extent		3	Extending across the site and to nearby settlements.
	Intensity		6	Irreparable damage to cultural heritage with unevaluated CS		Intensity		2	Minor medium-term social impacts on local population. Mostly repairable. Functions and processes not affected.
	Probability		5	The presence of unidentified, subsurface tangible cultural heritage cannot be predicted, and accidental exposure, damage or destruction is likely		Probability		4	The presence of unidentified, subsurface tangible cultural heritage cannot be predicted, and accidental exposure, damage or destruction is likely
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Serious (negative) – 80					Acceptable (negative) - 28				

Mitigation/Management Actions

- A pre-disturbance survey that is linked with stakeholder consultation is required in order to establish the locations of the noted heritage resources. Based on the location of these features in relation to the project footprint, appropriate recommendations will be made;
- Avoidance and management of cultural heritage features in-situ is the preferred mitigation strategy. This will require the establishment of no-go zones around heritage sites or observations, with a buffer zone of 100m, where feasible;
- If preservation is not possible, develop, implement, and monitor a Cultural Heritage Management Plan (CHMP) in consultation with relevant communities to document the identified risks, impacts and mitigation measures;
- A CHMP is further recommended for the management of the recorded cultural observations and the restoration of the disrupted environmental and social order as a way of healing and restoring mutual trust between Shanta Gold and the local communities.
- Implement the Chance Find Procedure (CFP) outlined under section 9.6 as part of the CHMP to describe the actions required in the event of a chance find (i.e., if previously unknown cultural heritage is encountered);
- Monitor implementation of the CHMP and CFP, and any related plans and procedures to mitigate against impact on cultural heritage resources;
- Ensure that personnel involved in ground disturbance activities are trained to comply and work in accordance with the CHMP and CFP;
- Ensure all activities are undertaken within approved areas of the Project;
- Monitoring of demarcated areas or sites left in situ;
- Implement required consultation and permitting processes for the possible exhumation and relocation of human remains if avoidance is not possible, if any burial sites are affected during any of the Project phases; and
- Controlled access to all sacred or heritage sites should be provided to individuals wishing to access them.

Table 8-20: Impact Assessment Relating to Nonreplicable Heritage Resources Encountered During the Project's Construction Phase

Activity:

- Site/vegetation clearance for the placement of the main infrastructure;
- General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material; and
- Land acquisition in the extended exclusion zone.

Impact Description:

- Damage/destruction of sacred sites such as sacred trees/ponds;
- Pollution of known cultural heritage sites from topsoil stripping and stockpiling; and

- Restriction of access to sites of cultural/ritualistic and spiritual beliefs and practice.

Pre-Mitigation/Management					With Mitigation/Management				
Dimension	Duration	Rating	7	The impact is irreversible, once tangible cultural heritage is exposed, it may not be reburied or restored to its original state as the site will continue being worked on and leaving them on site may lead to exposure and potential damage	Dimension	Duration	Rating	5	Although the impact remains irreversible, any further exposure can be avoided or managed
	Extent		2	Limited to immediate development footprint areas		Extent		2	Limited to immediate development footprint areas
	Intensity		6	Irreparable damage to nonreplicable cultural heritage		Intensity		3	Minor medium-term social impacts on local population. Mostly repairable. Functions and processes not affected.
	Probability		7	Development of the site will definitely destroy the sacred trees		Probability		3	Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Serious (negative) – 105					**Acceptable (negative) - 30**				

Mitigation/Management Actions

- A pre-disturbance survey that is linked with stakeholder consultation is required in order to establish the locations of heritage resources. Based on the location of these features in relation to the project footprint, appropriate recommendations will be made;
- Avoidance and management of cultural heritage features in-situ is the preferred mitigation strategy. This will require the establishment of no-go zones around heritage sites or observations, with a buffer zone of 100m, where feasible;
- If preservation is not possible, develop, implement, and monitor a Cultural Heritage Management Plan (CHMP) in consultation with relevant communities to document the identified risks, impacts and mitigation measures;
- A CHMP is further recommended for the management of the recorded cultural observations and the restoration of the disrupted environmental and social order as a way of healing and restoring mutual trust between Shanta Gold and the local communities.
- Implement the Chance Find Procedure (CFP) outlined under section 9.6 as part of the CHMP to describe the actions required in the event of a chance find (i.e., if previously unknown cultural heritage is encountered);
- Controlled access to all sacred or heritage sites should be provided to individuals wishing to access them
- Safeguard against dust pollution to known cultural heritage resources;
- Safeguard against waste pollution to known cultural heritage resources such as sacred trees/streams;
- Conduct preconstruction and construction consultative process with affected indigenous communities where their archaeological and cultural heritage resources are affected by construction activities;
- Undertake a social consultative process to identify custodians of living cultural heritage sites to develop a Heritage Site Management Plan and agree on access and site management;

8.2.1.10. Traffic

This section examines the impact of the Project on the road network. The project related traffic consists of traffic generated by both construction and operational activities. It is anticipated that the impacts would primarily be during the construction phase of the Project.

Table 8-21: Impacts related to construction stage road network performance and safety impacts

Dimension	Rating	Motivation	Significance
Impacts related to construction stage road network performance and safety impacts			
Impact Description: with and increase in traffic during the construction stage there is a possibility of impacts on road network performance and safety. This risk assessment relates to impact on intersections.			
Prior to Mitigation/Management			
Duration	3	Will commence during construction	Minor Negative (-52)
Extent	4	Will affect all construction workers and surrounding commuters along the construction routes.	
Intensity	4	This will include the impact during the full extent of the construction duration.	
Probability	4	Multiple intersections will be affected as construction vehicles will traverse through these.	
Nature	Negative		
Mitigation/Management Actions			
• Traffic Management Plans should be prepared prior to construction activities. Road safety measures should take into consideration speed restrictions, driver fatigue, in-vehicle communications, signage, demarcations, maintenance, safety checks, and interaction with public transport, transport of hazardous and dangerous goods and emergency response and disaster management. • Temporary road works, including diversion and signage, should be in accordance with relevant road design and road sign manuals. • Construction activities and vehicle movements to minimise travel during background peak hour • Fatigue management measures should be introduced and enforced for all workers. • Heavy vehicle turning signs are to be implemented during construction stage at the access intersection • Proper community notification is required in order to notify surrounding road users of construction vehicle activity utilising the access location and road network from Bougouni to site.			
Post-Mitigation			
Duration	3	As for pre-mitigation	Negligible Negative (-22)
Extent	4	As for pre-mitigation	
Intensity	2	Mitigation/ management measures will reduce the severity of this impact, should it occur	
Probability	2	Mitigation/ management measures will reduce the likelihood of this impact	
Nature	Negative		

Table 8-22: Construction Stage Road Link Impacts

Dimension	Rating	Motivation	Significance
Impacts related to construction stage road network performance and safety impacts			
Impact Description: with and increase in traffic during the construction stage there is a possibility of impacts on road network performance and safety. This risk assessment relates to impact on road links.			
Prior to Mitigation/Management			
Duration	3	Will commence during construction	Minor Negative (-51)
Extent	4	Will affect all construction workers and surrounding commuters along the construction routes.	
Intensity	3	This will include the impact during the full extent of the construction duration but will only relate to increase in road link capacity.	
Probability	4	Multiple road links will be affected as construction vehicles will traverse through these.	
Nature	Negative		

Dimension	Rating	Motivation	Significance
Mitigation/Management Actions			
• Travel demand management (TDM) campaign to inform the public on works and its effect on network operations • Construction Traffic Management Plan managing hours of work and deliveries, staff transport and staff parking, with the provision of on-site tool storage where practicable. • Relevant emergency services should be notified in advance prior to the movement of all hazardous/dangerous or oversize construction material and equipment. • All Oversize Over Mass Vehicles which might be used during construction should have a detailed route assessment done • Fatigue management measures should be introduced and enforced for all workers.			
Post-Mitigation			
Duration	3	As for pre-mitigation	Negligible Negative (-22)
Extent	4	As for pre-mitigation	
Intensity	2	Mitigation/ management measures will reduce the severity of this impact, should it occur	
Probability	2	Mitigation/ management measures will reduce the likelihood of this impact	
Nature	Negative		

Table 8-23: Construction and Operational Stage Road Safety Impacts

Dimension	Rating	Motivation	Significance
Impacts related to construction and operational stage road network performance and safety impacts			
Impact Description: with and increase in traffic during the construction stage there is a possibility of impacts on road network performance and safety. This risk assessment relates to road safety			
Prior to Mitigation/Management			
Duration	4	Will commence during construction and operational stages	Minor Negative (-51)
Extent	4	Will affect all construction workers and surrounding commuters along the construction and operational routes.	
Intensity	4	This will include the impact during the full extent of the construction and operational stage duration but will only relate to increase in road link capacity.	
Probability	4	Multiple road links will be affected as construction vehicles will traverse through these.	
Nature	Negative		

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4"><u>Intersection 1</u>

Vulnerable motorcycle and pedestrian activity occur at the intersections, and it is proposed that drivers of construction and operational traffic be made aware of such high usage during induction training and transport operating procedures. There are no formal pedestrian crossing opportunities evident and as such pedestrians across roads at random and at mid-block.
There is no lighting available at the intersection which may create a safety risk during low light and visibility conditions. It is recommended that all vehicles to be used during construction and operation stages be adequately maintained to ensure lights are in working condition.
Passing of heavy vehicles during construction and operational stages might increase dust production. Unchecked dust creation causes lung damage, crop damage, impedes visibility for drivers and workers and can be a nuisance for nearby villagers. Water should be applied at regular intervals in high-traffic and/or high population-density areas. This provision should be a clearly billed item and the Client/Consulting Engineer should ensure that the activity is carried out as per the contract specifications.
Consult the local public and encourage their participation in noise mitigating measures.
Consult local people and encourage their participation to protect public health and ensure safety.
Heavy vehicle turn signage should be provided to warn other modes of heavy vehicle conflict.
Vulnerable motorcycle and pedestrian activity occur at the intersection, and it is proposed that drivers of construction and operational traffic be made aware of such high usage during induction training and transport operating procedures. There are no formal pedestrian crossing opportunities evident and as such pedestrians across roads at random and at mid-block.
The surrounding community should be notified in advance of trip plans, construction activities and durations as well as operational haulage trip details and plans.
Steep edge drops are evident at some locations within the study area which may create a safety risk to road runoff. It is recommended that fatigue management plans be in place to ensure drivers are not at fatigue levels and concentration levels are adequate during work hours.
Heavy vehicles during both construction and operational stages might be using the gravel roads to and from the site. It is also recommended that the gravel roads be upgraded to a suitable gravel standard (cross section and layer works) sufficient to accommodate construction and operational traffic (as to be determined during engineering design stages).
It is recommended that sufficient clearance to fixed structures be provided for when the through road is formalised to ensure that vehicles do not collide with structures and objects.
Consult local people and encourage their participation to protect public health and ensure safety.
Basic left and right turn treatments would be sufficient to accommodate construction and operational traffic.
Any obstructions impeding on driver sight such as embankments, vegetation etc. should be removed prior to commencement of construction and operational activities to allow for clear sight envelopes.
Operating speed signs with speed limit of 60km/h along the access road to the Project and 70km/h along the major road used for transport during construction and operational stages.
Regular maintenance and grading of the unpaved roads are required to minimise corrugation which reduces riding quality and impacts on safety.
Grading works should be carried out on materials with proper moisture content to reduce dust build up in the air. Regular grading would also allow for a smooth road surface without grooves and cracks in order to keep the noise level to a minimum.
Grade and out-slope roadbeds to minimize water accumulation on road surfaces. The practice minimizes erosion and road failure potential. Out-sloping involves grading the road that it slopes downward from the toe of the road to the shoulder – the slope should be about 3-4%.
</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>4</td><td>As for pre-mitigation</td><td rowspan="5">Negligible Negative (-23)</td></tr>
<tr><td>Extent</td><td>4</td><td>As for pre-mitigation</td></tr>
<tr><td>Intensity</td><td>2</td><td>Mitigation/ management measures will reduce the severity of this impact, should it occur</td></tr>
<tr><td>Probability</td><td>2</td><td>Mitigation/ management measures will reduce the likelihood of this impact</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
</table>

Table 8-24: Construction and Operational Stage Air Pollution Impacts

Dimension	Rating	Motivation	Significance
Impacts related to construction and operational stage road network air pollution impacts			
Impact Description: with and increase in traffic during the construction stage there is a possibility of impacts on road network performance and safety. This risk assessment relates to road air pollution.			
Prior to Mitigation/Management			
Duration	4	Will commence during construction and operational stages	Minor Negative (-51)
Extent	4	Will affect all construction workers and surrounding commuters along the construction and operational routes.	
Intensity	4	This will include the impact during the full extent of the construction and operational stage duration but will only relate to increase in road link capacity.	
Probability	4	Multiple road links will be affected as construction vehicles will traverse through these.	
Nature	Negative		
Mitigation/Management Actions			
• Select road alignments during the design process in such a way to avoid passing close to housing estates, schools, hospitals and workplaces especially where unformed gravel roads leading to the site are proposed to be formalised with possible new alignments. • Avoid steep grades and sharp curves since they promote deceleration and acceleration • Manage the traffic in such a way that construction vehicles traverse the road network outside of background peak hour conditions in populated areas. • Machinery should be well maintained, and the most modern machines should be used, where possible. • Provide protective clothing to workers • Consult affected local community and encourage their participation in the implementation of further mitigation measures			
Post-Mitigation			
Duration	4	As for pre-mitigation	Negligible Negative (-23)
Extent	4	As for pre-mitigation	
Intensity	2	Mitigation/ management measures will reduce the severity of this impact, should it occur	
Probability	2	Mitigation/ management measures will reduce the likelihood of this impact	
Nature	Negative		

8.2.1.11. Socio-economic

The construction phase shall involve significant site and vegetation clearance which will be conducted to prepare for the main infrastructure, including the Tailings Storage Facility (TSF), Waste Rock Dumps (WRDs), Ramula Open Pit, processing plant, administration unit, camp area, ore stockpile, and Heavy Machinery Equipment (HME) workshop. This phase will also involve general construction activities such as using heavy vehicles and machinery, as well as managing and storing waste and hazardous materials.

The socio-economic impacts anticipated to arise during the construction phase which are assessed within this section are listed in Table 8-25 and further discussed in subsections.

Table 8-25: Summary of Impacts Expected During the Construction Phase

Theme	Change Drivers	Principle Impacts
Employment and economic development	Job opportunities	Wage-based livelihoods (+) • Increase in household incomes (+) • Increase standard of living (+)
		Training and skills development (+) • Improved work force skills (+) • Increased income-earning potential (+)
		Social differentiation (-) • Jealousy and division among communities/households (-) • Dissatisfaction stemming from unmet expectations (-) • Heightened risk of inequitable access to employment/income-generating opportunities (-) • Increased gender-based violence, domestic violence and sexual violence against women (-)
		In-flux of job-seekers (-) • Ignored traditions by mine employees (-) • Community unrest (-) • Shortage of accommodation/housing (-) • Limited access to services and facilities (-) • Altering a sense of place and culture (-) • Increase health-related and safety concerns, including social pathologies including (sex work and drug abuse) (-) • Increased risk of unwanted pregnancies and increased school drop-outs rates (-)

Theme	Change Drivers	Principle Impacts
		• Potential use of excessive forces against individuals leading to human rights violation (-) • Increased gender-based violence, domestic violence and sexual violence against women (-) • Unmet expectations over employment opportunities (-) • Increased volume of traffic (-)
	Investment and local procurement	Local livelihood and economic growth (+/-) • Increased revenues of the local enterprises and associated small business activities (+) • Improved market linkages and trade (+)
Labour and working conditions	Worker's health, safety and welfare (Personal protective Equipment (PPE), Accommodation/housing, medical facilities)	Occupational, Health and Safety (OHS) and nuisance disturbance (-) • Increased accidents and injuries, health and nuisance concerns (-) • Increased pressure on local health services (-) • Discomfort, overcrowding and hygiene issues (-)
Socio-economic development	Construction activities	Improved infrastructure and services (+) • Improved transportation networks (+)
Environmental degradation (dust, soil and water)	Construction-related activities on site and around communities through the use of heavy machinery, operation of heavy machinery, drilling, blasting (Vibration/blasting)	Reduced fertility of existing farm (-) • Decrease in household incomes (-) • Increase in household food insecurity (-)
		Community health, safety, and security (CHS) (-) and Nuisance • Increased traffic accidents (-) • Exposure to diseases transmission (-) • Anxiety and physical discomfort (-) • Disturbance of sleep (-) • Increased health-related issues i.e earing problems (-) • Increased vulnerability (-) • Increased accidents (-) • Structural damage to nearby buildings (-)

Theme	Change Drivers	Principle Impacts
		• Air quality deterioration (-)
	Land changes, Oil spills, improper storage or disposal of construction materials	Impact on Water Resources from Altered Hydrological Patterns and Contamination (-) • Reduced access to clean water for communities (-) • Increased health-related issues (-) • Increased risk of flooding and changes in drainage patterns (-) • Changes in stream flow (-)
Tangible and intangible cultural heritage resources	Land clearing and excavation	Cultural heritage disturbance and adjustment (-) • Damage to or loss of sacred sites, archaeological artifacts and historical landmarks (-) • Interference with ceremonies or gatherings (-) • Increased vulnerability (-) • Altering a sense of place (-)
	Influx of job seekers	Cultural changes in the community (-) • Exposure to new lifestyles and practices that weaken traditional customs (-) • Community tension arising from differing values (-)

8.2.1.11.1. Impact Description: Wage-based Livelihoods

During the construction phase, the project will generate a range of direct and indirect economic benefits at local, regional, and national levels. This phase will create substantial employment opportunities and contribute to county and national revenues by stimulating economic activity across these areas. As a precursor to full mine operations, the construction phase will prioritize hiring residents for unskilled, semi-skilled, and skilled labour positions where possible. This is expected to shift many households from agricultural-based or subsistence livelihoods to wage-based employment, enhancing household incomes, increasing access to savings and credit, and strengthening overall financial resilience.

The introduction of mining could significantly impact local employment and economic activities in Siaya and Vihiga counties by diversifying the economy beyond the predominant agriculture, fishing, and tourism sectors. The mining sector has the potential to create new job opportunities and foster skills development, helping to alleviate pressure on existing employment avenues. This diversification could reduce poverty levels and contribute to long-term economic growth in the region, enhancing the standard of living for local communities

Table 8-26: Wage-based Livelihoods

Wage-based livelihoods				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Medium term (3)	Equal to the duration of the construction activities	Consequence: Moderately beneficial (11)	Significance: Minor - positive (55)
Extent	National (6)	Unskilled/semi-skilled workforce will be sourced from the surrounding villages, whilst any skilled employees/contractors required may be sourced from other areas		
Intensity x type of impact	Low - positive (2)	Experienced by a small percentage of the local population (mainly workforce)		
Likelihood	Likely (5)	The significance of the benefits will depend on the number of local job opportunities provided		
MITIGATION				
• Work Certificates or Certificates of Completion must be provided to local employees for the work and training undertaken; • Continue to implement the Stakeholder Engagement Plan and grievance mechanism • Develop the Local Employment Plan and prioritise employment and training of people living within the primary study area over outsiders especially for unskilled and semi-skilled positions; • Ensure local communities understand the project's employment requirements in terms of skills and type of employment; • Require subcontractors used for construction activities to recruit in accordance with the SGKL's recruitment policy and plan (i.e., through contractual obligations); and • Develop and maintain a candidate database for the local communities in collaboration with existing governance structures.				
POST-MITIGATION				
Duration	Long term (4)	The implementation of enhancement measures can extend benefits beyond the construction phase.	Consequence: Highly beneficial (14)	Significance: Moderate - positive (98)
Extent	National (6)	As for pre-mitigation		
Intensity x type of impact	Moderately high - positive (4)	Measures will potentially increase employment from the project area, which will intensify positive change.		
Probability	Certain (7)	With the implementation of the prescribed measures, the benefits will be realised and optimised		

8.2.1.11.2. Impact Description: Training and Skills Development

Upon the commencement of mine construction, it is anticipated that skills transfer from expatriates to local workers will occur, along with organized training programs. The skills and work experience gained during the project will enhance the employability of those engaged in construction activities, enabling them to secure employment in similar projects both within the local area and beyond. Additionally, the acquired skills will broaden their potential for higher-paying job opportunities, contributing to long-term economic benefits and a more skilled local workforce.

Table 8-27: Training and Skills Development

Training and skills development				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Skills training will commence during the construction phase and continue for as long as the mine remains operational	Consequence: Moderately beneficial (10)	Significance: Minor - positive (60)
Extent	Local (3)	Skills training programmes also offered to local communities in addition to the workforce		
Intensity x type of impact	Low - positive (2)	Skills training programmes largely aimed at the current workforce with little benefit to the local community		
Likelihood	Highly probable (6)	It is highly probable that the mine will invest in training and diversifying the skills of the workforce.		
MITIGATION				

• Prioritise training and capacity development for the least qualified workforce members. The training initiatives should consider the levels of education of the targeted workforce and the areas of interest;
• Conduct a Workforce Skills Audit to better understand the current skills of the individuals and experience to identify gaps and propose programs to fill those gaps;
• Using the information sourced from the audit, develop and implement the Multi-Skilled Workforce program focusing on ensuring that the workforce members receive the training required. As part of the program:
  o Ensure that time is set aside for each employee participating in the program to receive required on-the-job training;
  o Set achievable monitoring targets for each employee participating in the program to enable HR and team supervisors to track progress; and
  o All workers who participate and complete the program must receive certificates of completion.				

POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately beneficial (11)	Significance: Moderate - positive (77)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderate - positive (3)	Mitigation measures could aid in expanding the skills training programmes to more of the local community, having further reaching effects.		
Probability	Certain (7)	Following the implementation of the proposed enhancement measures, it is certain that the mine will conduct training and skill development programs tailored to the needs of the workforce and the local community.		

8.2.1.11.3. Impact Description: Social Differentiation

While the construction of a mine brings numerous benefits such as employment opportunities, training and skills development, and compensation payments to the surrounding communities, these benefits are often unevenly distributed. This uneven distribution can foster jealousy and resentment among community members or households who perceive themselves as being left out or less favoured. Such divisions may fragment community cohesion and lead to conflicts as different groups vie for the perceived benefits.

Additionally, dissatisfaction can arise from unmet expectations. Mining projects often come with high expectations for economic prosperity and job creation. When these expectations are not met, whether due to fewer jobs than anticipated, lower wages, or more precarious employment conditions, significant dissatisfaction can arise. This dissatisfaction can be exacerbated if the reality of mining impacts, such as environmental degradation or social disruption, proves harsher than expected. The gap between expectations and reality can erode trust in the mining project and in local leadership, leading to discontent and unrest.

Furthermore, the heightened risk of inequitable access to employment and income-generating opportunities is also anticipated. If certain groups (based on gender, ethnicity, or socio-economic status) have preferential access to jobs, this can deepen social cleavages. Inequitable access might be due to discrimination, lack of qualifications, or geographic proximity to the mine. This disparity not only affects economic equality but also influences social dynamics, as those excluded from benefits may feel marginalized.

Table 8-28: Social Differentiation

Social Differentiation				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	The impact will begin at the commencement of the project, becoming most pronounced during the operational phase, and will gradually diminish throughout the decommissioning phase, expected to cease following mine closure	Consequence: Highly detrimental (-15)	Significance: Moderate - negative (-90)
Extent	Sub-regional (4)	The differentiation may extend beyond the local community to a wider coverage prior to mitigation.		
Intensity x type of impact	Very high - negative (-6)	If not effectively mitigated, social differentiation can have significant impacts beyond the local community.		
Likelihood	Highly probable (6)	It is highly probable that the presence of the project will trigger social differentiation in the area.		
MITIGATION				
• Implementing a community-wide sensitization program that addresses the potential for jealousy, grievances and conflicts arising in the community; • Establish ongoing stakeholder engagements to promote peaceful co-existence and ensure access to a grievance redress mechanism; • Set up a community-based conflict resolution and mediation committee with respected members from various backgrounds to address disputes; • Implement strict policies and awareness programs to prevent gender-based violence, domestic violence, and sexual violence; • Partner with local NGOs to provide support services, including counselling and legal assistance for victims of violence; and • Monitor and control alcohol and substance use among workers to mitigate risks of violence.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately detrimental (-11)	Significance: Minor - negative (-55)
Extent	Local (3)	Implementation of the proposed mitigation measures will minimise the extent to which social differentiation can be extended.		
Intensity x type of impact	Moderate - negative (-3)	Implementation of the proposed mitigation measures will minimise the magnitude of the impacts to the community.		
Probability	Likely (5)	Following the implementation of the proposed mitigation measures, it is likely that this impacts will be minimised.		

8.2.1.11.4. Impact Description: Influx of Jobseekers

The baseline study anticipates the influx of jobseekers as the project execution will create new economic opportunities, both directly through employment and indirectly through the procurement of local goods and services. This impact is expected to persist throughout the construction, and operational phases of the project and is likely to result in adverse impacts to the direct PACs such as increased strain on available social services and infrastructure, conflict between long-term residents and incoming migrants, and a heightened risk of communicable diseases.

Moreover, the influx of job seekers may lead to rapid changes in the physical environment, which can disrupt the established cultural and social norms of the area. This alteration may result in the loss of community identity and cohesion, as natives may feel disconnected from the evolving cultural landscape. Additionally, the influx may result in disruptions in community dynamics, leading to unrest and an increase in health-related and safety concerns, increased risk of unwanted pregnancies and school dropouts.

Table 8-29:In-flux of Jobseekers

In-flux of jobseekers				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Impact will likely continue throughout all project phases	Consequence: Highly detrimental (-14)	Significance: Moderate - negative (-84)
Extent	Local (3)	It is likely that people seeking economic opportunities will come to the local area.		
Intensity x type of impact	Very high - negative (-6)	The presence of the project in the area will result in the in-flux which will have significant social impacts affecting the local community. Without appropriate management measures, this could lead to a breakdown of social orders.		
Likelihood	Highly probable (6)	Based on the assessment of baseline conditions, it is likely that people will move into the Project AoI for financial gain.		
MITIGATION				
• Develop and implement an Influx Management Plan (IMP), which considers appropriate objectives and interventions for influx management, incl. public consultation and monitoring methods; • Develop and implement a community-wide sensitization program to address potential grievances and conflicts arising from the influx of new residents; • Develop and implement Security Management Plan (SMP) to effectively monitor, mitigate and manage security risks • Conduct ongoing stakeholder engagements with local communities to foster peaceful coexistence and provide a clear grievance redress mechanism; • Enhance local infrastructure and social services to accommodate the increased population and mitigate strain on existing resources; • Increase capacity for healthcare services, particularly to address potential rises in communicable diseases; • Strengthen security measures to address potential issues of insecurity arising from the establishment of new residences; • Develop and promote health and safety programs focused on preventing the spread of communicable diseases, including regular health screenings and awareness campaigns.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately detrimental (-12)	Significance: Minor - negative (-60)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderately high - negative (-4)	With the implementation of effective Influx management Plan the severity of the impact may be reduced.		
Probability	Likely (5)	With the implementation of appropriate mitigation measures the likelihood of unmanageable population influx is reduced.		

8.2.1.11.5. Impact Description: Local Livelihood and Economic Growth

As per the baseline study, it is observed that the most reliable livelihood sources in Ramula sub-location apart from contract employment are sales from livestock and natural resources followed by crop sales. During construction, it is anticipated that the Project will require highly technical capital goods and services, and it will procure these through contracts lasting several months. Although most of the mine Project's specific products may need to be sourced nationally and/or internationally, requirements such as civil engineering services, food supply, maintenance services for non-technical aspects, security services, buildings and facilities maintenance, general vehicle maintenance, employee transport, and land management are able to be procured from some businesses within the secondary and regional study areas. In turn this will help to boost the increase in revenue of the local enterprises and associated small business activities, increase local government revenues from taxes and royalties.

Table 8-30: Local Livelihood and Economic Growth

<table>
<tr><th colspan="5">Local Livelihood and Economic Growth</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Equal to the duration of the construction activities</td><td rowspan="3">Consequence:
Slightly beneficial (8)</td><td rowspan="4">Significance:
Negligible - positive (32)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Communities surrounding the project area will be affected with water contaminations</td></tr>
<tr><td>Intensity x type of impact</td><td>Low - positive (2)</td><td>Prior to enhancement measures, the mine may source the goods and services outside the local community.</td></tr>
<tr><td>Likelihood</td><td>Probable (4)</td><td colspan="2">The significance of the benefits will depend on the number of local opportunities provided (this is not yet known).</td></tr>
<tr><td colspan="5">MITIGATION</td></tr>
<tr><td colspan="5">• Conduct an audit of local businesses and their capacity to meet Project needs, including those businesses in the study area, and maintain a database of local business information;
• Ensure that the policy or plan sets out guidance on targets for local businesses used by the Project and that these are monitored accordingly;
• Adaptation of Project procurement documents to suit local businesses as far as possible within the standards required of the Project;
• Provision of incentives for Project contractors to purchase locally and partner with local businesses, including tender requirements regarding local procurement;
• Promotion of joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development;
• Partner with relevant organisations where available and appropriate (e.g., government agencies, civil society, and NGOs) to provide access for local businesses to finance and advisory services to develop their capacity to competitively supply to the Project
• Empowerment of women in business opportunities;
• Consider provision of loan to small registered groups within the villages with affordable interest;
• Consider provision of loan to small registered groups within the villages with affordable interest;
• Provide training to locals on entrepreneurship.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>The implementation of enhancement measures can extend benefits beyond the construction phase.</td><td rowspan="3">Consequence:
Moderately beneficial (13)</td><td rowspan="4">Significance:
Moderate - positive (78)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>As for pre-mitigation</td></tr>
<tr><td>Intensity x type of impact</td><td>Very high - positive (6)</td><td>Implementation of enhancement measures will ensure that the mine sources all its goods and services from the local community where practicable.</td></tr>
<tr><td>Probability</td><td>Highly probable (6)</td><td colspan="2">With the implementation of the prescribed, measures the benefits will be realised and optimized.</td></tr>
</table>

8.2.1.11.6. Impact Description: Occupational, Health and Safety (OHS) and Nuisance Disturbance

In all mining projects, there is a risk that workers (including directly employed workers, main contractors, subcontractors, and the employees of suppliers) may be exposed to unsafe and/or inequitable working conditions. This risk is heightened in situations where:

- Many local employees may be working on a mining site for the first time, making them unfamiliar with the health and safety protocols required in such settings.
- Multiple contractors, subcontractors and suppliers are involved;
- Local labour law offers insufficient protection, or law enforcement capacity is limited.

Given that these conditions are likely to apply to this project, SGKL is committed to upholding national occupational health and safety legislation, along with relevant international standards, through its corporate and site-specific policies. However, during the construction phase, workers will face several specific risks, including:

- physical hazards which include accidents related to heavy machinery, vehicular traffic, electrocution, equipment, and construction materials. Falls from heights, slips, trips, and falls on the construction site can also pose risks
- construction sites can be noisy, dust exposure and vibrations from machinery can also affect workers' health
- chemical hazards including exposure to harmful chemicals, such as construction materials like concrete, paints, or solvents, can affect workers' health if not properly managed
- biological hazards including pathogens especially in damp sites or poorly ventilated areas
- Ergonomic and psychosocial hazards including poorly designed workstations or repetitive tasks can lead to musculoskeletal disorders among workers. Stress, long working hours, inadequate breaks, and a demanding work environment can have a significant impact on workers' mental health and well-being.

In addition to these typical industrial risks, the high levels of crime in the project area also pose a direct threat to worker safety. Criminal activities, including assaults, theft, burglary, and gold ore theft, are common and could escalate with the commencement of the project. The increased presence of workers, equipment, and valuable materials could make project personnel targets for criminal acts. Workers could be at risk of assault, robbery, or theft of personal belongings and equipment, particularly during travel to and from the worksite or when operating in isolated or unmonitored areas.

Table 8-31: Occupational, Health and Safety (OHS) and Nuisance Disturbance

Occupational, Health and Safety (OHS) and nuisance disturbance				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Beyond project life (6)	It will continue for the duration of the Project and likely continue post mine closure.	Consequence: Highly detrimental (-15)	Significance: Moderate - negative (-90)
Extent	Project footprint and immediate surrounds (2)	Will mostly affect the workers within the site-specific area.		
Intensity x type of impact	Extremely high - negative (-7)	Inadequate OH&S measures could lead to injury or death of workers, whilst poor working conditions could impact on worker physical and emotional well-being		
Likelihood	Highly probable (6)	Several factors (including prolonged exposure to hazards) will exacerbate the risk of this impact.		
MITIGATION				
Integration of SGKL Corporate OH&S policies, plans and procedures in Construction Environmental and Social Management Plan for occupational health and safety; Establishment and implementation of the construction Health, Safety and Environment (HSE) Plan throughout the Project construction phase; Strict task-based risk assessment before commencement of works; Provision of HSE induction and periodic safety meetings and refresher training sessions for all construction labour; Provision of appropriate Personal Protective Equipment (PPE) and safety measures to safeguard workers from hazards; Regular assessment and addressing any potential hazards on the construction site; Clearly define and communicate to employees, contractors, visitors, and suppliers (at each level) their responsibilities with respect to OH&S; Ensure the participation and consultation of workers, and their representatives (when applicable) in the decision-making process for OH&S matters; Routinely monitor and review the OH&S management systems and set performance objectives at all levels and functions to ensure continuous improvement with our operations. Proper fencing, lighting, and security personnel should be employed at project sites to deter criminal activity and protect both workers and equipment. Employees should be briefed on local security risks, including crime hotspots, and provided with safe transportation options, particularly for late-night shifts. The project team should collaborate with local police stations to ensure heightened security patrols around the project area, particularly during periods of heightened criminal activity. An internal security monitoring system should be put in place to promptly address any incidents or threats to workers' safety. Develop and implement a Security Management Plan (SMP) specifically designed to safeguard workers and project assets from local crime risks.				
POST-MITIGATION				
Duration	Long term (4)	As for pre-mitigation	Consequence: Moderately detrimental (-10)	Significance: Minor - negative (-50)
Extent	Project footprint and immediate surrounds (2)	As for pre-mitigation		
Intensity x type of impact	Moderately high - negative (-4)	Impacts will still occur, albeit not to the degree it was initially expected		
Probability	Likely (5)	Appropriate mitigation will reduce the risk of this impact		

8.2.1.11.7. Impact Description: Community Health, Safety and Security (CHS) and Nuisance

The IFC Performance Standard 4 recognizes that project activities, equipment, and its related infrastructure can increase community exposure to risks and impacts. Mining is a high-risk industry, which can have serious health and safety consequences. Most of the impacts related to this will occur in all project phases.

The health, safety and security impacts include but not limited to:

Health Risks

- Increased noise levels from movement of vehicles, people, and other equipment;
- Air pollution and dust caused by construction vehicles and general constructions can lead to respiratory illnesses;
- The spread of communicable diseases may increase within communities because of the project development throughout the life of the mine. This is mainly due to potential interactions between the construction workforce and local communities; and in-migrants to the area bringing new diseases or varying disease profiles compared to the existing community.

Safety risks

- Increased numbers of heavy motor vehicle traffic associated with the project, if not effectively mitigated, will likely pose a safety risk for existing road users and pedestrians, and animals in the areas adjacent to the access road. This impact may extend to regional or national roads. and
- An increase in the number of heavy-duty vehicles on the local roads is likely to result in a formation of potholes, and should these be left unfixed, will pose a danger to all road users, including the mine vehicles and other private vehicles.
- Vibrations caused by blasting and heavy machinery operations can result in structural damage to nearby houses, potentially causing cracks or fractures in walls and foundations. This not only poses safety risks for residents but also leads to financial burdens due to repair costs and decreased property values.

Security risks

The project area is already experiencing significant levels of criminal activity, including assaults, theft, burglary, and gold ore theft. Assaults are commonly driven by land disputes, especially during traditional mourning periods (disco matanga) and celebrations at the end of the year. With the commencement of the project, there is a risk that these crime levels could increase, exacerbated by an influx of new residents, increased traffic, and greater economic activity. The local community, particularly vulnerable groups such as women and children, could face heightened exposure to these risks.

Table 8-32: Community Health, Safety and Security (CHS) and Nuisance

<table>
<tr><td colspan="5">Community health, safety and security (CHS) and Nuisance</td></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Beyond project life (6)</td><td>It will continue for the duration of the Project and likely continue post mine closure.</td><td rowspan="3">Consequence:
Highly detrimental (-16)</td><td rowspan="4">Significance:
Moderate - negative (-96)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Will mostly affect the population within the direct Project Affected Communities (PACs) and local road users.</td></tr>
<tr><td>Intensity x type of impact</td><td>Extremely high - negative (-7)</td><td>Could place the lives of community members at risk, especially those using the initial access road, as well as exposure to dust, vibration and noise.</td></tr>
<tr><td>Likelihood</td><td>Highly probable (6)</td><td colspan="2">Several factors (including prolonged exposure to hazards) will exacerbate the risk of this impact.</td></tr>
<tr><td colspan="5">MITIGATION</td></tr>
<tr><td colspan="5">
Implement mitigation measures outlined in the Noise, Blasting and Vibrations Specialist Studies and follow required measures for blasting such as informing the community of the blasting schedule, follow up with community of any impacts of the blasting thereafter and implement the available community Grievance Management and Resolution Procedure
Implement mitigation measures proposed in the Air Quality Impact Assessment Study
In partnership with government authorities the Project to support improvements to existing health services to handle the increase in population numbers and changes to the existing health profile of the area. This may include facilities, quality of medical personnel, diagnostic capacity, and treatment, etc.
Implement mitigation measures proposed in the Air Quality Impact Assessment Study
Road safety interventions may need to range beyond their fleets of company vehicle and their workers’ commutes and should consider the driving, walking, and riding practices of community members in the locality;
Develop a Traffic Management Plan covering vehicle safety, driver, and passenger behaviour, use of drugs and alcohol, hours of operation, rest periods and accident reporting and investigations
Develop and implement a Community Health, Safety, and Security Management Plan that includes measures to prevent the spread of communicable diseases between workers and the local community. The plan should also incorporate strategies to protect the community from potential crime risks, ensuring both health and safety are prioritized throughout the project's lifecycle.
Strictly implement and enforce Alcohol and Drug Procedure in relation to Project drivers and undertake regular and random testing of drivers and in response to suspicious behaviour;
Require Project drivers to be trained in defensive driving and provided regular refresher courses
Propose road bypasses where there is a significant risk to public safety from road accidents
In partnership with local authorities and the police, educate communities on road traffic laws and road safety
Increasing police presence in crime hotspots
Improve infrastructure such as street lighting, and supporting community-led crime prevention programs.
</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>As for pre-mitigation</td><td rowspan="3">Consequence:
Moderately detrimental (-11)</td><td rowspan="4">Significance:
Minor - negative (-55)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>As for pre-mitigation</td></tr>
<tr><td>Intensity x type of impact</td><td>Moderately high - negative (-4)</td><td>Impacts will still occur, albeit not to the degree it was initially expected</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td colspan="2">Appropriate mitigation will reduce the risk of this impact</td></tr>
</table>

8.2.1.11.8. Impact Description: Improved Infrastructure and Services

Despite that the mine construction activities may result into loss of access routes that were originally present prior to mine establishment, new access routes may be created in the process of site assessment.

In the course of rendering support and enhancing their operations, the mine often invests in building or upgrading infrastructure which may include roads, bridges, and utilities such as water and electricity.

Additionally, to meet the needs of the growing population and workforce, the mine may collaborate with local governments to enhance public services. This can include upgrading healthcare facilities, rendering support to schools, and improving waste management systems. These improvements can lead to better access to quality services for local residents. Also, the mine may engage in CSR projects as part of the commitment to the local community in which they operate.

These initiatives may focus on areas such as education, health, and community development. The baseline report spots that motorcycles and walking are the most prevalent means of transportation across the six villages in Ramula sub-location which is an alarming call for road improvement. Therefore, the enhancement of infrastructures such as roads by the mine would be a plus to the local community.

Table 8-33: Improved Infrastructure and Services

Improved Infrastructure and Services				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Impact will last for at least the duration of the Project, but has the potential to last beyond the project's life	Consequence: Moderately beneficial (11)	Significance: Minor - positive (44)
Extent	Sub-regional (4)	Impacts will be concentrated in the primary study area; however, some initiatives will be beneficial secondary AoI		
Intensity x type of impact	Low - positive (2)	Without granting of public use, road infrastructure will have no impact, also programmes developed without consideration of needs and relevant development agendas, will likely have a very limited impact		
Likelihood	Probable (4)	It is probable that project will improve the existing infrastructures such as roads that will boost the local economy.		
MITIGATION				
• Through Corporate and Social Responsibility Policy, develop Community development Initiatives to support the local area and align development initiatives with government's development agendas; • Through stakeholder engagement, engage project beneficiaries regarding proposed development initiatives; and • Ensure public is not deprived of the access to road infrastructure and other essential services by mine activities.				
POST-MITIGATION				
Duration	Beyond project life (6)	Successful enhancement will prolong benefits of infrastructure development beyond life of the Project	Consequence: Highly beneficial (16)	Significance: Moderate - positive (96)
Extent	Sub-regional (4)	As for pre-mitigation		
Intensity x type of impact	Very high - positive (6)	Successful mitigation will ensure infrastructure development address needs appropriately and increase the number of people who can access these facilities		
Probability	Highly probable (6)	Mitigation will increase the likelihood of this impact occurring		

8.2.1.11.9. Impact Description: Reduced Fertility of Existing Farm

Construction activities often involve extensive land clearing and earthmoving which can lead to soil erosion, where the topsoil, which is rich in nutrients and organic matter necessary for agriculture, is removed or degraded. The loss of topsoil reduces the soil's fertility and its ability to support agricultural crops. This impact is significant in Ramula because crop sales are ranked third among the highest sources of income in the sub-location with over 22% of the population reliant on it. Therefore, this could result in a decrease in household income and increased household food insecurity since the fertility of the soil has been deteriorated.

Table 8-34: Reduced Fertility of Existing Farm

Reduced Fertility of Existing Farms				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	This will peak during the Project construction phase and continue throughout the remainder of the project.	Consequence: Moderately detrimental (-13)	Significance: Minor - negative (-65)
Extent	Local (3)	If left unmanaged, the changes could affect the local area		
Intensity x type of impact	High - negative (-5)	Serious impacts to the livelihoods of the local community, potentially impacting the food security of households		
Likelihood	Likely (5)	Unmanaged land degradation is likely to reduced fertility of the agricultural and grazing land surrounding the project		
MITIGATION				
• Implement measures proposed in the Ecosystem Services Assessment; • Implement measures proposed in the Soils, Land Use and Land Capability Assessment Study; • Carefully remove and store topsoil during land clearing, then redistribute it after construction for rehabilitation and to maintain soil fertility; • Restrict land clearing to only the areas necessary for construction to preserve as much vegetation and topsoil as possible; and Conduct regular monitoring of erosion-prone areas to assess the effectiveness of mitigation measures and make adjustments as needed.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately detrimental (-10)	Significance: Negligible - negative (-30)
Extent	Project footprint and immediate surrounds (2)	With the implementation of appropriate mitigation measures, the impacts can be contained to the PAC's only		
Intensity x type of impact	Moderate - negative (-3)	Implementation of appropriate mitigation measures could reduce the impact experienced		
Probability	Unlikely (3)	Appropriate mitigation measures to reduce land degradation and its impacts will reduce the likelihood that agricultural and grazing land to be affected		

8.2.1.11.10. *Impact Description: Impact on Water Resources from Altered Hydrological Patterns and Contamination*

According to the socio-economic data collected for the direct PACs, 85% of households rely primarily on streams/rivers for drinking water. During the construction phase of the mine, significant alterations to the hydrological environment are anticipated, which may impact these crucial water sources. Construction activities can lead to changes in the channel geometry and flow patterns of streams and rivers.

This can disrupt the natural flow and quality of water bodies that the communities depend on for drinking and domestic use. Redirection of water courses and increased sediment loads due to construction activities can degrade water clarity and quality, making it potentially unsafe for consumption.

This impact would particularly be severe in these communities since Kenya is known to be a water scarce country, thus the communities will be forced to rely on potentially contaminated or distant water sources, increasing their vulnerability to water scarcity.

Moreover, alterations to the hydrological balance can exacerbate the risk of flooding and changes in drainage patterns. Modifications to the natural geometry of streams and drainage lines can significantly impact the area's hydrological balance, potentially increasing the risk of flooding, especially during heavy rains. These altered drainage patterns can lead to waterlogging or unexpected water flow paths, which can damage local agriculture, degrade soil quality, and increase the vulnerability of infrastructure.

The contamination of water sources due to construction activities poses serious health risks. Chemicals used in ore processing and metal recovery, such as cyanide, heavy metals, and acids, may leach into surface and groundwater through improper containment, spills, or leaks from tailing ponds and storage facilities. This contamination can lead to an increased incidence of waterborne diseases and chronic health issues among the PACs.

Table 8-35: Impact on Water Resources from Altered Hydrological Patterns and Contamination

<table>
<tr><th colspan="5">Impact on Water Resources from Altered Hydrological Patterns and Contamination</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>The impact will commence at the start of the construction activities and continue during the operational and decommissioning phase</td><td rowspan="3">Consequence:
Highly detrimental (-14)</td><td rowspan="4">Significance:
Moderate - negative (-84)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Communities surrounding the project area will be affected from these changes and water contaminations</td></tr>
<tr><td>Intensity x type of impact</td><td>Very high - negative (-6)</td><td>Effects of water lead to the deterioration in surface water quality from contamination and reduction of water quantity from water sources, results to water scarcity as well as waterborne diseases</td></tr>
<tr><td>Likelihood</td><td>Highly probable (6)</td><td colspan="2">Community members will have concerns regarding drainage changes and pollution</td></tr>
<tr><td colspan="5">MITIGATION</td></tr>
<tr><td colspan="5">• Implement measures proposed in the Hydrology and Hydrogeology Assessment Study;
• Develop and enforce Water Management Plans;
• Establish a robust water quality monitoring program to detect changes in water quality early;
• Ensure that chemicals used in mining are stored securely and handled according to best practices to prevent spills and leaks;
• Establish and maintain alternative water supply systems;
• Educate local communities on water conservation practices and how to identify and report water quality issues;
• Ensure compliance with all relevant environmental regulations and standards related to water use and contamination;
• Maintain transparency with stakeholders by regularly reporting on water quality and mitigation measures; and
• Minimise contractor vehicles or equipment access to any watercourse or surface water body near communities, if allowed management plans should be in place to prevent leakages and spills.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Mitigation measures will reduce impact to such a level that those affected will adapt to disruption over time</td><td rowspan="3">Consequence:
Moderately detrimental (-10)</td><td rowspan="4">Significance:
Minor - negative (-50)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>As for pre-mitigation</td></tr>
<tr><td>Intensity x type of impact</td><td>Moderate - negative (-3)</td><td>The application of mitigation measures should reduce the severity of the impact but not avoid the impact.</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td colspan="2">Mitigation will reduce the likelihood of this impact occurring to the extent predicted</td></tr>
</table>

8.2.1.11.11. Impact Description: Cultural Heritage Disturbance and Adjustment

Land clearance and excavation for mine construction may involve damage and complete destruction of sites that hold cultural, historical or religious significance. Sacred places, which are often central to local communities' spiritual practices and beliefs, may be desecrated or lost, causing a disruption in cultural heritage and ancestry connections. In addition, archaeological sites and historical landmarks risk irreversible damage, leading to the loss of valuable information about past civilizations and cultures. Such disturbances not only impact the local communities associated with these sites but also contribute to a broader loss of national heritage.

In the baseline state, the tradition of burying deceased family members within household compounds is prevalent in the direct PACs. The construction phase of a mine could directly disrupt these burial sites. Such disruptions would be deeply distressing to local communities, as they involve tampering with the resting places of ancestors, which hold significant cultural and spiritual importance. This may lead to emotional grievances, conflict, and a sense of loss of identity and heritage within the community.

The physical transformation of the landscape also can alter the community's sense of place, leading to an emotional and psychological disconnect. As areas that once held personal and collective memories are changed beyond recognition, community members may experience a loss of identity. This alteration weakens the cultural ties that bind people together, diminishing the shared sense of heritage and belonging.

Additionally, the physical presence of the mine, along with associated noise, pollution, and restricted access due to safety and security concerns, can prevent these communities from performing their rituals and cultural practices. This disruption can lead to a breakdown of social structures and community bonds that are traditionally reinforced through these gatherings.

Table 8-36: Cultural Heritage Disturbance and Adjustment

<table>
<tr><th colspan="5">Cultural Heritage Disturbance and Adjustment</th></tr>
<tr><td>Predicted for project phase:</td><td>Pre-construction</td><td>Construction</td><td>Operation</td><td>Decommissioning</td></tr>
<tr><td>Dimension</td><td>Rating</td><td colspan="3">Motivation</td></tr>
<tr><td colspan="5">PRE-MITIGATION</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>The impact will begin at the commencement of the project, becoming most pronounced during construction phase</td><td rowspan="3">Consequence:
Highly detrimental (-14)</td><td rowspan="4">Significance:
Moderate - negative (-98)</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Will mostly affect the population within site-specific study area and surrounding communities</td></tr>
<tr><td>Intensity x type of impact</td><td>Very high - negative (-6)</td><td>If not effectively mitigated, cultural heritage disturbance can have significant impacts beyond the local community.</td></tr>
<tr><td>Likelihood</td><td>Certain (7)</td><td colspan="2">It is highly probable that the project will lead to disturbances and adjustments related to cultural heritage in the area.</td></tr>
<tr><td colspan="5">MITIGATION</td></tr>
<tr><td colspan="5">Implement measures proposed in the Archaeology and Cultural Heritage Assessment Study;
Develop and implement Cultural Heritage Management Plan
Develop and implement a Chance Finds Procedure during construction activities;
Provision of mandatory basic training to all staff involved in construction activities to be able to report observed artefacts (as a compliance to CFP) on site;
Conduct Cultural heritage monitoring during construction activities;
Foster ongoing engagements and consultation with local communities to understand their cultural values and practices;
Invest in and support community-led initiatives aimed at preserving cultural heritage and promoting cultural activities;
If cultural sites cannot be preserved, provide fair compensation to affected communities and support for the relocation of cultural practices and sites; and
Continuously monitor and evaluate the cultural impacts of mining activities throughout the project.</td></tr>
<tr><td colspan="5">POST-MITIGATION</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>As for pre-mitigation</td><td rowspan="3">Consequence:
Moderately detrimental (-11)</td><td rowspan="4">Significance:
Minor - negative (-55)</td></tr>
<tr><td>Extent</td><td>Project footprint and immediate surrounds (2)</td><td>Implementation of the proposed mitigation measures will minimise the extent to which cultural heritage disturbance and adjustment will occur</td></tr>
<tr><td>Intensity x type of impact</td><td>Moderately high - negative (-4)</td><td>Implementation of the proposed mitigation measures will minimise the magnitude of the impacts to the community.</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td colspan="2">Following the implementation of the proposed mitigation measures, it is likely that this impacts will be minimised.</td></tr>
</table>

8.2.1.11.12. Impact Description: Cultural Changes in the Community

The likelihood of in-migration into areas surrounding the project and project-affected communities (PACs) is high, triggered by various factors including direct and indirect economic opportunities resulting from project execution.

Owing to the fact that the in-migrants come from different areas carrying cultural values different from that of the project surrounding communities, it is anticipated to bring about rapid changes in the physical environment, which can disrupt the established cultural and social norms of the area.

This alteration may result in the loss of community identity and cohesion, as natives may feel disconnected from the evolving cultural landscape. Additionally, cultural changes in the community are community tension arising from differing values which often occurs when members of a community hold diverse beliefs, cultural practices, or social norms that conflict with one another.

These differences can manifest in various ways, such as disagreements over religious practices, lifestyle choices, or priorities for community development. When these values clash, it can lead to misunderstandings, mistrust, and even hostility between groups, as each may feel that their way of life or beliefs are being threatened or disrespected. This tension can be exacerbated if there is a lack of effective communication or avenues for resolving conflicts, leading to a fractured community where cooperation and social cohesion are undermined.

Table 8-37: Cultural Changes in the Community

Cultural Changes in the Community				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Long term (4)	If not properly mitigated, the change in culture may persist for a very long time.	Consequence: Highly detrimental (-14)	Significance: Moderate - negative (-84)
Extent	Sub-regional (4)	The changes in culture may extend beyond the local community to a wider coverage prior to mitigation.		
Intensity x type of impact	Very high - negative (-6)	If not effectively mitigated, cultural change can have significant impacts beyond the local community.		
Likelihood	Highly probable (6)	It is highly probable that the presence of the project will trigger cultural change in the area.		
MITIGATION				
• Develop and implement programs to raise awareness among both local residents and incoming migrants about cultural diversity, fostering mutual respect and understanding; • Form community-based committees that include local leaders and representatives from diverse cultural backgrounds to address and mediate tensions and conflicts; • Engage local authorities and traditional leadership in monitoring in-migration and facilitating community integration efforts; • Through the Stakeholder Engagement Plan, conduct regular engagements between the project team, local communities, and in-migrants to ensure open communication and address grievances before they escalate; • Ensure transparent hiring practices that offer opportunities to both local residents and migrants to prevent perceptions of favoritism; and • Organize events that celebrate different cultural practices, promoting social cohesion and reducing the risk of cultural conflicts.				
POST-MITIGATION				
Duration	Short term (2)	Successful mitigation will reduce the persistence of this impact.	Consequence: Slightly detrimental (-8)	Significance: Minor - negative (-40)
Extent	Local (3)	Implementation of the proposed mitigation measures will minimise the extent to which changes in culture can be extended.		
Intensity x type of impact	Moderate - negative (-3)	Implementation of the proposed mitigation measures will minimise the magnitude of the impacts to the community.		
Probability	Likely (5)	Following the implementation of the proposed mitigation measures, it is likely that this impact will be minimised.		

8.2.2. Operation Phase

The main activities to be carried out during the Operational Phase which may result in environmental and socio-economic impacts are summarised in Table 8-38 below.

Table 8-38: Operation Phase Activities

Phase	Activity
Operation	Open pit mining (incl. blasting).
	Ore and mineral waste handling (low-grade ore stockpiles and WRDs).
	Operation and management of water management infrastructure (dams, trenches, silt traps, etc.)
	General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material.
	Potential for discharge of treated effluent

The subsections below provide the identified potential impacts that could result from the activities that have been identified for the various applicable environmental and social aspects.

8.2.2.1. Soils and Land Use

The operation, maintenance and potential spills from the WRDs, ore stockpiles, sediment ponds and other infrastructure areas could potentially lead to soil contamination, which threatens biodiversity and human health. Various unplanned and residual impacts to the soils might occur due to the surface infrastructure such as soil deterioration, pollution/contamination, erosion and compaction. This may lead to decreased soil depth, loss of useable soil for agricultural purposes (although already limited), decreased soil fertility and impacts to soil resources.

Unprotected surfaces and stockpiles (e.g., topsoil, WRD and ore) may lead to erosion and sedimentation as well as leaching of contaminants into the vadose zone. Erosion could transpire and result in the creation of preferential flow paths, sedimentation, hydrogeomorphic changes, loss of vegetation cover and soil fertility and decreased land capability. Chemical contamination is dependent on the size of the spill and the permeability/infiltration rate into the soils. Contaminants and potentially impacted soils/waste material transported by water may potentially, rapidly infiltrate into the soils.

8.2.2.1.1. Impact Ratings

The pre-mitigation impact ratings during the operation phase range from “Minor-Negative” to “Moderate-Negative”. These scores are expected to decrease with the implementation of recommended mitigation and management measures with the highest post-mitigation significance rating scored “Minor-Negative”. The lowest of significance ratings are associated with general operation activities with the highest of impacts associated with discharging treated effluent which could result in indirect impacts towards adjacent and downstream soil resources.

Table 8-39: Operational Impact for Open Pit Mining (incl. Blasting)

Activity: Open pit mining (incl. blasting)									
Impact Description: Potential contamination of adjacent and downstream areas. Soil deterioration, pollution/contamination, erosion and compaction. This may lead to decreased soil depth, loss of useable soil for agricultural purposes, decreased soil fertility and impacts to soil resources. By the time the operational phase starts, the construction phase would have already led to the loss/stripping of soil. Therefore these impacts are associated with indirect impacts to intact soil resources adjacent to the footprint area.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	**Dimension**	**Duration**	**Rating**	Project Life (5)	The impact will cease after the operational lifespan of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		**Extent**		Limited (2)	Limited to the site and its immediate surroundings.
	Intensity		Very Serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.		**Intensity**		Serious (4)	Serious medium term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of significance.
	Probability		Almost Certain / Highly Probable (6)	It is most likely that the impact will occur.		Probability		Probable (4)	Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Moderate (negative) **-84**					**Minor (negative)** **-44**				
Mitigation/Management Actions									

- Re-vegetate cleared areas to avoid erosion;
- The WRD, TSF and ore stockpiles should be lined to avoid contamination of soil resources;
- Cut off trenches should be installed along the stockpiles to prevent potential mine-affected water and runoff from the WRD, TSF and ore stockpiles into the adjacent areas;
- Monitoring of the condition of all unpaved roads is necessary due to the potential water runoff and erosion of the soils present in the AoI. Water runoff from compacted road surfaces may cause erosion of road shoulders degrading the road surface;
- Monitoring needs to be carried out for all unpaved roads, especially during the rainy season;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and revegetated as soon as possible to avoid erosion;
- Operations vehicles and equipment should be serviced regularly;
- Soil monitoring (chemical laboratory analyses) must be undertaken where decant/seepage occurs or is expected (to be analysed for heavy metals and SO_4);
- Service and parking areas must be paved; and
- Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities.

Table 8-40: Operational Impact for Ore and Mineral Waste Handling (Low-Grade Ore Stockpiles and WRDs).

<table>
<tr><td colspan="10">Activity: Ore and mineral waste handling (low-grade ore stockpiles and WRDs).</td></tr>
<tr><td colspan="10">Impact Description: During this activity, material will be hauled, during which material could spill from vehicles, leading to sedimentation of adjacent areas. Indiscriminate driving could take place, if not controlled, leading to compaction and general degradation of soil resources.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Project Life
(5)</td><td>The impact will cease after the operational life span of the Project.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Long Term
(4)</td><td>6-15 years to reverse impacts.</td></tr>
<tr><td>Extent</td><td>Limited
(2)</td><td>Limited to the site and its immediate surroundings.</td><td>Extent</td><td>Very Limited
(1)</td><td>Limited to specific isolated parts of the site.</td></tr>
<tr><td>Intensity</td><td>Very Serious
(5)</td><td>Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.
Very serious widespread social impacts. Irreparable damage to highly valued items.</td><td>Intensity</td><td>Moderate (3)</td><td>Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month.
On-going social issues. Damage to items of significance.</td></tr>
<tr><td>Probability</td><td>Likely
(5)</td><td>The impact may occur.</td><td>Probability</td><td>Probable
(4)</td><td>Has occurred here or elsewhere and could therefore occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Minor (negative)
-60</td><td colspan="5">Negligible (negative)
-32</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">
• Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible;
• Monitoring and maintenance of the condition of all unpaved roads is necessary due to the high rainfall and potential water runoff and erosion of the soils present in the footprint areas. Water runoff from compacted road surfaces may cause erosion of road shoulders degrading the road surface and leading to sedimentation of adjacent areas;
• If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
• Only the designated access routes and haul roads are to be used to reduce any unnecessary compaction;
• Operations vehicles and equipment should be serviced regularly;
• Service and parking areas must be paved;
• Once a spill occurs, immediate action must be taken to clean the area. This should include removing the soil and replacing it with a clean and suitable topsoil (up to 300 mm);
• A suitable AIPs control program must be put in place to prevent further encroachment as a result of disturbance to the surrounding areas; and
• Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities.
</td></tr>
</table>

Table 8-41: Operational Impact for General Operation Activities

Activity: General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material. This includes Operation and management of water management infrastructure (dams, trenches, silt traps, etc.)

Impact Description: Unprotected and hardened surfaces (e.g., infrastructure areas) may lead to erosion and sedimentation as well as the leaching of contaminants into the groundwater. Erosion could transpire and result in the creation of preferential flow paths, sedimentation, hydrogeomorphic changes, loss of vegetation cover and soil fertility and decreased land capability. There is also a potential for sewage spills and hydrocarbon pollution. Water management infrastructure not maintained could lead to dirty water entering undisturbed areas adjacent to the footprint areas, leading to contamination and erosion.

Pre-Mitigation/Management					With Mitigation/Management				
Dimension	**Duration**	Rating	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	Dimension	**Duration**	Rating	Project Life (5)	The impact will cease after the operational lifespan of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		**Extent**		Limited (2)	Limited to the site and its immediate surroundings.
	Intensity		Serious (4)	Serious medium-term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of significance.		**Intensity**		Minor (2)	Minor effects on the biological or physical environment. Environmental damage can be rehabilitated internally with/ without the help of external consultants. Minor medium-term social impacts to the local population. Mostly repairable. Functions and processes are not affected.
	Probability		Likely (5)	The impact may occur.		**Probability**		Probable (4)	Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		**Type**		Neg	Negative Impact (-)
Minor (negative) -66					**Minor (negative) -36**				

Mitigation/Management Actions

- All vehicle maintenance and refueling must occur within designated areas and inspected regularly for leaks;
- All spills must be cleaned up immediately to prevent contaminants to enter the soils and groundwater. Monitoring must take place at least three months after the spill has occurred to determine any contamination;
- The water management infrastructure, culverts, roads, pipelines, powerlines and river crossings must be maintained, cleared and monitored;
- Stockpiles of excess material should be monitored and vegetated (if possible) to ensure no runoff, erosion, sedimentation and loss of soil fertility;
- Chemicals, such as paints, reagents and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical’s specific storage descriptions;
- Bare land surfaces must be vegetated should natural re-vegetation not occur within six months to limit erosion from surface runoff associated with infrastructure areas;
- Preserve the soil fertility of stockpiled soil by executing fertilization and seeding operations by hand;
- A suitable AIPs control program must be put in place to prevent further encroachment as a result of disturbance to the soil fertility, biodiversity and functionality; and
- Compacted areas are to be ripped to loosen the soil structure.

Table 8-42: Operational Impact for Potential Discharge of Treated Effluent

Activity: Potential discharge of treated effluent									
Impact Description: Treated effluent could be discharged into the environment. If discharge volumes are not controlled significant erosion could take place together with sedimentation. If water quality of discharged water is not monitored, contamination could take place.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	**Dimension**	**Duration**	**Rating**	Project Life (5)	The impact will cease after the operational lifespan of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		**Extent**		Local (3)	Extending across the site and to nearby settlements.
	Intensity		Significant (6)	Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures are required to prevent irreversible impacts. Irreparable damage to highly valued items of cultural significance or breakdown of social order.		**Intensity**		Very Serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.
	Probability		Highly Probable (6)	It is most likely that the impact will occur.		**Probability**		Likely (5)	The impact may occur
	Type		Neg	Negative Impact (-)		**Type**		Neg	Negative Impact (-)
Moderate (negative) -90					**Minor (negative) -65**				
Mitigation/Management Actions									

- All effluent should be treated prior to discharge;
- Water quality of effluent designated for discharge should be monitored monthly according to the Kenyan Water Quality Regulations (Republic of Kenya, 2006).
- Discharge should be concentrated at one or a maximum of two points to limit impacts;
- Watercourses within proximity to infrastructure have undergone significant erosion/incision. Increasing surface flow volumes and velocities through discharge will further degrade these systems. A surface hydrology study should inform the volumes of discharge in assisting the engineering designs to have the least impacts on soils and water courses;
- Discharge should preferably be diffuse over long periods as opposed to concentrated over short periods;
- Erosion control measures (i.e. gabion baskets) should be implemented at the point of discharge to limit erosion;
- Water quality should be monitored downstream of discharge points to monitor potential water quality impairments as a result of discharge; and
- Rehabilitation of watercourses discharged into should be investigated. Improvement to these systems will improve functionality, which will ensure erosion control and assimilation of toxicants and will ultimately decrease impacts to downstream watercourses.

8.2.2.2. Surface Water

8.2.2.2.1. Impact Description: Sedimentation and Siltation of Surface Watercourses Resulting from Erosion of Disturbed Soils

Movement of vehicles and machinery , transportation of raw material, and mining of the pit will disturb soils making them prone to erosion leading to sedimentation and siltation of watercourses. The movement of vehicles and machinery tend to loosen soils allowing erosion to occur through the media of water and/or wind.

8.2.2.2.2. Impact Description: Reduction of Catchment Yield

Operation and management of open water facilities, including the PCD and the pit, will likely result in the reduction of catchment runoff yield. This occurs as rainfall/runoff is intercepted by open storage facilities allowing only a fraction of runoff to reach nearby rivers and streams. The abstraction of water from rivers could affect the volume of water that is being received to downstream users

8.2.2.2.3. Impact Description: Contamination of Water Resources

Accidental spills or leakages of hydrocarbons may occur directly from vehicles and machinery during the operational phase. When waste, particularly hazardous or non-biodegradable materials, finds its way into watercourse through improper disposal, it leads to contamination and loss of aquatic life. If the treated effluent that will potentially be discharged into the environment is not within the acceptable standards for water quality, contamination of the nearby watercourses will increase.

Table 8-43: Operational Phase Impacts Ratings (Before and After Mitigation Measures) for Movement of Vehicles and Machinery

Activity: Operation and maintenance of mining and extraction gold, movement of vehicles and machinery and transportation of raw material.									
Impact Description: Sedimentation and siltation of surface watercourses resulting from erosion of disturbed soils									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	5	Project Life: The impact will cease after the operational life span of the Project.	**Dimension**	Duration	**Rating**	2	Short term: Less than 1 year to completely reverse the impact.
	Extent		3	Local: Extending across the site and to nearby settlements.		Extent		2	Limited: Limited to the site and its immediate surroundings
	Intensity		4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		5	Likely: The impact may occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) -60					**Negligible (negative) -28**				
Mitigation/Management Actions									

- Ensure that stockpiles are placed in suitable locations and are appropriately protected to minimise erosion resulting in unconsolidated materials mobilising into watercourses. During the removal of stockpiles, ensure that materials are collected timeously to prevent mobilisation of unconsolidated materials into the receiving environment;
- Install silt fences, and erosion blankets prior to soil stabilisation on steep surfaces to reduce chances of erosion;
- Regular inspection for occurrence of erosion should be conducted and maintenance should be implemented once incidences of erosion are noticed;
- Dust suppression measures on the haul roads and other cleared areas must be undertaken on regular basis to prevent or limit dust generation;
- Movement of vehicles and machinery should be confined to designated haul and access roads; and
- Surface water quality monitoring should continue to detect any potential sources of pollution.

Table 8-44: Operational Phase Impacts Ratings (Before and After Mitigation Measures) Operation and Management of Open Water Facilities

Activity: Operation and management of open water facilities, including the PCD and the pit, will likely result in the reduction of catchment runoff yield.									
Impact Description: Reduction of catchment yield.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	5	Project Life: The impact will cease after the operational life span of the Project.	**Dimension**	Duration	**Rating**	3	Medium term: 1-5 years to reverse impacts.
	Extent		3	Local: Extending across the site and to nearby settlements.		Extent		2	Limited: Limited to the site and its immediate surroundings.
	Intensity		4	Serious medium term environmental effects.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		5	Likely: The impact may occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)

Minor (negative) -60	Negligible (negative)-32
Mitigation/Management Actions	

- Demarcate and adhere to the designed footprint of the proposed open storage facilities so that the remaining natural environment will continue contributing flows to adjacent watercourses;
- Ensure that the SWMP is being implemented for the release of clean water into the natural environment; and
- Regular maintenance of existing stormwater management infrastructure should be conducted.

Table 8-45: Operational Phase Impacts Ratings (Before and After Mitigation Measures) Maintenance of Vehicles as well as Storage and Handling of Waste and Hazardous Material

Activity: Maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material.									
Impact Description: Contamination of water resources.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	5	Project Life: The impact will cease after the operational life span of the Project.	**Dimension**	Duration	**Rating**	2	Short term: Less than 1 year to completely reverse the impact.
	Extent		3	Local: Extending across the site and to nearby settlements.		Extent		2	Limited: Limited to the site and its immediate surroundings.
	Intensity		4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		5	Likely: The impact may occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) -60					**Negligible (negative) -28**				
Mitigation/Management Actions									

- Runoff from dirty areas should be directed to the storm water management infrastructure and should not be allowed to flow into the natural environment;
- The SWMP must be implemented so that contaminated runoff from dirty catchment areas is contained in the PCD;
- Minimise as much as possible, the footprint or catchment of the dirty area and maximize the clean areas within the site to ensure minimal water quality impact on the generated site runoff;
- The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to appropriate disposal sites;
- Overall housekeeping and maintenance of storm water infrastructure (including berms, de-silting of dams and conveyance channels and clean-up of leaks) must be adhered to throughout the life of mine;
- Fuel and hazardous material storage areas must be located on hard standing (paved or concrete surface that is impermeable) and bunded facilities. This will prevent mobilisation of leaked hazardous substances;
- Training of mine personnel and contractors in proper hydrocarbon and chemical waste handling procedures is recommended; and implement an effective surface water management; and
- Surface water quality monitoring should continue to detect any potential sources of pollution.

8.2.2.3. Groundwater

Activities during the Operational Phase that may have potential impacts are captured in Table 8-46.

Table 8-46: Operational Interactions and Impacts of Activity

Interaction	Impact
Open pit mining (incl. blasting).	• Groundwater Abstraction and Drawdown • Potential Contamination Plume
Ore and mineral waste handling (low-grade ore stockpiles, Waste Rock Dumps (WRDs) and tailings (TSF)).	• Potential Contamination Plume
Operation and management of water management infrastructure (dams, trenches, silt traps, etc.)	• Accidental spillages
General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material.	• Accidental spillages
Potential for discharge of treated effluent	• None

8.2.2.3.1. Impact Description: Accidental Spillages

Activities that take place during the operation phase could potentially result in accidental spills of hydrocarbons or chemicals, which can infiltrate and contaminate the aquifers. Accidental spills are considered as unplanned and low risk events and have therefore been discussed under Section 8.4

- **Impact Description: Groundwater Abstraction and Drawdown**

Groundwater ingress into the mine workings will dewater the surrounding aquifer resulting in a decrease in the groundwater level within a zone of influence (drawdown cone). The extent of the drawdown cone depends on several factors which includes but is not limited to the depth of the mine pit below the regional groundwater levels, recharge to the aquifers from rainfall and the size of the mining area and hydraulic properties of the aquifers.

Digby Wells received a final pit shell instead of annual pit shells, which does not show the progression of mining over time in extent and depth, and using the final pit shell in the model from the initial commencement of mining up to the end of Life of Mine (LoM) influences the dewatering simulations. It is recommended to re-assess the drawdown impacts once annual pit shells are available.

During the operation phase, the drawdown impacts will be greatest at the end of LoM for the Project. The maximum radius of influence from the perimeter of the pit is simulated to be approximately 700 m (based on a 1 m drawdown contour). The groundwater levels within the pit area will be drawn down by approximately 124 m (Figure 8-1). Identified receptors within the drawdown radius of influence includes one borehole, four hand dug wells, 12 springs and the associated groundwater fed streams and wetlands (alluvial and seeps):

- Of the identified receptors, one borehole and one hand dug well will lose production by the development of the pit. The owners of the water supply features would need to be compensated for the loss of supply, if they are not relocated as part of the Project development;
- Three hand dug wells will be impacted by drawdown. Two hand dug wells (Andayi and Dutla) can expect drawdowns of between 1 m and 4 m, the other hand dug well (Omukoko) can expect between 7 m and 10 m drawdown. These receptors are within the Project boundary and will likely be relocated. An alternative water supply must be provided at the location selected for individual to be relocated to;
- The flow rate will need to be measured for all impacted springs to determine the potential loss of water supply to the ecosystem and downgradient users of the streams sourced by the springs. From the hydrocensus, springs have a flow rate ranging between 0.01 l/s and 0.8 l/s (with an average of 0.3 l/s). Although the loss of water to the tributaries may be impacted, the loss of water to the Dhene or Awachi Rivers would be expected to be low. Receptors using the springs will likely be relocated as part of the project, however, there may potentially be water supply loss to downstream users of the tributaries to the Awachi River; and
- The baseline conditions at the Project showed that most of the wetlands have already been impacted upon, however, the wetlands are identified as being groundwater fed and therefore are sensitive to reduced contributions from groundwater due to dewatering activities.

Receptors within the Project boundary will be relocated and therefore the loss of water supply will need to be compensated for at the site selected to relocate the individual or community.

Predicted pit inflows are provided in Figure 8-2. Inflows are highest during the first year at an estimated 1 740 m^3/d, decreasing to an average of 540 m^3/d for the remaining five years of mining. This would need to be re-assessed with annual pit shells.

- **Management Objectives**

The objective of the management measures is to ensure that dewatering impacts associated with the extraction of gold ore from the open pit are avoided, minimised and/or managed.

- **Impact Ratings and Management Actions**

The impact ratings (before and after mitigation measures) as well as the recommended mitigation measures are provided in Table 8-47. The pre- and post- mitigation measures ratings are the same as no mitigation will reduce the impact to the spring and groundwater fed wetland ecosystems, unless the operational timeframe or method changes.

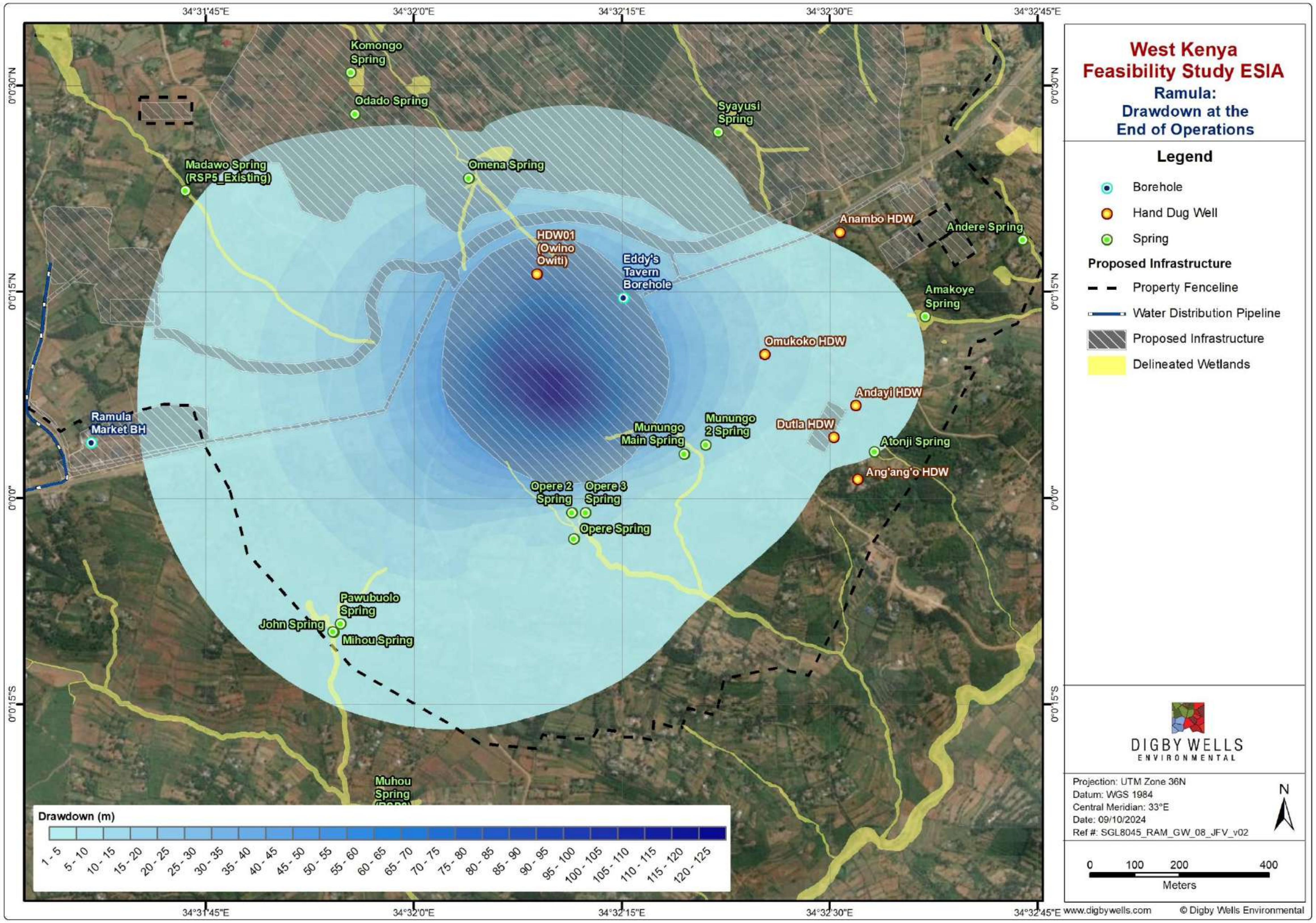


Figure 8-1: Drawdown Cone at the End of the Operational Phase

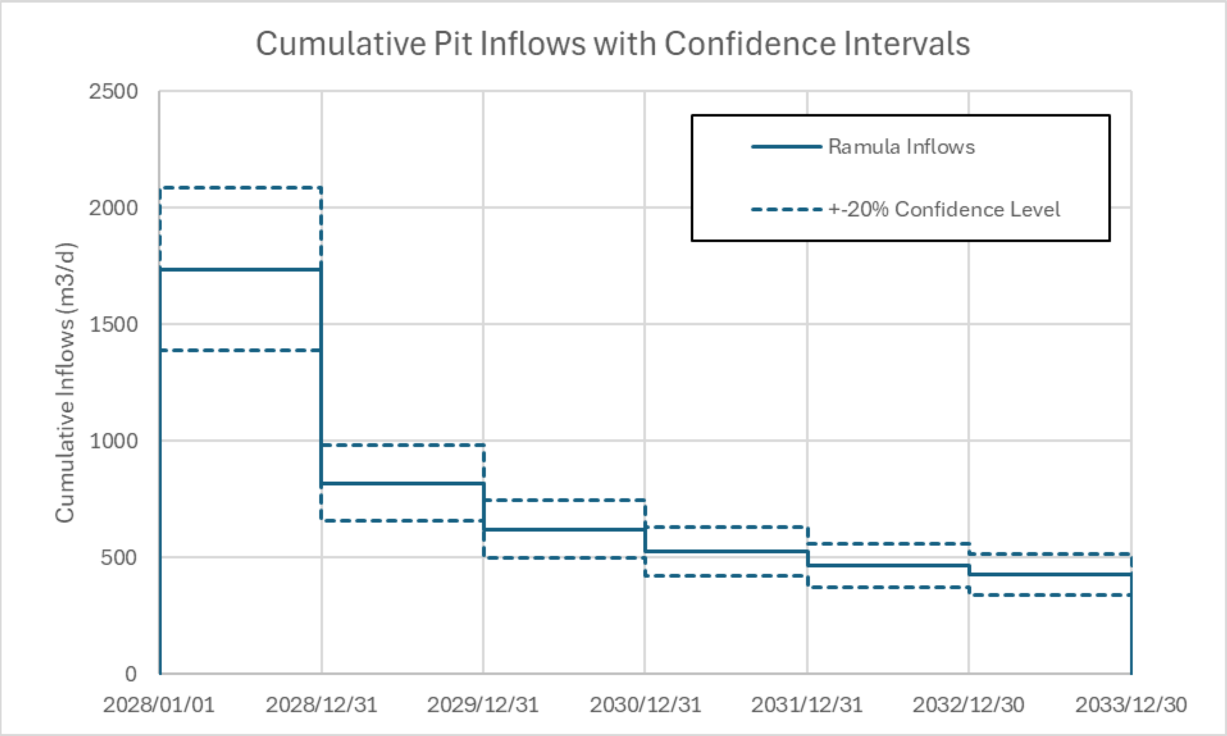


Figure 8-2: Predicted Groundwater Inflows

Table 8-47: Operational Impact for Groundwater Abstraction and Drawdown

Activity: Open pit mining

Impact Description:

A pit will be developed below the groundwater table and will need to be dewatered. As groundwater flows into the pit, a drawdown cone will develop around the pit.

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	5	Project Life	**Dimension**	Duration	**Rating**	5	Project Life
	Extent		3	Local		Extent		3	Local
	Intensity		5	Very serious, long term environmental impairment of eco-systems		Intensity		5	Very serious, long term environmental impairment of eco-systems
	Probability		7	Certain		Probability		7	Certain
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Moderate (negative) 91					**Moderate (negative) 91**				

Mitigation/Management Actions

- Monitor abstraction volumes and implement a groundwater monitoring network. This will allow confirmation of the current model results and provide more information for numerical model updates;
- Update the numerical model, with changes to the mine plan and/or if monitoring shows deviations from current estimates;
- Abstracted water must be accounted for in the mine water balance, to ensure adequate storage capacity for and management of the abstracted water;
- Abstracted groundwater must meet regulatory discharge limits prior to being released into the environment. Where the regulatory discharge limits are exceeded by regional baseline water quality, discharged water should meet the regional baseline quality;
- Monitor the spring flow, to assess potential loss of water to the downgradient receptors who rely on springs and associated stream flow for water supply;
- Assess the depth of the impacted hand dug wells to verify if the expected drawdowns will result in the wells becoming dry;
- Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities; and
- Divert storm water runoff around and away from pit. Storm water collected in the contact water footprint must be directed to designated water containment facilities.

- **Impact Description: Potential Contamination Plume**

The Project will be operational for a minimum period of six years, which could allow for sufficient time for acid rock drainage (ARD) processes to occur in the mined-out areas and waste storage facilities. The geochemical assessment determined that the ore and waste rock will have a neutral to alkaline generation potential. Sulphate, iron and zinc were identified as the main contaminants of concern and included in the model simulations. Iron had notably high concentrations in the geochemistry results, these have been used as conservative estimates within the simulations and impact assessment. At an alkaline pH, it is unlikely that iron would have concentrations of up to 38 mg/L as iron would likely precipitate out of solution (Digby Wells Environmental, 2024).

During the operational phase groundwater will be drawn to the pit as a result of active dewatering, and therefore potential contamination from the pit will be contained within the mine workings and dirty water management system. The simulated sulphate, iron and zinc plumes emanating from the WRD and TSF extend up to 500 m downgradient of the infrastructure footprints based on a 5 mg/L (sulphate), 0.2 mg/L (iron) and 0.1 mg/L (zinc) concentration contour (Figure 8-3 to Figure 8-5)

For the development of the WRD, a total of four springs, three streams and associated wetlands will be covered by the proposed dump. For the development of the TSF one stream and associated wetlands will be covered. The maximum concentrations simulated for the saprolite at the end of the operational phase were as follows:

- Sulphate at 35 mg/L, which is below the Kenyan (EAS 12: 2014) limit of 400 mg/L but above the average baseline water quality of 4.9 mg/L. Based on a 5 mg/L contour, elevated sulphate concentrations are not expected to reach the Dhene River or springs;
- Iron at 35.2 mg/L, which exceeds the Kenyan (EAS 12: 2014) limit of 0.3 mg/L, the IFC discharge limit of 2 mg/L and the average baseline water quality of 0.2 mg/L. The World Health Organisation (World Health Organisation, 2022) has not established a guideline value. Concentrations of up to 5.2 mg/L could potentially reach the Dhene River. Based on the 0.2 mg/L contour, elevated iron concentrations are not expected to reach the Dhene River or springs. Elevated iron concentrations could potentially be treated passively with aeration processes.; and
- Zinc at 1.1 mg/L, which is below the Kenyan (EAS 12: 2014) limit of 5 mg/L but exceeds the IFC discharge limit of 0.5 mg/L and the average baseline water quality of 0.1 mg/L. Concentrations of up to 0.1 mg/L zinc could potentially reach the Dhene River.

- **Management Objectives**

The objective of the management measures is to ensure that groundwater contamination impacts associated with extraction of gold ore are avoided, minimised and/or managed.

- **Impact Ratings and Management Actions**

The impact ratings (before and after mitigation measures) as well as the recommended mitigation measures are provided in the table below Table 8-48.

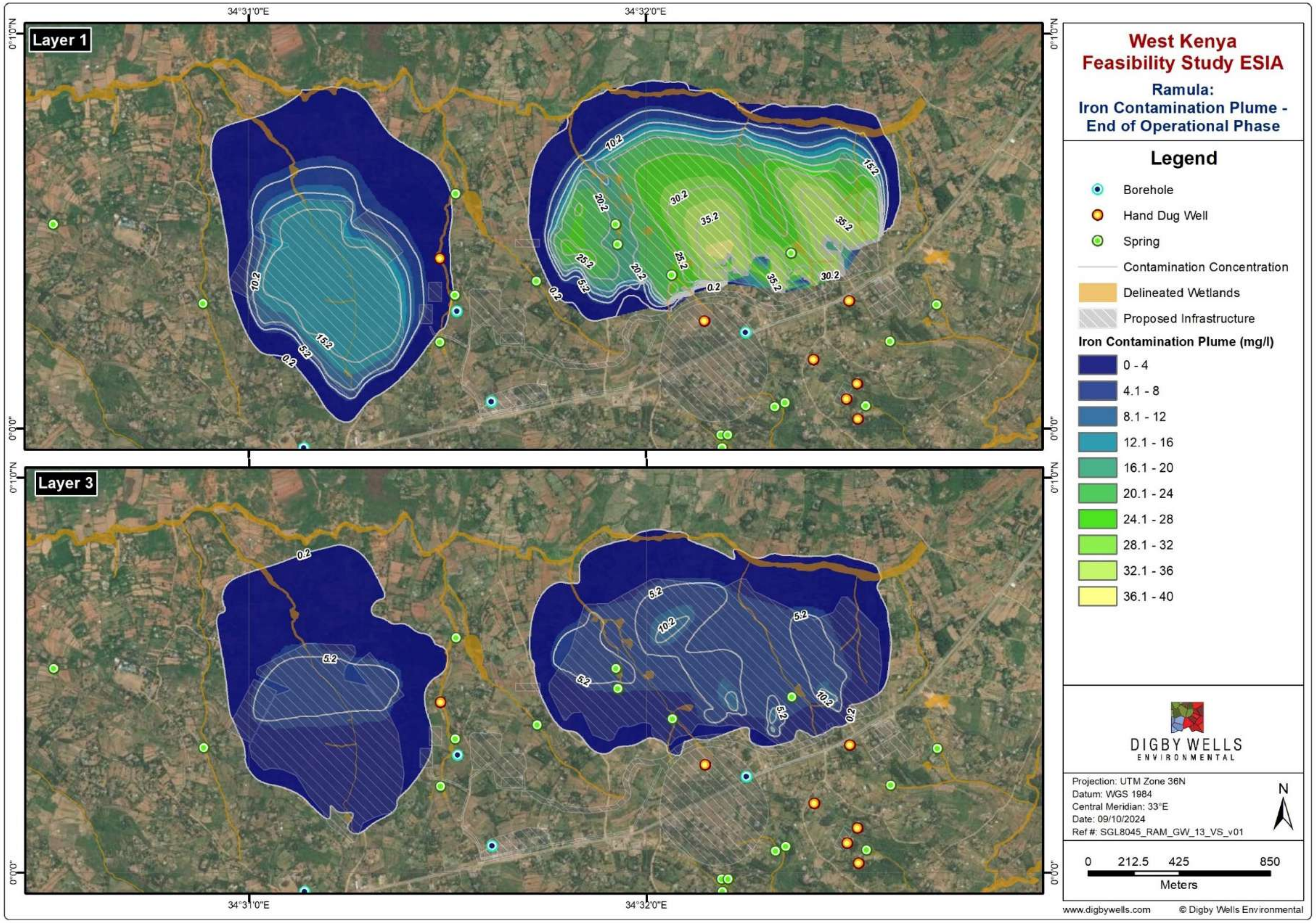


Figure 8-3: Iron Contaminant Plume at the End of the Operational Phase

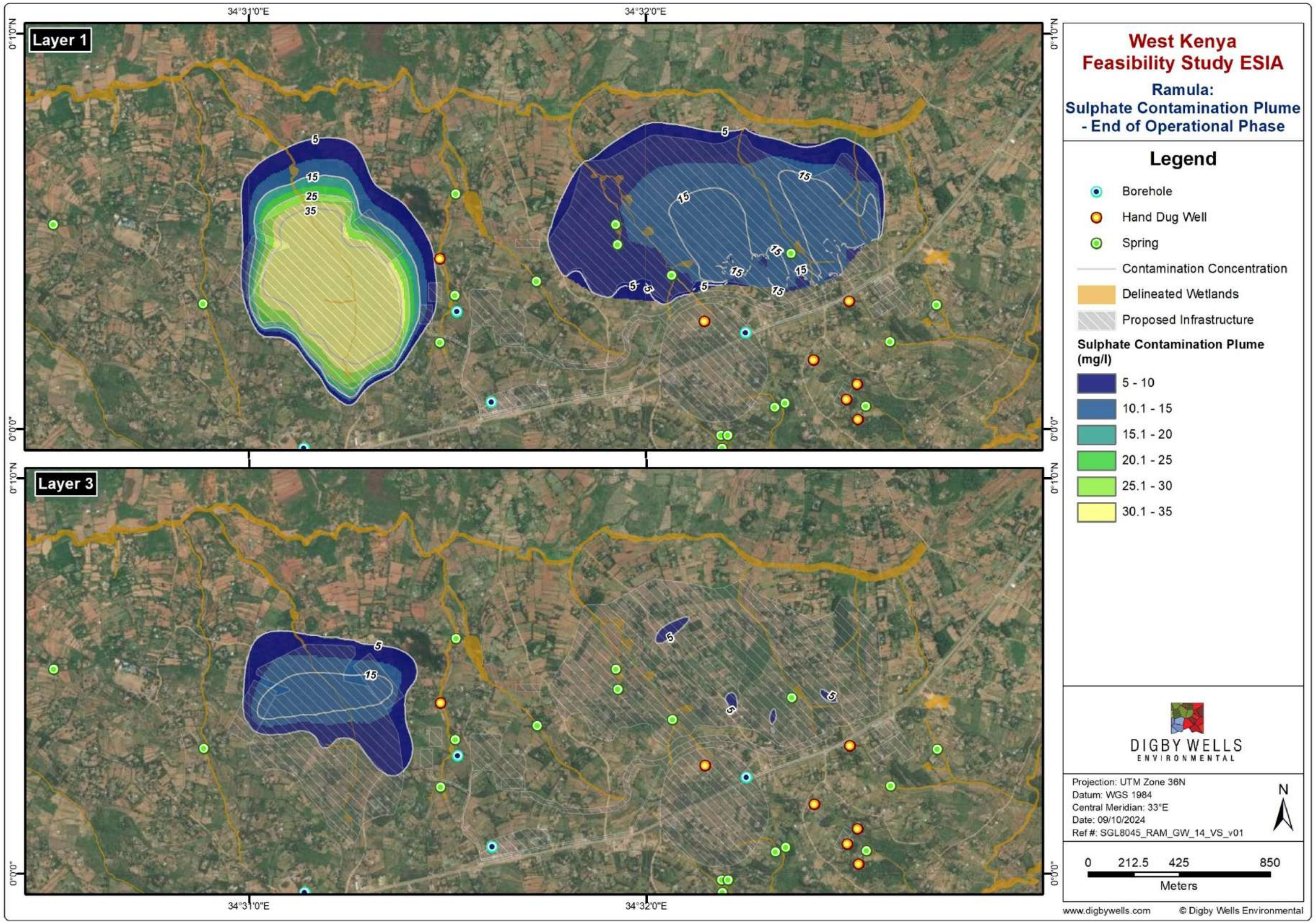


Figure 8-4: Sulphate Contaminant Plume at the End of the Operational Phase

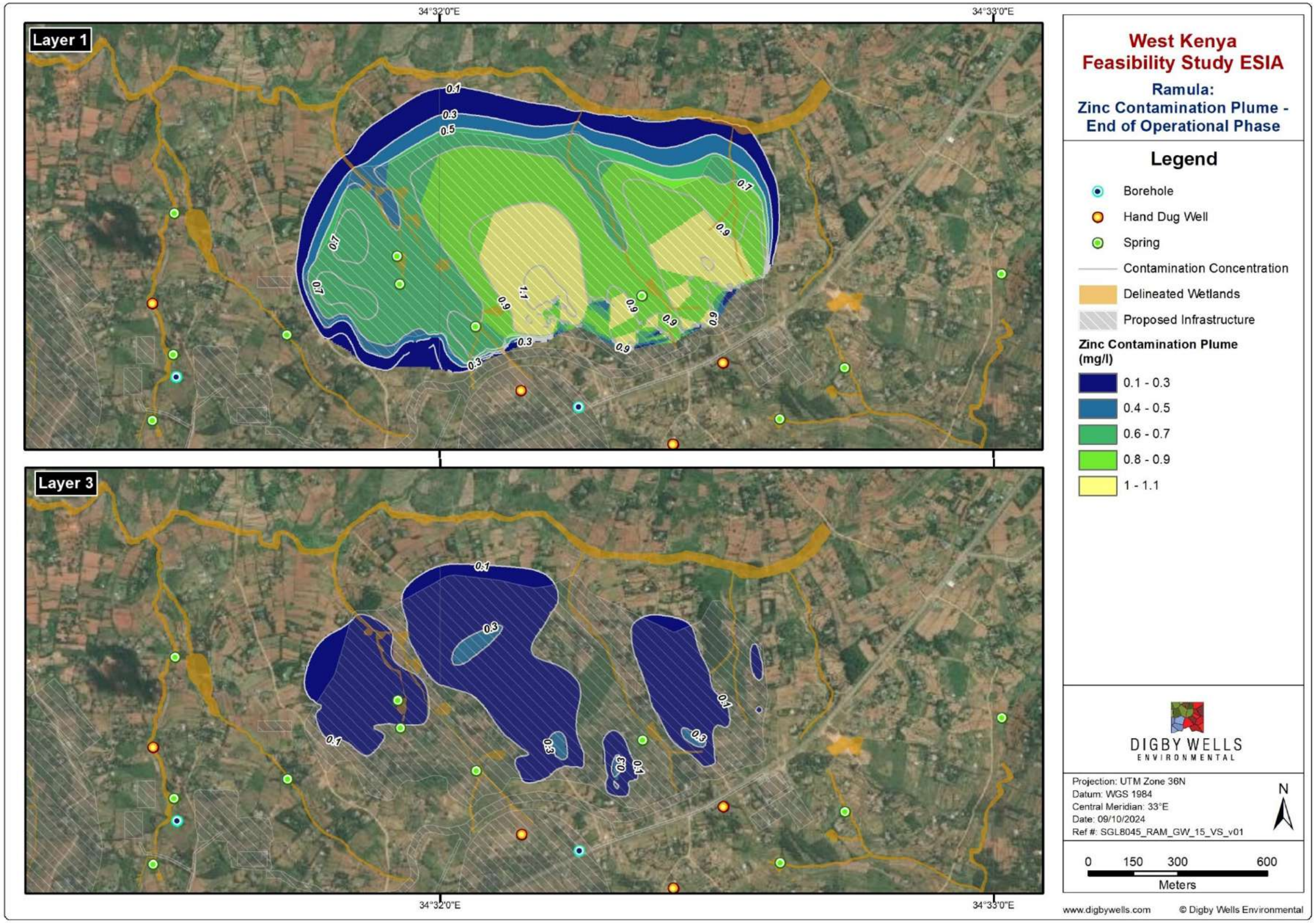


Figure 8-5: Zinc Contaminant Plume at the End of the Operational Phase

Table 8-48: Operational Impact for the Potential Contamination Plume

Activity: Open pit mining and ore and mineral processing									
Impact Description: Exposing sulphide bearing minerals to ARD conditions. Active dewatering will contain the contaminated water in the pit and contact water facilities established for the project. ARD from waste rock and tailings has a low potential to contaminate the aquifer the aquifer within the immediate footprint area.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	5	Project Life	**Dimension**	Duration	**Rating**	5	Project Life
	Extent		3	Local		Extent		3	Local
	Intensity		2	Minor		Intensity		1	Limited
	Probability		5	Likely		Probability		4	Probable
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) 50					**Minor (negative) 36**				
Mitigation/Management Actions									

- Monitor the groundwater monitoring network. This will allow confirmation of the current model results and provide more information for numerical model updates;
- Update the numerical model, with changes to the mine plan and/or if monitoring shows deviations from the current estimates;
- Update the geochemical assessments as mining progresses to increase the ARD knowledge for the waste rock material and verify the iron leachate results;
- Should it be confirmed that the iron concentration in the leachate is as high as assessed with the geochemistry assessment, then water will need to be treated to meet the discharge or regional baseline limits;
- Implement recommendations from the geochemical and geotechnical assessment report for the design of the WRD, to manage seepage quality and prevent failure of the WRD;
- Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities; and
- Monitor the spring flow from the springs underneath the WRD. This flow may need to be incorporated into the water balance for the project, if water quality indicates that water does not meet the discharge or regional baseline limits for the Project. Culverts may be required if these springs have significant flows.

8.2.2.4. Wetlands

The operation, maintenance and potential spills from the WRDs and TSF could potentially lead to water and soil contamination, leading to contamination of low-lying areas such as wetlands. Contamination of the environment will lead to deterioration and loss of biodiversity, EcoServices, decreased PES, limited clean water provision and various social constraints.

Potential dewatering activities are likely to result in the loss of water supply to the wetlands, specifically lower-lying wetlands and moisture stress to the surrounding catchment.

Vehicle movement and machinery maintenance may lead to compaction, therefore increasing runoff and erosion potential. High velocity runoff from stockpiles may lead to erosion and contaminants entering wetlands, directly impacting the natural biota and wetland integrity. Sedimentation may lead to the suffocation of vegetation, reducing basal cover and infiltration. Contamination from heavy mining machinery containing large volumes of oils and diesel could spill into the soils and water, ending up in the wetlands and therefore changing the natural wetland functioning.

Unprotected surfaces and stockpiles (e.g., WRD, TSF and soil stockpiles) may lead to leaching of contaminants into the groundwater and ultimately groundwater-fed wetland systems downstream. Erosion could occur and result in preferential flow paths, sedimentation, hydrogeomorphic changes, and loss of vegetation cover.

The general maintenance and operation of the infrastructure will lead to increased vehicle movement, increased compaction and increased risk of AIPs introduction. Blasting will continue during the operational phase which is likely to cause indirect impacts to surrounding wetlands in the form of debris and dust collection. During the operational phase, mine dewatering is likely to result in the lowering of the groundwater table and a reduction in the quantity of the groundwater resource. The groundwater modelling was not completed at the time of writing this report, although inputs from the groundwater baseline were used to back this statement.

Discharge of treated effluent will take place during the operational phase. The volumes of discharge need to be controlled to avoid high velocity flows which could lead to scouring and erosion. This will in turn result in a decrease in wetland health and functionality. Water quality also needs to be monitored to avoid contaminated water entering wetlands.

8.2.2.4.1. Impact Ratings

The pre-mitigation impact ratings during the operation phase range from “Minor-Negative” to “Moderate-Negative”. These scores are expected to decrease with the implementation of recommended mitigation and management measures with the highest post-mitigation significance rating scored “Minor-Negative”. The lowest significance ratings are associated with general operation activities with the highest of impacts associated with open cast mining, including blasting, which will result in a complete loss of wetland drivers where wetlands have not already been lost during the construction phase. This will specifically be relevant to wetland areas adjacent to the Ramula Pit. Modelling results was not yet available at the time of writing the Wetland Baseline and Impact Assessment Report. Therefore, it has been assumed that there will be significant impacts to all wetlands located within the AoI through dewatering/loss of moisture.

Table 8-49: Operational Impact for Open Pit Mining (incl. Blasting)

Activity: Open pit mining (incl. blasting)									
Impact Description: During this activity, overburden will be excavated, the WRD will be established and mining of ore will take place. This potentially includes blasting and will lead to a loss of bedrock layers crucial for sustaining wetland soil moisture and ultimately functionality. The loss of bedrock will lead to indirect impacts on downstream wetland systems due to the loss of wetland drivers. The establishment of the WRD and TSF will take place in areas already cleared (on completion of the construction phase), meaning that wetland systems would have already been lost during the construction phase (which has already been considered). Therefore, indirect downstream impacts will be more relevant to this activity and phase. Dewatering is expected during open pit mining, which will have an impact on total streamflow and soil moisture associated with wetlands within the AoI.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Permanent (7)	The impact will remain long after the life of the Project. The impacts are	**Dimension**	**Duration**	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		**Extent**		Limited (2)	Limited to the site and its immediate surroundings.
	Intensity		Significant (6)	Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures required to prevent irreversible impacts. Irreparable damage to highly valued items of cultural significance or breakdown of social order.		**Intensity**		Very Serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.
	Probability		Almost Certain / Highly Probable (6)	It is most likely that the impact will occur.		Probability		Likely (5)	The impact may occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Moderate (negative) -96					**Minor (negative) -65**				
Mitigation/Management Actions									

- Ensure that sound environmental management is in place during the operational phase. This should be done by following the monitoring programme and the mitigation measures listed in the EMPr.;
- Ensure that no incision and canalisation of the wetland features takes place as a result of the operational activities. This should be done by following the monitoring plan and applying the recommended mitigation measures;
- All erosion noted within and in the vicinity of the footprint areas should be remedied immediately and included as part of the ongoing rehabilitation plan;
- A suitable AIP control programme must be put in place to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zone of regulation. All vehicles must remain on demarcated roads and within footprint areas;
- All vehicles must be regularly inspected for leaks and re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons;
- Spill containment and clean-up kits should be available on-site and clean-up from any spill must be in place and executed at the time of spillage with appropriate disposal as necessary;
- Maintenance of the stormwater infrastructure should be undertaken regularly;
- Seepage must be monitored at WRD and all stockpiles to avoid poor quality seepage entering downstream wetlands; and

- All spills should be immediately cleaned up and treated accordingly.

Table 8-50: Operational Impact for Ore and Mineral Waste Handling (Low-Grade Ore Stockpiles and WRDs)

Activity: Ore and mineral waste handling (low-grade ore stockpiles and WRDs)									
Impact Description: During this activity, material will be hauled to the WRD, during which material could spill from vehicles, leading to sedimentation of nearby wetlands. Indiscriminate driving could take place, if not controlled, leading to compaction and general degradation of relevant wetland systems. Where material is deposited at the WRD footprint, platforms should be sealed to avoid uncontrolled erosion and infiltration of contaminants into the soil surface.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	**Dimension**	**Duration**	**Rating**	Project Life (5)	The impact will cease after the operational life span of the Project.
	Extent		Limited (2)	Limited to the site and its immediate surroundings.		**Extent**		Limited (2)	Limited to the site and its immediate surroundings.
	Intensity		Serious (4)	Serious medium term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of significance.		**Intensity**		Moderate (3)	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires the intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of significance.
	Probability		Almost Certain / Highly Probable (6)	It is most likely that the impact will occur.		**Probability**		Probable (4)	Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		**Type**		Neg	Negative Impact (-)
Minor (negative) -72					**Minor (negative) -40**				
Mitigation/Management Actions									

- Care must be taken to ensure that contamination of the receiving environment as a result of haulage is minimised as far as possible;
- Monitoring and maintenance of the condition of all unpaved roads is necessary due to the high rainfall and potential water runoff and erosion of the soils present in the footprint areas. Water runoff from compacted road surfaces may cause erosion of road shoulders degrading the road surface and leading to sedimentation of adjacent wetlands;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- Only the designated access routes and haul roads are to be used to reduce any unnecessary compaction;
- Operations vehicles and equipment should be serviced regularly;
- Service and parking areas must be paved;
- The Stormwater Management (SM) system associated with all waste facilities must be cleaned and maintained;
- A suitable AIPs control program must be put in place to prevent further encroachment as a result of disturbance to the surrounding areas; and
- Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities.

Table 8-51: Operational Impact for General Operation Activities

<table>
<tr><td colspan="10">Activity: General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material. This includes Operation and management of water management infrastructure (dams, trenches, silt traps, etc.)</td></tr>
<tr><td colspan="10">Impact Description: During this activity, general activities from already constructed components will lead to alterations of soil hydraulic properties through compaction and cleared vegetation. This will increase overland flow velocities, erosion and sedimentation. This could result in indirect impacts towards wetland health and functionality.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Beyond Project Life (6)</td><td>The impact will remain for some time after the life of the Project.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Project Life (5)</td><td>The impact will cease after the operational lifespan of the Project.</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Limited to the site and its immediate surroundings.</td><td>Extent</td><td>Very Limited (1)</td><td>Limited to specific isolated parts of the site.</td></tr>
<tr><td>Intensity</td><td>Moderate (3)</td><td>Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in less than a month.
On-going social issues. Damage to items of significance.</td><td>Intensity</td><td>Minor (2)</td><td>Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.
Minor medium-term social impacts on local population. Mostly repairable. Functions and processes not affected.</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>Has occurred here or elsewhere and could therefore occur.</td><td>Probability</td><td>Unlikely (3)</td><td>Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Minor (negative)
-44</td><td colspan="5">Negligible (negative)
-24</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">• Culverts, roads, bridges, powerlines and river crossings must be maintained, cleared and monitored;
• A SWMP must be maintained throughout the operational phase. This should consider all wetlands adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural wetlands to maintain catchment yield as far as possible. The SWMP should also convey contaminated water to the proposed sediment ponds to limit contamination of the soils and groundwater;
• All stockpiles should be monitored and vegetated to ensure no runoff, erosion, sedimentation and impacts on the wetlands;
• If spills have occurred, clean-up should be undertaken immediately and implement a monitoring program for at least three months after the spill has occurred. This should include soil sampling and analyses for heavy metals to monitor improvement after clean-up;
• Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible;
• Ensure the correct storage of all chemicals at operations as per each chemical’s specific storage requirements (e.g., sealed containers for hydrocarbons);
• Ensure staff involved in the proposed Project have been trained to correctly work with chemicals at the sites;
• All vehicle maintenance and refueling must occur within designated areas and inspect regularly for leaks;
• All vehicles must be regularly inspected for leaks and re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons;
• Spill containment and clean-up kits should be available on-site and clean-up from any spill must be in place and executed at the time of spillage with appropriate disposal as necessary;
• Re-vegetate cleared areas and stockpiles to avoid wind and water erosion; and</td></tr>
</table>

- A suitable AIP Management Plan must be put in place to minimise the risk of AIP introduction and spread as a result of disturbance to wetlands.

Table 8-52: Operational Impact for Potential Discharge of Treated Effluent

Activity: Potential discharge of treated effluent									
Impact Description: Treated effluent potentially could be discharged into the environment. If discharge volumes are not controlled significant erosion could take place within wetland systems discharged together with sedimentation. If water quality of discharged water is not monitored, contamination could take place. These impacts will have an indirect impact to downstream wetlands.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	**Dimension**	**Duration**	**Rating**	Project Life (5)	The impact will cease after the operational lifespan of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		**Extent**		Local (3)	Extending across the site and to nearby settlements.
	Intensity		Significant (6)	Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures are required to prevent irreversible impacts. Irreparable damage to highly valued items of cultural significance or breakdown of social order.		**Intensity**		Very Serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.
	Probability		Highly Probable (6)	It is most likely that the impact will occur.		**Probability**		Likely (5)	The impact may occur
	Type		Neg	Negative Impact (-)		**Type**		Neg	Negative Impact (-)
Moderate (negative) **-90**					**Minor (negative)** **-65**				
Mitigation/Management Actions									

- All effluent should be treated prior to discharge;
- Water quality of effluent designated for discharge should be monitored monthly according to the Kenyan Water Quality Regulations (Republic of Kenya, 2006);
- Discharge should be concentrated at one or a maximum two points to limit impacts;
- Wetlands within proximity to infrastructure have undergone significant erosion/incision. Increasing surface flow volumes and velocities through discharge will further degrade these systems. A surface hydrology study should inform the volumes of discharge;
- Discharge should be diffused over long periods as opposed to concentrated over short periods;
- Erosion control measures (i.e. gabion baskets) should be implemented at the point of discharge to limit erosion;
- Water quality should be monitored downstream of discharge points to monitor potential water quality impairments as a result of discharge; and
- Rehabilitation of wetlands discharged into should be investigated. Improvement to these systems will improve functionality, which will ensure erosion control and assimilation of toxicants and will ultimately decrease impacts to downstream wetlands.

8.2.2.5. Terrestrial Ecology

Open-pit mining, including blasting, and the handling of ore and mineral waste (such as low-grade ore stockpiles and waste rock dumps - WRDs) can have significant impacts on both fauna and flora. These activities disrupt natural habitats, alter landscapes, and introduce pollutants into the environment, all of which can lead to long-term ecological damage.

The removal of overburden and surface soils during mining can result in the loss of nutrient-rich topsoil. Soil degradation and compaction can limit the potential for revegetation, leading to the decline of native plant species and an increase in opportunistic invasive species.

Blasting and mineral waste handling generate large amounts of dust, which can settle on plants and reduce photosynthesis, impairing plant growth and health. Airborne pollutants from blasting, such as sulphur and nitrogen oxides, can also acidify soils, negatively affecting plant communities. Blasting operations produce loud noises and vibrations that can stress or displace animals. Sensitive species, such as birds, mammals, and amphibians, may abandon their territories due to these disturbances. The vibrations may also affect burrowing animals by collapsing their dens or disturbing their activity cycles.

Leachate and runoff from WRDs and ore stockpiles can contaminate nearby water bodies with heavy metals, acids, and other toxic substances. This can severely affect aquatic and riparian plant species and disrupt the hydrological balance needed to sustain vegetation in wetlands and riverine areas. This can affect aquatic fauna by reducing water quality, impairing the health of fish and amphibians, and reducing food availability through the destruction of aquatic vegetation.

Use of artificial lighting can disrupts the natural diurnal and nocturnal rhythms of many species, altering behaviours related to feeding, mating, and migration. For nocturnal species, such as bats, owls, and certain insects, artificial lights can cause disorientation and disrupt their foraging and navigation patterns. Artificial lighting also attracts vector insects like mosquitoes and other light-sensitive species. This increases the risk of disease transmission (e.g., malaria and dengue fever) to both wildlife and human populations in the surrounding area

Mining operations often increase human presence in previously undisturbed areas, which can lead to conflicts with wildlife. Animals may come into closer contact with humans, leading to increased incidences of hunting, poaching, or the capture of wildlife for illegal trade.

8.2.2.5.1. Impact Ratings

Table 8-53, Table 8-54 and Table 8-55 and present the impact ratings associated with the operation phase of the Project.

Table 8-53: Impact Assessment for the Operational Phase (excavation and stockpiling of Ore)

Activity: Excavation and stockpiling of materials (Ore and mineral waste handling)									
Impact Description: During operations, increased dust pollution may lead to a decline in vegetation growth in the surrounding area. Additionally, the heightened traffic activity poses a risk to slow-moving fauna, potentially resulting in fatalities during this phase. Leachate and runoff from WRDs and ore stockpiles can contaminate nearby water bodies with heavy metals, acids, and other toxic substances. This can severely affect aquatic and riparian plant species and disrupt the hydrological balance needed to sustain vegetation in wetlands and riverine areas.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	Rating	Beyond Project Life (6)	Impacts can remain sometime after the operations.	Dimension	Duration	Rating	Long Term (4)	Mitigation measures can limit the impacts from occurring.
	Extent		Local (3)	Contaminants can reach water systems polluting downstream entities.		Extent		Limited (2)	Limited to the operational area only.
	Intensity		Irreplaceable Loss (6)	Sensitive species are present and may be impacted by the activities.		Intensity		Moderate Loss (3)	Mitigation measures can limit the severity impacts and from occurring.
	Probability		Likely (5)	Likely that the impacts will occur if not mitigated		Probability		Probable (4)	Very probable that the impacts may occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
- 75 Moderate (negative)					**Minor (negative) – 44**				
Mitigation/Management Actions									

- Develop and implement habitat restoration plans to restore disturbed areas and encourage the re-establishment of native flora and fauna, and prevent the establishment of AIPs.
- Concurrent rehabilitation measures must be investigated and implemented to prevent windblown dust generation from the operation activities and any remaining bare areas following the Construction Phase.
- Regularly monitor the impacts of mining activities on fauna and flora to assess the effectiveness of mitigation measures and adapt strategies as needed.
- An AIP monitoring and management strategy should be implemented, the operational area should be continuously monitored for AIP sprawl, leaching and spills and encroachment and attended to accordingly.
- Contain dust pollution by routinely spraying haul roads and dry areas with water i.e. dust suppression. Ensure concurrent rehabilitation and monitor berms of the pit for erosion.
- Implementing sediment control measures around WRDs and stockpiles can reduce water contamination and protect nearby water bodies and riparian habitats
- Ensure that all mining personnel adhere to safety protocols and speed limits. Special care should be taken when night driving is needed, normal health and safety protocols must be abided by and drivers should be aware of nocturnal fauna that may be at risk.

Table 8-54: Impact Assessment for the Operational Phase (Water Management)

Activity: Operation of the water management infrastructure									
Impact Description: Habitat alteration arises from the disruption of natural ecosystems, potentially leading to loss of biodiversity and habitat fragmentation. The contamination of surrounding water bodies can occur through various means such as leaching of pollutants or runoff from operational activities, posing risks to aquatic life, vegetation and ecosystems downstream. Soil compaction, resulting from heavy machinery and equipment, can degrade soil structure, impede water infiltration, and impair nutrient cycling, affecting the health and productivity of terrestrial ecosystems.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	Rating	Project Life (5)	Areas have already been removed therefore impacts will remain during the life of the project until rehabilitation.	Dimension	Duration	Rating	Project Life (5)	Project life, until rehabilitation.
	Extent		Local (3)	The impact could extend to the footprint as well as the surroundings.		Extent		Limited (2)	Impacts should be limited to isolated areas only with mitigation.

	Intensity		Serious Loss (5)	Activities may lead to irreplaceable impacts on the surrounding natural habitats.		Intensity		Serious Loss (4)	Activities may lead to serious impacts on the surrounding habitats.
	Probability		Almost Certain (6)	Highly probable to impact the surrounding landscapes.		Probability		Probable (4)	Impacts may probably still occur, even with mitigation implemented.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
- 78 Moderate (negative)					**Minor (negative) – 44**				
Mitigation/Management Actions									

- Regularly monitor the impacts of mining activities on fauna and flora to assess the effectiveness of mitigation measures and adapt strategies as needed.
- Develop and implement habitat restoration plans to restore disturbed areas and encourage the reestablishment of native flora and fauna.
- An AIP monitoring and management strategy should be implemented, the operational area should be continuously monitored for AIP sprawl and encroachment and attended to accordingly
- Erosion should be continuously monitored throughout the operational phase. Where erosion is identified, corrective measures must be implemented timeously
- Implement best practices for water management to reduce contamination and ensure the protection of surrounding habitats.

Table 8-55: Impact Assessment for the Operational Phase (general activities and use of haul road)

Activity: General operational activities and use of haul road

Impact Description: AIP establishment may be exacerbated by the operational activities. Faunal casualties may occur due to increased vehicular traffic or habitat disruption. Soil compaction, often caused by heavy machinery and equipment, can degrade soil quality, impede root growth, and decrease soil permeability, affecting overall ecosystem health. Potential soil and land contamination may arise from spillage or leakage of hazardous materials, posing risks to soil fertility and human health. Furthermore, wildlife disturbances caused by operational activities (noises, increased light) can disrupt natural behaviours, species movement and habitat utilization patterns, leading to stress and displacement among local wildlife populations.

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	Rating	Life of the Project (5)	Impacts may occur during the life of the project	Dimension	Duration	Rating	Life of Project (5)	Impacts may occur during the life of the project.
	Extent		Limited (2)	Limited to the areas for general operational activities		Extent		Limited (2)	Will be limited to the general operational areas.
	Intensity		Serious loss (5)	If not controlled these impacts can result in serious loss of faunal species.		Intensity		Moderate Loss (3)	Intensity can be reduced if mitigation measures are adhered to.
	Probability		Almost Certain (6)	These are very common impacts that occur in open pit mining operations.		Probability		Probable (4)	Probable that the impacts may occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
- 72 Minor (negative)					**Negligible (negative) – 28**				
Mitigation/Management Actions									

- Implement Speed Limits and Signage: Enforce speed limits and install wildlife crossing signs to reduce the risk of collisions between vehicles and wildlife.
- Create Wildlife Corridors: Identify and establish wildlife corridors or underpasses to allow fauna to safely cross transportation routes, especially where roads bisect sensitive habitats such as wetlands, rivers, streams or indigenous forest.
- Time and Route Restrictions: Schedule hauling activities during periods of lower wildlife activity (during the warmer periods of the day) and avoid critical wildlife areas such as drainage lines as much as possible.
- Installing lights with shielding or directional features to minimize light spillage into surrounding natural habitats. Lights should be focused downward or toward specific areas (e.g., workspaces) to reduce the overall light pollution affecting nocturnal species. Use low-intensity lighting, particularly in areas close to natural habitats. Lights in the red spectrum are less likely to attract insects and have been shown to have a reduced impact on nocturnal wildlife compared to white or blue light. This can help reduce the attraction of vector insects and minimize disruption to nocturnal species.
- Implement effective waste management practices to prevent pollution and contamination of soil and water resources.
- Use deterrents such as noise or motion-activated devices to discourage wildlife from entering operational areas.
- Create biodiversity awareness. Provide training and awareness programs for staff to promote responsible environmental practices and wildlife conservation.

8.2.2.6. Aquatics

Increased runoff through/from the pit discharges, ore and topsoil stockpiles, TSF and WRDs has the potential to increase sedimentation and contaminants within the associated watercourses. Impacts are expected to be heightened during the operational stripping and stockpiling associated with the development of the open cast pit, TSF and WRD's which are located both away from and directly within the Dhene River tributaries, respectively. Increased bare surfaces and runoff through/from various stockpiles have further potential to result in habitat and water quality modifications which may lead to the loss of aquatic biota and overall deterioration of the ecological integrity within the affected downstream systems.

Established infrastructure, including buildings and access routes, will result in increased surface runoff and erosion events. Watercourse crossings and transport of material over the tributary network will further contribute to erosion and water quality-related impacts. Surface and/or stormwater runoff measures will be vital for managing the impacts associated with runoff from these areas.

The operation, maintenance and potential discharges/decant, seepage and spills from the pit, TSF, WRDs, stockpiles, sediment ponds and other infrastructure areas could potentially result in further water quality deterioration within the receiving and downstream watercourses. This together with habitat losses, will negatively impact aquatic biodiversity and the ecological integrity of the receiving watercourse which may include the downstream Yala River should AMD develop. According to the geochemistry report (Digby Wells, 2024), no acid-forming minerals were recorded for the pit and the presence of the fast-dissolving acid-neutralising minerals in the exposed pit wall waste rock will be Potentially Acid Neutralizing (PAN). The geochemical risk associated with the pits is the generation of alkaline mine drainage with parameters of concern including high pH, electrical conductivity, sulfate, fluoride, barium, iron, copper, magnesium, scandium, sodium, zinc and nitrates from the use of explosives. Similar parameters of concern are expected for the WRD and TSF facilities. If not responsibly managed, the seepage and runoff from these facilities may impact the surface and groundwater quality.

8.2.2.6.1. Impact Ratings

The pre- and post-mitigation impact ratings for the Operational Phase are detailed between Table 8-56 and Table 8-58. The pre-mitigation impact ratings during the operation phase ranges from “Minor-Negative” to “Major-Negative”. These scores are expected to decrease with the implementation of recommended mitigation and management measures with the highest post-mitigation significance rating scored “Moderate-Negative”. The lowest significance ratings are associated with general operational mining activities and infrastructure located away from watercourses, while the highest of impacts associated with infrastructure located directly within watercourses with associated seepage and discharge of decant with associated habitat impacts and water quality-related impacts that have the potential to extend beyond the project footprint.

Table 8-56: Impact ratings determined for stripping and mining of pits (incl. blasting) and stockpiling material in close proximity to the local watercourses during the Operational Phase

Activity: Stripping and mining of pits (incl. blasting) and stockpiling material in close proximity to the local watercourses. This excludes the WRDs discussed elsewhere.									
Impact Description: Habitat and water quality deterioration within associated watercourses.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Project Life (5)	Mining activities and stockpiles will persist throughout the life of the Project. However, the pit will likely remain in-place beyond closure and the impacts associated with potential water quality through pit lake systems need to be considered.	**Dimension**	Duration	**Rating**	Project Life (5)	Mining activities and stockpiles will persist throughout the life of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		Extent		Isolated part of site (1)	The proposed mitigation measures will reduce the extent of the impact as the tributaries will be indirectly influenced.
	Intensity		Serious (4)	The intensity of the potential impacts are expected to be serious when considering the close proximity of the proposed stockpiles to the tributaries. The pit is of lower impact due to its location on the watershed.		Intensity		Moderate (3)	The proposed mitigation measures should reduce the intensity of the impact, especially downstream from the proposed infrastructure. However, this is limited due to direct influences.
	Probability		Highly Probable (6)	Impacts will occur, especially due to the proximity of the proposed infrastructure to the tributaries.		Probability		Probable (4)	Should the mitigation measures be implemented, especially the stormwater management and berms, the likelihood of the impact will be reduced.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) -72					**Minor (negative) -36**				
Mitigation/Management Actions									

- Stormwater management measures that should have been implemented during the Construction Phase can also be used in a similar manner to collect/trap contaminated seepage and runoff from the proposed pits and stockpile areas.
- Establish sediment ponds to manage the general mine runoff and pit water.
- Clean water should be diverted around the pit and stockpile areas throughout the Operational Phase.
- Implement efficient soil management measures and facilitate re-vegetation using securing mats, pegs (and/or mesh), to reduce the extent of exposed soils between the pits and stockpiles and the associated tributaries. This is expected to limit runoff and sedimentation into the associated systems and contain potentially contaminated water to some extent.
- Conduct regular infrastructure and water quality monitoring and biological monitoring activities

Table 8-57: Impact ratings determined for general mining activities including operation of administrative and workshop buildings located away from watercourses

Activity: General mining activities including operation of administrative and workshop buildings located away from watercourses.									
Impact Description: Increased runoff and erosion from established infrastructure areas resulting in habitat and water quality deterioration. This includes the possibility of discharging untreated/contaminated water (i.e., untreated sewage, oil-contaminated water, etc.).									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Project Life (5)	Mining activities and operation of established infrastructure will continue throughout the life of the Project.	**Dimension**	Duration	**Rating**	Project Life (5)	As per pre-mitigation.
	Extent		Local (3)	Extending across the site and to nearby settlements.		Extent		Site (2)	The proposed mitigation measures will reduce the extent of the impact.
	Intensity		Moderate (3)	The intensity of the potential impacts are expected to be moderate due to indirect impacts to associated watercourses and downstream environments.		Intensity		Low (2)	Should the mitigation measures be implemented successfully, they are expected to reduce runoff and associated impacts within the associated watercourses.

Activity: General mining activities including operation of administrative and workshop buildings located away from watercourses.									
	Probability		Likely (5)	Impacts are likely to occur especially at river crossing points. Impacts associated with the operation of the proposed buildings are however less likely due to their location away from the local watercourses.		Probability		Unlikely (3)	If the mitigation measures are implemented successfully, especially at the river crossing points, then the probability of runoff-related impacts is expected to be reduced notably.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) -55					**Negligible (negative) -27**				
Mitigation/Management Actions									

- The stormwater management measures that should have been implemented during the construction phase should continue to be used in a similar manner to collect/trap contaminated seepage and runoff from selected infrastructure areas (e.g., downstream of buildings, storage areas and processing areas).
- Clean water should be diverted around any of the established infrastructures and into natural watercourses or drainage lines where practically possible.
- Surface and/or stormwater management measures should be continuously monitored for structural integrity and the removal of excessive debris or silt.
- Silt traps should be installed at discharge points.
- Dust suppression efforts can also be undertaken along access routes and especially near river crossings. However, water utilised during these efforts should not be allowed to flow excessively, limiting the formation of erosion gullies into nearby watercourses. Bank revegetation must be undertaken.
- Application of environmentally safe organic compounds should be considered for dust suppression where needed to supplement water spraying.
- Dust suppression efforts must incorporate use of NAF water, rather than contaminated PAF water sources.
- Add management/treatment of effluents from Admin buildings (include wastewater treatment plant) and workshops/wash bay (include oil-water separator machine).
- Conduct regular infrastructure and water quality monitoring and biological monitoring activities.
- Fuel and heavy hydrocarbon products storage on site should be secured by bunded facilities.
- Emergency spill and appropriate clean-up kits should be available in strategic areas at all times.
- All staff should be educated in environmental awareness, and all staff associated with haulage and/or hazardous material handlers should be trained in the correct use of the aforementioned clean-up kits.

Table 8-58: Impact ratings determined for Operation and maintenance of TSF, WRDs directly within the watercourses, including discharge of decant

Activity: Operation and maintenance of TSF, WRDs directly within the watercourses, including discharge of decant.									
Impact Description: Habitat deterioration through increased erosion and sedimentation, as well as water quality impacts from mine decant and infrastructure.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	Rating	Permanent: No Mitigation (7)	Several pieces of infrastructure will remain in-place beyond the LOM and throughout the closure phase (e.g. TSF, WRDs, etc.). These structures likely remain *in-situ* and as such, discharge of mine decant and associated changes to flow regime and/or water quality will remain beyond project life.	Dimension	Duration	Rating	Project Life (5)	Discharge of decant will need to continue until the end of the life of the mine. The impacts can be managed yet not completed mitigated.
	Extent		Regional (5)	Due to the longitudinal and dynamic nature of rivers, impacts are likely to extend beyond the point of entry to the associated watercourses especially when considering long-term impacts to the natural flow regime and water quality impacts of the system and environments downstream from the discharge areas.		Extent		Municipal (4)	When considering long-term impacts to the natural flow regime and water quality (seepage and discharge) associated with low-grade ore stockpiles and PAF WRDs, these impacts are expected to affect the whole municipal area and downstream environments beyond the immediate project footprint. The extent of the impact is likely to be reduced through mitigation, especially if appropriate water quality mitigation is implemented (constructed wetlands).
	Intensity		Significant impact (6)	The intensity of the potential impacts are expected to be significant due to the direct loss of tributaries. Depending on the quality of the discharge and sedimentation-related impacts throughout the life of the Project, impacts towards the downstream		Intensity		Serious (4)	The intensity (long term) of the impact is likely to reduce if the proposed mitigation measures are implemented correctly. May take several years to rehabilitate.

Activity: Operation and maintenance of TSF, WRDs directly within the watercourses, including discharge of decant.									
				environment may be significant. Significant management and rehabilitation measures are required to lower irreplaceable impacts.					
	Probability		Certain / Definite (7)	There are sound evidence based reasons to expect that the impact will definitely occur due to operation activities taking place directly within the tributaries, with decant and water quality issues expected.		Probability		Highly Probable (6)	Impacts are still expected to occur as operation activities will take place directly within the tributaries despite implementation of the proposed mitigation measures. However, the probability of some impacts (e.g., bank instability and erosion and water quality) will be reduced.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Major (negative) -126					**Moderate (negative) -78**				
Mitigation/Management Actions									

- Discharge water should be treated to suitable conditions for aquatic life prior to any discharge, which includes lowering turbidity levels from associated stormwater management requirements.
- Of particular concern will be to ensure the dissolved solids (i.e., electrical conductivity) and oxygen levels of the discharge and seepage does not impact the baseline conditions recorded within the local watercourses.
- To mitigate the generation of acidic water or Acid Rock Drainage (ARD) during the dewatering of pits and management of Potentially Acid Forming (PAF) and Non-Acid Forming (NAF) materials, the following actions can be taken:
  - Water Treatment and Monitoring: Establish water treatment systems (e.g., lime dosing, reverse osmosis, etc) to neutralize acidity in pit water before discharge into natural waterways. Regular monitoring of water quality is essential to ensure compliance with environmental standards.
  - Selective Material Handling: Segregate PAF materials from NAF materials during excavation and stockpiling. This minimizes the risk of PAF materials reacting with water and oxygen, which would generate acidic runoff.
  - Progressive Rehabilitation: Rehabilitate disturbed areas promptly by covering waste materials with soil and vegetation to prevent the exposure of PAF materials to oxygen and moisture, reducing the risk of ARD.
- Conduct regular infrastructure and water quality monitoring and biological monitoring activities.
- The discharge of decant must enter within a sediment pond to ensure lowering turbidity and sedimentation related impacts to receiving watercourses.
- Discharge events should ideally align with the natural flow regime of the associated watercourses and/or study area (i.e., excessive discharges should ideally not take place during the dry season of the study area).
- An ‘armoured’ area fitted with energy dissipators should be constructed to allow for the discharge to flow onto first, prior to entry into the sediment ponds and/or receiving watercourses. This will limit the immediate erosion effects of discharge and limit initial contact with banks and substrates prone to erosion. Ideally, this should avoid smooth concrete and should be constructed from aggregate to mimic natural rock cascades limiting erosion while allowing infiltration.
- The banks of the receiving watercourse should be regularly monitored to account for additional erosion events.
- Banks should be sloped to gentle gradients and vegetated (hydroseeded) to improve the stability of the associated watercourse. Gentle slopes ensure revegetation success and long-term retention. Ideally this should include the recommended constructed wetlands and associated routine monitoring and management activities.

8.2.2.7. Visual

The activities associated with the operational phase (open pit mining, utilisation of equipment, machinery and constructed infrastructure, material transportation, stockpiling of various mined materials) of the Project will lead to the alteration of the natural landscape which will impact the visual character and sense of place of the receiving environment. Open pit mining activities (incl. blasting) will lead to the generation of dust which has the potential to be a nuisance for nearby visual receptors. In addition, the proposed open pit mining activities will lead to transformation of the natural landscape, ultimately replacing the existing land use and land cover environments. Prominent features such a WRDs and the TSF may lead to high visual exposure and subsequently high visual impacts for the nearby visual receptors. Less prominent features such as

The activities associated with the operational phase will be long-term in nature (will occur throughout the Project's life cycle) therefore visual impacts will also be long-term in nature. In addition, a 24-hour operation is planned for this phase, therefore, the lighting of night-time activities will have a negative visual impact, resulting in a further negative visual impact.

In addition, lighting impacts associated with mainly the plant, workshop, admin buildings and support infrastructure will also have an impact on the nearby receptors. The visual impact will be similar to that of the viewshed analysis. However, a detailed illumination study is recommended to address lighting impacts in detail.

8.2.2.7.1. Impact Ratings

The noise impacts during the operational phase of the Project have been assessed and is provided in Table 8-60.

Table 8-59: Impact Assessment for the Operational Phase of the Project

Activity:

- Open pit mining (incl. blasting and release of dust);
- General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material;
- Operation of the processing plant; and
- Ore and mineral waste handling (low-grade ore stockpiles and WRDs).

Impact Description: Visual impact of the built infrastructure (plant and ancillary infrastructure as well as stockpiles, WRDs, TSF etc.) post-construction will alter the visual character of the receiving environment creating a contrast between the mine site and the natural environment.

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	Rating	Permanent (7)	Prominent features such as TSF and WRD at maximum height, will remain long after the life of the Project.	Dimension	Duration	Rating	Permanent (7)	Prominent features such as TSF and WRD at maximum height, will remain long after the life of the Project.
	Spatial scale		Limited (2)	Operational phase visual impacts will be limited to the site and immediate surroundings due to the vegetation screening effect of the receiving environment..		Spatial scale		Limited (2)	No change post-mitigation
	Intensity		Serious (4)	Receptors within 5km of the Project area will experience mainly high - to very high visual impacts. However the screening effect of vegetation and the partially degraded nature of the receiving environment may further reduce the visual impact at the nearest receptor.		Intensity		Moderate (3)	Proposed mitigation measures may further reduce the impact..
	Probability		Likely (5)	The transformation of the current land use to mining will definitely occur. Altering the natural landscape and sense of place. Thus, resulting in significant visual impact. However the screening effect of vegetation and topography may reduce the visual impact at the nearest receptor. In addition, the transformed of the receiving environment will also reduce this impact.		Probability		Likely (5)	No change post-mitigation.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative)– 65					**Minor (negative)– 60**				

Mitigation/Management Actions

- Implement a dust suppression programme.
- Use of neutral colours so that infrastructure blends in with the natural environment.
- Concurrent rehabilitation of prominent features such as TSF and WRD to minimise the visual exposure of the features.

8.2.2.8. Noise

The activities associated with the operational phase of the Project will result in noise emissions to the environment which has the potential to have a significant negative impact on the NSRs. These activities will be long-term in nature (will occur throughout the Project's life cycle) therefore noise impacts at the NSRs will also be long-term in nature. In addition, a 24-hour operation is planned for this phase therefore potential noise impacts will affect the nearby NSRs during both daytime and night-time. However, due to the mining method of open cast mining, noise impacts at the NSRs will be short-term in nature due to the reduction in noise emissions at the NSRs as mining progresses further down into the pit. In addition, the waste rock dumps will serve as man-made noise barriers which will also aid in noise emission reductions.

The screening effect of topography based on model simulations has aided in reducing the anticipated noise impacts as well as elevated baseline ambient noise levels which have masked the noise impacts associated with Project related noise emissions.

8.2.2.8.1. Impact Ratings

The noise impacts during the operational phase of the Project has been assessed and is provided in Table 8-60.

Table 8-60: Impact Assessment for the Operational Phase of the Project

<table>
<tr><td colspan="10">Activity:
• Open pit mining (incl. blasting).
• Ore and mineral waste handling (low-grade ore stockpiles and WRDs).
• Operation and management of water management infrastructure (dams, trenches, silt traps, etc.)
• General operational activities including use and maintenance of vehicles and machinery as well as storage and handling of waste and hazardous material.</td></tr>
<tr><td colspan="10">Impact Description: Noise will emanate from machinery/ equipment being operated during the operational phase.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Project Life (5)</td><td>Noise emissions will occur for the operational life span of the Project.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>Project Life (5)</td><td>Noise emissions will occur for the operational life span of the Project.</td></tr>
<tr><td>Spatial scale</td><td>Local (3)</td><td>Based on the noise dispersion model, impacts will extend across the site and to nearby settlements..</td><td>Spatial scale</td><td>Limited (2)</td><td>Project related noise emissions will be limited to the site and its immediate surroundings post-mitigation</td></tr>
<tr><td>Intensity</td><td>Minor (2)</td><td>The majority of the NSRs will experience little changes to the baseline environment. Only Three NSRs are expected to experience serious (high to very high) noise impacts</td><td>Intensity</td><td>Minor (2)</td><td>Minor noise impacts will continue to occur post-mitigation.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>Three NSRs are expected to experience noise levels that will result in a high to very high noise impact. Therefore, the probability of noise impacts occurring at the NSRs is unlikely</td><td>Probability</td><td>Rarer / Improbable (2)</td><td>The possibility of noise impacts materialising post-mitigation is rare.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Negligible (negative) – 30</td><td colspan="5">Negligible (negative) – 18</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">• Utilise WRDs and stockpiles as noise barriers.
• Machinery, equipment and vehicles should be switched off when not in use and not left idling unnecessarily.
• Where practicable, utilise low frequency / low sound reverse beepers on vehicles.
• Machinery, equipment and vehicles are to be serviced as per the OEM’s requirements to limit noise emissions.
• Install exhaust mufflers (where applicable) on vehicles engine exhausts.
• Where practical, reduce equipment fleet at night, at least until mining has moved further down into the pit.
• Re-locate NSRs located within the Project / Study area footprint.
• Noise monitoring and the development of a mechanism to record and respond to noise complaints.</td></tr>
</table>

8.2.2.9. Air Quality

The establishment of the open pit and removal of materials, transportation of waste and ore material and stockpiling, will result in fugitive emissions, such as TSP, $PM_{10,}$ and $PM_{2.5}$ and gases (i.e. blasting). Gaseous emissions will dissipate to negligible levels in a short period.

The management objectives are geared to curtail on-site emissions and off-site exposure levels below the WHO guideline limits that are protective of human health and wellbeing.

Activities during the operational phase will require similar mitigation measures to contain emissions. Therefore, related activities are grouped for rating as indicated in Table 8-61. However, impacts have been rated separately for handling hazardous materials and diesel (Table 8-62).

Table 8-61: Significance Ratings for Establishment of Open pits, Excavation of Materials, Hauling (including loading, tipping and stockpiling at the Ore and Waste)

Activity: Establishment of Open pits, Excavation of Materials, Hauling (including loading, tipping and stockpiling the Ore and Waste)									
Impact Description: Dust generation leads to a poor ambient air quality									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Project life (5)	Pollutants will be generated for the LoM of the project life.	**Dimension**	Duration	**Rating**	Project life (5)	No change, pollutants will continue to be generated for the LoM
	Extent		Limited (2)	Pollutants will be limited– with emissions impacting the site and its immediate surroundings.		Extent		Limited (2)	Pollutants will be limited to the mine permit boundary after mitigation.
	Intensity		Serious (4)	Serious medium-term environmental effects on ambient air quality		Intensity		Minor (2)	Reduction in spatial extent indicates minor impacts on ambient air quality for nearby receptors.
	Probability		Likely (5)	Impacts may likely occur, although, the probability may have been overestimated given the modelling represents a worst-case scenario.		Probability		Unlikely (3)	Unlikely that impact will occur after mitigation.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) – 55					**Negligible (negative) – 27**				
Mitigation/Management Actions									

- Ensure dust suppressants are used on exposed surface areas, access and haul roads, where practicable;
- Set maximum speed limits on-site and have these limits enforced;
- Limit high dust-generating activities (i.e. blasting) to periods of low wind conditions where possible (wind speed less than 5.4 m/s);
- Minimise the drop heights when loading onto trucks and at tipping points;
- Minimise the footprint of disturbance as far as practicable;
- Application of water sprays at loading and tipping points to suppress emissions; and
- Undertake regular air quality monitoring to enable identification of impacts, and implementation of corrective actions if impacts are identified.

Table 8-62: Significance Ratings for Storage and Handling of Hazardous products

Activity: Storage and Handling of Hazardous Products Onsite									
Impact Description: Spill of Chemicals and evaporation of volatiles from fuel storage facility leading to poor air quality									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Project life (5)	Emissions may occur for the LoM.	**Dimension**	Duration	**Rating**	Project life (5)	Emissions may occur for the LoM
	Extent		Limited (2)	Impacts will be limited to the site and immediate surroundings		Extent		Very Limited (1)	Emissions are limited to the site and its immediate surroundings after mitigation.
	Intensity		Minor (2)	Minor impacts on air quality anticipated		Intensity		Minimal (1)	Minimal impacts are anticipated after mitigation measures are applied
	Probability		Probable (4)	Impacts would probably occur		Probability		Unlikely (3)	Unlikely that impact will occur after mitigation.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) – 36					**Negligible (negative) – 21**				
Mitigation/Management Actions									

- Strict adherence to products and waste management plan;
- Handle, store and dispose of hazardous substances in accordance with local or international regulations;
- Storage of hazardous materials in leak-proof containers and ensure containers are properly labelled;
- Deal with emergencies promptly i.e. leaks and spills;
- Provision of secondary containment for fuel storage; and
- Train, equip and designate a responsible officer to deal with accidental leaks and fire immediately.

8.2.2.10. Heritage

The following impacts can be anticipated for the Operational Phase of the proposed Project:

There will be no impact on surface archaeological and heritage resources or palaeontological resources during the operational phase of the Project as the operations remain above surface. Exposure of subsurface heritage resources and / or archaeological resources by excavations associated with infrastructure maintenance and care could occur but will be managed through the implementation of the CFP. The main impacts are socially related with specific reference to the disruption of the Social Harmony and displacement from Ancestral Lands.

Table 8-63: Impact Ratings Associated with Intangible Heritage Encountered During the Operational Phase of the Project

Activity:

- Open pit mining (incl. blasting).
- Ore and mineral waste handling (low-grade ore stockpiles and WRDs).
- Ore and mineral waste handling (low-grade ore stockpiles and WRDs).
- Ore and mineral waste handling (low-grade ore stockpiles and WRDs).
- Potential for discharge of treated effluent

Impact Description:

Displacement and disruption of the way of life of communities in the Project area.

Pre-Mitigation/Management					With Mitigation/Management				
Dimension	Duration	**Rating**	7	Permanent	**Dimension**	Duration	**Rating**		
	Extent		2	Limited		Extent			
	Intensity		6	Irreparable damage to highly valued items of cultural significance or breakdown of social order.		Intensity			
	Probability		6	Almost certain / Highly probable		Probability			
	Type		Neg	Negative		Type			
Serious (negative) – 90									

Mitigation/Management Actions
Mitigation measures outlined in the Social Impact Assessment should be adhered to.

8.2.2.11. Socio-economic

The operational phase involves active mining activities, including open pit mining with blasting operations. This phase also encompasses the handling of ore and mineral waste, including low-grade ore stockpiles and WRDs. Additionally, general operational activities will include the use and maintenance of vehicles and machinery, along with the storage and handling of waste and hazardous materials. There is also a potential for the discharge of treated effluent during this phase.

The socio-economic impacts anticipated to arise during the operational phase which are assessed within this section are listed in Table 8-64 and further discussed in subsections.

Table 8-64: Summary of Impacts Expected During the Operation Phase

Theme	Change Drivers	Principle Impacts
Employment and economic development	Job opportunities	Increase in household incomes and Improved living standards (+) • Increased social stability (+) • Enhanced Infrastructure and services (+) • Increase in household incomes (+) • Improved standard of living (+)
		Training and skills development (+/-) • Improved work force skills (+) • Increased income-earning potential (+)
		Social differentiation **(-)** • Jealousy and division among communities/households (-) • Dissatisfaction stemming from unmet expectations (-) • Increased gender-based violence, domestic violence and sexual violence against women (-)
		In-flux of jobseekers (-) • Ignored traditions by mine employees (-) • Community unrest (-) • Shortage of accommodation/housing (-) • Limited access to services and facilities (-) • Altering a sense of place and culture (-) • Increase health-related and safety concerns, including social pathologies including (sex work and drug abuse) (-)

Theme	Change Drivers	Principle Impacts
		• Increased risk of unwanted pregnancies and increased school drop-outs rates • Potential use of excessive forces against individuals leading to human rights violation (-) • Increased gender-based violence, domestic violence and sexual violence against women (-) • Unmet expectations over employment opportunities (-)
	Investment and local procurement	Local livelihood and economic growth (+) • Increased revenues of the local enterprises and associated small business activities (+) • Improved market linkages and trade (+) • Increased local government revenues from taxes and royalties (+)
Labour and working conditions	Worker's health, safety and welfare	Occupation, Health and Safety (OHS) and nuisance disturbance (-) • Increased accidents and health concerns (-) • Emulsified exposure to hazards and unsafe conditions. (-) • Increased pressure on local health services (-)
Community and mine interactions	Community 's health, safety and social welfare.	Community Health and Safety (CHS), nuisance disturbance and social welfare (-) • Increased vulnerability (-) • Increased health concerns (HIV/TB/communicable diseases, STDs etc.), (traffic), including sex work and drug abuse (-) • Increased community unrest (-) • Social disruption and cultural clash (-) • Enhanced social vices (-) • Economic inequality, social division and emergence of classes. (-) • Gender-based violence (-)
Socio-economic development	Provision, demand and use of existing infrastructure	Strain on local infrastructures (-) • Increased pressure on existing infrastructure leading to potential congestion or overuse (-) • Potential delays in service delivery due to increased demand (-)

Theme	Change Drivers	Principle Impacts
		• Shortage of water and electricity (-) <u>Improved infrastructure and services</u> • Improved transportation networks (+) • Improved access to education and health facilities (+) • Community development programmes (+)

8.2.2.11.1. Impact Description: Increase in Household Incomes and Improved Living Standards

During the operational phase, it is anticipated that the project will generate around 452 employment opportunities, encompassing both short-term and long-term labor requirements across skilled, semi-skilled, and unskilled positions in the mining, contracting, social development, support, and safety departments. These employment opportunities will be sourced from local, district, and national levels, potentially leading to an improvement in the standard of living among local households.

Currently, socio-economic data reveals that most households are self-employed, engaging in activities such as selling livestock, agricultural products, and natural resources. The provision of employment by the mine is expected to shift households from predominantly agricultural-based or subsistence livelihoods to wage-based livelihoods. This shift is likely to enhance household incomes, foster social stability, and increase access to savings and credit. As a result, employment opportunities from the project are anticipated to strengthen households, reduce vulnerabilities, and enhance local capacities.

Moreover, the commencement of mining operations may stimulate improvements in infrastructure and services within surrounding communities. During the operational phase, the mine will engage with village government authorities using a participatory approach to identify and address key priority areas for intervention, such as water, roads, education, and health, which could be integrated into Corporate Social Responsibility (CSR) projects. The proposed mining project is also expected to lead to increased local procurement of goods and services, benefiting local businesses. However, the influx of additional population, including consultants, contractors, and company employees, will escalate the demand for goods and services, thereby creating extensive trade opportunities for local communities, including shops, restaurants, kiosks, guest houses, recreational facilities, and mechanic shops

Table 8-65: Increase in Household Incomes and Improved Living Standards

Increase in household incomes and improved living standards				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Equal to the duration of the operation activities	Consequence: Moderately beneficial (13)	Significance: Minor - positive (65)
Extent	National (6)	The unskilled/semi-skilled workforce will be sourced from the surrounding villages, whilst any skilled employees/contractors required may be sourced from other regions. Also, increased local procurement of goods and services will benefit local businesses		
Intensity x type of impact	Low - positive (2)	Serious: The job opportunities will be available throughout the operational phase. Other induced impacts to the local economy will also be experienced.		
Likelihood	Likely (5)	The significance of the benefits will depend on the number of local job opportunities provided (this is not yet known).		
MITIGATION				
• Develop the Local Employment Plan and prioritise employment and training of people living within the primary study area over outsiders especially for unskilled and semi-skilled positions; • Develop and continuously update (throughout the LoM) an Employment Policy to increase local employment and transfer operational positions from migrant workers to people from within the study area; • Ensure local communities understand the project's employment requirements in terms of skills and type of employment; • Develop and maintain a candidate database for the local communities in collaboration with existing governance structures; • Maintain an employee database, including origin of employee, position, working hours, training received, wages/ benefits; • Provide appropriate training opportunities to employees and contractors; • Work Certificates or Certificates of Completion must be provided to local employees for the work and training undertaken; and • Implement the Stakeholder Engagement Plan and Community Grievance Management and Resolution Procedure.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Highly beneficial (16)	Significance: Major - positive (112)
Extent	National (6)	As for pre-mitigation		
Intensity x type of impact	High - positive (5)	The job opportunities will be available throughout the operational phase. Other induced impacts to the local economy will also be experienced.		
Probability	Certain (7)	With the implementation of the prescribed measures the benefits will be realised and optimized.		

8.2.2.11.2. Impact Description: Training and Skills Development

Those who secure employment opportunities with the Project during operations will benefit from extensive training and skills development, in accordance with the provisions of the Mining Act, 2016, particularly Section 46, which emphasizes the importance of capacity building within the sector. The skills and work experience gained through the Project will not only enhance the employability of workers in the mining sector but also broaden their potential for higher-income employment opportunities in related work programs across the province. This training will equip them with valuable competencies that are transferable to other industries, thereby contributing to long-term socio-economic benefits for the local community.

Table 8-66: Training and Skills Development

Training and skills development				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Skills training will continue as long as the mine is operational.	Consequence: Moderately beneficial (10)	Significance: Minor - positive (60)
Extent	Local (3)	Skills training programmes also offered to local communities in addition to the workforce		
Intensity x type of impact	Low - positive (2)	Skills training programmes largely aimed at the current workforce with little benefit to the local community		
Likelihood	Highly probable (6)	It is highly probable that the mine will invest in training and diversifying the skills of the workforce.		
MITIGATION				
• Prioritise training and capacity development for the least qualified workforce members. The training initiatives should consider the levels of education of the targeted workforce and the areas of interest; • Conduct a Workforce Skills Audit to better understand the current skills of the individuals and experience to identify gaps and propose programs to fill those gaps; • Appoint a Life-Coach/ Career Development Coach or mentor to assist and guide the workforce in their selection of education programs of their own interest; • Introduce an in-house Mentorship Program. The program will target the workforce who have existing qualifications that they are not using as part of their current job; • Develop the bursaries that will include non-mining related bursaries; • Ensure provision of employment to at least 80% of the people who receive bursaries and or training through the mine; and • Develop a Workforce Grievance Procedure and encourage the workforce to use the Workforce Grievance Procedure should they be dissatisfied with the implementation of the program.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately beneficial (11)	Significance: Moderate - positive (77)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderate - positive (3)	Mitigation measures could aid in expanding the skills training programmes to more of the local community, having further reaching effects.		
Probability	Certain (7)	Following the implementation of the proposed enhancement measures, it is certain that the mine will conduct training and skill development programs tailored to the needs of the workforce and the local community.		

8.2.2.11.3. Impact Description: Social Differentiation

While the operational phase of a mine brings numerous benefits, such as employment opportunities, training and skills development, and compensation payments to the surrounding communities, these benefits are often unevenly distributed. This uneven distribution can foster jealousy and resentment among community members or households who perceive themselves as being left out or less favoured. Such divisions may fragment community cohesion and lead to conflicts as different groups vie for the perceived benefits.

Additionally, dissatisfaction can arise from unmet expectations. Mining projects often come with high expectations for economic prosperity and job creation. When these expectations are not met, whether due to fewer jobs than anticipated, lower wages, or more precarious employment conditions, significant dissatisfaction can arise. This dissatisfaction can be exacerbated if the reality of mining impacts, such as environmental degradation or social disruption, proves harsher than expected. The gap between expectations and reality can erode trust in the mining project and in local leadership, leading to discontent and unrest.

Moreover, mining operations may trigger instances of gender-based violence, domestic violence, and sexual violence. The influx of predominantly male workers into the project-affected communities could disrupt social norms and contribute to elevated levels of violence, particularly against women. This issue may be exacerbated by the temporary nature of the workforce, which might lack strong community ties or long-term investment in the community well-being. Furthermore, the sudden availability of disposable income among project workers can lead to increased alcohol and substance use, which is frequently associated with higher rates of domestic and sexual violence.

Table 8-67: Social Differentiation

Social differentiation				
Predicted for project phase:	**Pre-construction**	**Construction**	**Operation**	**Decommissioning**
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	The impact will begin at the commencement of the project, becoming most pronounced during the operational phase, and will gradually diminish throughout the decommissioning phase, expected to cease following mine closure	Consequence: Highly detrimental (-15)	Significance: Moderate - negative (-90)
Extent	Sub-regional (4)	The differentiation may extend beyond the local community to a wider coverage prior to mitigation.		
Intensity x type of impact	Very high - negative (-6)	If not effectively mitigated, social differentiation can have significant impacts beyond the local community.		
Likelihood	Highly probable (6)	It is highly probable that the presence of the project will trigger social differentiation in the area.		
MITIGATION				
• Implementing a community-wide sensitization program that addresses the potential for jealousy, grievances and conflicts arising in the community • Establish ongoing stakeholder engagements to promote peaceful co-existence and ensure access to a grievance redress mechanism. • Set up a community-based conflict resolution and mediation committee with respected members from various backgrounds to address disputes • Implement strict policies and awareness programs to prevent gender-based violence, domestic violence, and sexual violence. • Partner with local NGOs to provide support services, including counselling and legal assistance for victims of violence. • Monitor and control alcohol and substance use among workers to mitigate risks of violence. • Implement measures to minimize environmental degradation, such as pollution control and land rehabilitation.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately detrimental (-11)	Significance: Minor - negative (-55)
Extent	Local (3)	Implementation of the proposed mitigation measures will minimise the extent to which social differentiation can be extended.		
Intensity x type of impact	Moderate - negative (-3)	Implementation of the proposed mitigation measures will minimise the magnitude of the impacts to the community.		
Probability	Likely (5)	Following the implementation of the proposed mitigation measures, it is likely that these impacts will be minimised.		

8.2.2.11.4. Impact Description: In-flux of Jobseekers

The baseline study anticipates the in-flux of jobseekers as the project execution will create new economic opportunities, both directly through employment and indirectly through the procurement of local goods and services. This impact is expected to persist throughout the pre-construction, construction, and operational phases of the project and is likely to result in adverse impacts to the direct PACs such as increased strain on available social services and infrastructure, conflict between long-term residents and incoming migrants, and a heightened risk of communicable diseases.

Moreover, the influx of new residents could trigger rapid changes in the physical environment, potentially disrupting established cultural and social norms. This shift may lead to a loss of community identity and cohesion, as natives may feel disconnected from the evolving cultural landscape. The influx may also cause land disputes and insecurity, particularly if these new migrants establish residences, leading to conflicts over land ownership and usage rights. Additionally, the diverse backgrounds of new arrivals might contribute to community unrest if expectations regarding employment opportunities and other benefits are not met.

Table 8-68: Influx of Jobseekers

In-flux of jobseekers				
Predicted for project phase:	**Pre-construction**	**Construction**	**Operation**	**Decommissioning**
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Impact will likely continue throughout all project phases.	Consequence: Highly detrimental (-14)	Significance: Moderate - negative (-84)
Extent	Local (3)	It is likely that people seeking economic opportunities will come to the local area.		
Intensity x type of impact	Very high - negative (-6)	The presence of the project in the area will result in the in-flux which will have significant social impacts affecting the local community. Without appropriate management measures, this could lead to a breakdown of social orders.		
Likelihood	Highly probable (6)	Based on the assessment of baseline conditions, it is likely that people will move into the Project AoI for financial gain.		
MITIGATION				
• Develop an Influx Management Plan, which considers appropriate objectives and interventions for influx management, incl. public consultation and monitoring methods; • Security Management Plan (SMP) to effectively monitor, mitigate and manage security risks; • Develop and implement a community-wide sensitization program to address potential grievances and conflicts arising from the influx of new residents; • Conduct ongoing stakeholder engagements with local communities to foster peaceful coexistence and provide a clear grievance redress mechanism; • Enhance local infrastructure and social services to accommodate the increased population and mitigate strain on existing resources; • Increase capacity for healthcare services, particularly to address potential rises in communicable diseases; • Strengthen security measures to address potential issues of insecurity arising from the establishment of new residences; and • Develop and promote health and safety programs focused on preventing the spread of communicable diseases, including regular health screenings and awareness campaigns.				
POST-MITIGATION				
Duration	Project Life (5)	As for pre-mitigation	Consequence: Moderately detrimental (-12)	Significance: Minor - negative (-60)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderately high - negative (-4)	With the implementation of effective Influx management Plan the severity of the impact may be reduced.		
Probability	Likely (5)	With the implementation of appropriate mitigation measures the likelihood of unmanageable population influx is reduced.		

8.2.2.11.5. *Impact Description: Occupation, Health and Safety (OHS) and Nuisance Disturbance*

In all mining projects, there is a risk that workers (including directly employed staff, main contractors, subcontractors, and employees of suppliers) may be exposed to unsafe and/or inequitable working conditions. This risk is heightened in several scenarios:

- The project may introduce many local employees to the mining industry for the first time. These individuals may be unfamiliar with the specific health and safety protocols and standards required in mining settings;
- Workers with limited experience in mining operations may not fully understand or adhere to necessary safety practices, increasing the likelihood of accidents or health issues;
- Insufficient training on safety procedures and emergency responses can further exacerbate the risk of unsafe working conditions;
- Multiple contractors, subcontractors and suppliers are involved;

It is likely that the above conditions will apply to this project. However, SGKL demonstrates a commitment to national occupational health and safety legislation and relevant international standards with corporate and site standards. However during operation phase, workers will face several specific risks, including:

- Physical hazards which include accidents related to heavy machinery, vehicular traffic, electrocution, equipment, and operation materials. Falls from heights, slips, trips, and falls on the operation site can also pose risks;
- Operation sites can be noisy, dust exposure and vibrations from machinery/blasting activities can also affect workers' health;
- chemical hazards including exposure to harmful chemicals used in the production areas and other operation areas can affect workers' health if not properly managed;
- biological hazards including pathogens especially in production sites or poorly ventilated areas; and
- Ergonomic and psychosocial hazards including poorly designed workstations or repetitive tasks can lead to musculoskeletal disorders among workers. Stress, long working hours, inadequate breaks, and a demanding work environment can have a significant impact on workers' mental health and well-being.

In addition to these typical industrial risks, the high levels of crime in the project area also pose a direct threat to worker safety. Criminal activities, including assaults, theft, burglary, and gold ore theft, are common and could escalate with the commencement of the project. The increased presence of workers, equipment, and valuable materials could make project personnel targets for criminal acts. Workers could be at risk of assault, robbery, or theft of personal belongings and equipment, particularly during travel to and from the worksite or when operating in isolated or unmonitored areas

Table 8-69: Occupation, Health and Safety (OHS) and Nuisance Disturbance

Occupation, Health and Safety (OHS) and nuisance disturbance				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Beyond project life (6)	It will continue for the duration of the Project and likely continue post mine closure.	Consequence: Highly detrimental (-15)	Significance: Moderate - negative (-90)
Extent	Project footprint and immediate surrounds (2)	Will mostly affect the workers within the site-specific area.		
Intensity x type of impact	Extremely high - negative (-7)	Inadequate OH&S measures could lead to injury or death of workers, whilst poor working conditions could impact on worker physical and emotional well-being		
Likelihood	Highly probable (6)	Several factors (including prolonged exposure to hazards) will exacerbate the risk of this impact.		
MITIGATION				
• Implement the Occupational Health and Safety (OH&S) Policy and related OHS procedures; • Immediately eliminate or control all serious hazards (hazards that will cause or are likely to cause death or serious physical injuries) through a hierarchy of controls; • Clearly define and communicate to employees, contractors, visitors, and suppliers (at each level) their responsibilities with respect to OH&S; • Maintain plant, equipment, and all infrastructure in a safe condition with documented safe work procedures, practices, and record management systems; • Ensure the participation and consultation of workers, and their representatives (when applicable) in the decision-making process for OH&S matters; • Routinely monitor and review the OH&S management systems and set performance objectives at all levels and functions to ensure continuous improvement with our operations; and • Communicate the Health and Safety Policy to employees, partners, contractors, subcontractors, local communities, and other stakeholders affected by their operations, and making it available to the public. • Proper fencing, lighting, and security personnel should be employed at project sites to deter criminal activity and protect both workers and equipment. • Employees should be briefed on local security risks, including crime hotspots, and provided with safe transportation options, particularly for late-night shifts. • The project team should collaborate with local police stations to ensure heightened security patrols around the project area, particularly during periods of heightened criminal activity. • An internal security monitoring system should be put in place to promptly address any incidents or threats to workers' safety. • Develop and implement a Security Management Plan (SMP) specifically designed to safeguard workers and project assets from local crime risks.				
POST-MITIGATION				
Duration	Long term (4)	As for pre-mitigation	Consequence: Moderately detrimental (-10)	Significance: Minor - negative (-50)
Extent	Project footprint and immediate surrounds (2)	As for pre-mitigation		
Intensity x type of impact	Moderately high - negative (-4)	Impacts will still occur, albeit not to the degree it was initially expected		
Probability	Likely (5)	Appropriate mitigation will reduce the risk of this impact		

8.2.2.11.6. Impact Description: Community Health and Safety (CHS), Nuisance Disturbance and Social Welfare

Owing to general mine operational activities, it is likely that communities surrounding the project area will be subject to nuisance impacts, reducing the overall amenity of the local area. These nuisances primarily stem from noise, dust, increased traffic, and vibrations from blasting activities. Heavy machinery used in operational activities generates substantial noise, disrupting daily lives and potentially affecting the health of nearby residents. Dust raised by earth-moving activities and vehicle movements can spread to adjacent areas, reducing air quality and depositing on homes and crops, which can lead to respiratory issues and other health problems for the community.

Moreover, vibrations caused by blasting and heavy machinery operations can result in structural damage to nearby houses, potentially causing cracks or fractures in walls and foundations. This not only poses safety risks for residents but also leads to financial burdens due to repair costs and decreased property values. Additionally, the influx of operational vehicles and the transportation of materials significantly increases traffic on local roads. This not only contributes to noise and dust but also leads to traffic congestion and potential safety hazards for local residents. Together, these impacts can degrade the quality of life in nearby communities, causing frustration and potentially leading to conflicts between the mine and local residents.

In addition to these nuisances, the project area is already experiencing significant levels of criminal activity, including assaults, theft, burglary, and gold ore theft. Assaults are often driven by land disputes, especially during traditional mourning periods (disco matanga) and celebrations at the end of the year. With the commencement of the project, there is a risk that crime levels could increase, exacerbated by an influx of new residents, increased traffic, and greater economic activity. The local community, particularly vulnerable groups such as women and children, could face heightened exposure to these risks, underscoring the need for proactive security measures to protect the community.

Table 8-70: Community Health and Safety (CHS), nuisance disturbance and social welfare

Community Health and Safety (CHS), nuisance disturbance and social welfare				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Beyond project life (6)	It will continue for the duration of the Project and likely continue post mine closure.	Consequence: Highly detrimental (-16)	Significance: Moderate - negative (-96)
Extent	Local (3)	Will mostly affect the population within the direct Project Affected Communities (PACs) and local road users.		
Intensity x type of impact	Extremely high - negative (-7)	Could place the lives of community members at risk, especially those using the initial access road, as well as exposure to dust and noise.		
Likelihood	Highly probable (6)	Several factors (including prolonged exposure to hazards) will exacerbate the risk of this impact.		
MITIGATION				
• In partnership with government authorities the Project to support improvements to existing health services to handle the increase in population numbers and changes to the existing health profile of the area. This may include facilities, quality of medical personnel, diagnostic capacity, and treatment, etc; • Implement mitigation measures outlined in the Noise, Blasting and Vibrations Specialist Studies and follow required measures for blasting such as informing the community of the blasting schedule, follow up with community of any impacts of the blasting thereafter and implement the available community Grievance Management and Resolution Procedure; • Implement mitigation measures proposed in the Air Quality Impact Assessment Study; • Road safety interventions may need to range beyond their fleets of company vehicle and their workers' commutes and should consider the driving, walking, and riding practices of community members in the locality; • Develop a Traffic Management Plan covering vehicle safety, driver, and passenger behaviour, use of drugs and alcohol, hours of operation, rest periods and accident reporting and investigations; • Develop and implement a Community Health, Safety, and Security Management Plan that includes measures to prevent the spread of communicable diseases between workers and the local community. The plan should also incorporate strategies to protect the community from potential crime risks, ensuring both health and safety are prioritized throughout the project's lifecycle. • Implement different procedures documented in the Health and Safety Handbook; • Propose road bypasses where there is a significant risk to public safety from road accidents; • Develop and implement preparedness and response capabilities to deal with any road traffic or other accidents that may occur including multiple casualty events; and • In partnership with local authorities and the police, educate communities on road traffic laws and road safety.				
POST-MITIGATION				
Duration	Long term (4)	As for pre-mitigation	Consequence: Moderately detrimental (-11)	Significance: Minor - negative (-55)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderately high - negative (-4)	Impacts will still occur, albeit not to the degree it was initially expected		
Probability	Likely (5)	Appropriate mitigation will reduce the risk of this impact		

8.2.2.11.7. Impact Description : Strain on Local Infrastructures

As the mine becomes operational, the influx of workers, contractors, and support personnel is likely to place substantial pressure on the existing infrastructure, which is already limited according to baseline data. In local areas where the primary means of transport are bodaboda (motorbike taxis) and walking, with minimal use of public transport, the increased traffic from mining operations could exacerbate road congestion and cause rapid wear and tear on road networks. This surge in activity may also heighten the demand for transport services, leading to slowdowns and delays.

Public facilities such as healthcare centers and educational institutions may struggle to accommodate the increased population, potentially leading to overcrowding and diminished quality of services. The growing demand for essential services, including waste management and emergency response, can overwhelm local service providers, resulting in delays and inefficiencies.

For example, waste collection services may become inadequate, contributing to unsanitary conditions that affect community health. Additionally, the pressure on utility networks, such as water and electricity, may lead to shortages, further straining local resources and requiring costly maintenance and upgrades. Generally, the operational phase of the project is expected to create significant challenges for local infrastructure, requiring careful planning and support to mitigate potential adverse impacts

Table 8-71: Strain on Local Infrastructures

Stain on local infrastructures				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Project Life (5)	Will continue for the duration of the Project	Consequence: Highly detrimental (-14)	Significance: Moderate - negative (-84)
Extent	Local (3)	Will mostly affect the population within site-specific study area and surrounding communities		
Intensity x type of impact	Very high - negative (-6)	Strain on local infrastructure could potentially lead to overcrowding, a decline in the quality of services, and shortages in the area if no proper mitigation measures are implemented		
Likelihood	Highly probable (6)	Lack of reliable infrastructures is already a problem in the local study area		
MITIGATION				
• Partner with local authorities to improve and expand road networks, particularly those most affected by increased traffic; • Provide financial or logistical support to local healthcare facilities and schools to accommodate increased demand. • Work with local utility providers to upgrade water, electricity, and waste management infrastructure to meet the rising demand; • Develop a comprehensive waste management plan for the mine's operations to prevent overwhelming local waste collection services; • Through Stakeholder Engagement Plan, continuous engagements should be done with local communities and authorities to monitor the impact of the project on infrastructure and services; and • Launch CSR programs that directly contribute to infrastructure development, such as building roads, clinics, or schools, to offset the pressures placed on local services and facilities by the project.				
POST-MITIGATION				
Duration	Short term (2)	As for pre-mitigation	Consequence: Slightly detrimental (-8)	Significance: Negligible - negative (-32)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderate - negative (-3)	The application of mitigation measures should reduce the severity of the impact but not avoid the impact.		
Probability	Probable (4)	Appropriate mitigation will reduce the risk of this impact		

8.2.3. Decommissioning, Rehabilitation and Closure Phases

The main activities to be carried out during the Decommissioning, Rehabilitation and Post-Closure Phase which may result in environmental and socio-economic impacts are summarised in Table 8-72.

Table 8-72: Decommissioning, Rehabilitation and Closure Phases

Phase	Activity
Decommissioning, Rehabilitation and Closure	Rehabilitation of open pits
	Rehabilitation of WRD
	Rehabilitation of TSF and adjoining infrastructure
	Potential demolition and removal of infrastructure.
	Post-closure monitoring and rehabilitation.

The subsections below provide the identified potential impacts which could result from these activities which have been identified for the various applicable environmental and social aspects.

8.2.3.1. *Soils and Land Use*

During the decommissioning and rehabilitation activities, previously undisturbed areas could potentially become compacted, leading to increased erosion, loss of effective rooting depth, decreased water and root penetration, water holding capacity and soil fertility. The movement of heavy machinery on the soil surface could lead to compaction, which reduces the vegetation's ability to grow and as a result erosion and loss of soil organic material. Soils might be degraded due to erosion from unprotected surfaces.

Rehabilitation should include ripping, spreading of overburden and topsoil and establishment of vegetation. In the first phase of the rehabilitation plan, demolishing the infrastructure, TSF, WRD and stormwater management infrastructure could potentially lead to soil contamination, resulting in decreased soil fertility, increased AIPs, decreased biological activity and land capabilities. However, when rehabilitation of these areas commences and is implemented correctly, the land capability status should increase, having a positive impact. Post-mining land capabilities will be calculated as a recommendation to rehabilitate disturbed areas back to.

Removal/demolishing of linear infrastructure may lead to erosion, compaction and hydrocarbon spills. Depending on the outcome of the groundwater numerical model and in the event of decanting, it can lead to contamination of soils. During the backfilling of the open pits, negative impacts are expected through means of heavy machinery and generally increased activities adjacent to the pit, however, it's worth considering that the land capability will change from "no land capability" to at least wilderness (open pit to backfilled pit). This will ultimately have a positive impact. If mitigation is met (especially concerning meeting post-mining land capability targets (Table 8-73 and Table 8-74) a greater positive significance rating is to be expected.

8.2.3.1.1. Impact Ratings

The pre-mitigation impact ratings during the decommissioning, closure and rehabilitation phases range from “Negligible-Positive” to “Minor-Negative” for decommissioning and rehabilitation/monitoring respectively. These scores are expected to decrease with the implementation of recommended mitigation (and increase in positive significance in the case of decommissioning) and management measures with all post-mitigation significance ratings expected to be positive. Rehabilitation and monitoring, if carried out successfully (adhering to mitigation and management measures) will ensure positive impacts towards soil resources whereas decommissioning and backfilling of pits inevitably resulting in a positive impact due to the land capability change from “none”/developed to at least wilderness

Table 8-73: Decommissioning and Rehabilitation Impact for Backfilling Pits and Potential Demolition and Removal of Infrastructure.

Activity: Potential demolition and removal of infrastructure as well as rehabilitation of open pits (backfill of Ramula Open Pit, cover with overburden, landscape and re-vegetation).									
Impact Description: During the decommissioning activities, the soils could potentially become compacted, leading to increased erosion, loss of effective rooting depth and decreased water and root penetration, water holding capacity and soil fertility. It is however worth noting that these impacts are negligible compared to the positive impacts associated with the removal of infrastructure and backfilling of pits. Prior to decommissioning, the footprint areas will be characterised by no land capability. These areas will at least be characterised by “wilderness” land capability post-decommissioning. Without mitigation/management measures, the negative impacts are sure to outweigh the positive impacts. Therefore, the pre-mitigation significance rating has been scored negative. By implementing the prescribed mitigation measures, a positive significance rating is expected.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Project Life (5)	The impact will cease after the operational lifespan of the Project.	**Dimension**	**Duration**	**Rating**	Project Life (5)	The impact will cease after the operational lifespan of the Project.
	Extent		Limited (2)	Limited to the site and its immediate surroundings.		**Extent**		Limited (2)	Limited to the site and its immediate surroundings.
	Intensity		Minor (2)	Minor effects on the biological or physical environment. Environmental damage can be rehabilitated internally with/ without the help of external consultants. Minor medium-term social impacts to the local population. Mostly repairable. Functions and processes are not affected.		**Intensity**		Average (3)	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.
	Probability		Unlikely (3)	Unlikely: This has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur. < 25% probability.		**Probability**		Probable (4)	Probable: Has occurred here or elsewhere and could therefore occur. < 50% probability.
	Type		Neg	Negative Impact (-)		**Type**		Neg	Positive Impact (-)
Negligible (negative) -27					**Minor (positive) -36**				
Mitigation/Management Actions									

- Rehabilitation and decommissioning/demolition should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, rapid spread of contaminants and sedimentation;
- Rehabilitation must be completed as soon as any impacts are observed;
- The backfilled pits must be reshaped and sloped to avoid preferential flow paths;
- Continue with concurrent rehabilitation, and implement land rehabilitation measures;
- Address compacted areas by deep ripping to loosen the soil, and revegetate the area;
- Ensure proper stormwater management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; and
- The backfilled, reprofiled landscape should be topsoiled and revegetated to allow free drainage close to the pre-mining conditions.

Table 8-74: Decommissioning and Rehabilitation Impact on Post-closure Monitoring and Rehabilitation.

Activity: Post-Closure Monitoring and Rehabilitation.

Impact Description: Rehabilitation activities could potentially lead to soil contamination, resulting in decreased soil fertility, increased AIPs, decreased biological activity and land capabilities. Heavy machinery used could also lead to increased compaction, resulting in an increase in overland flow velocities and ultimately erosion of adjacent areas. Monitoring will be undertaken throughout this phase which is likely to cause minor impacts in respect to general movement, resulting in compaction. If rehabilitation is carried out successfully and mitigation measures are adhered to, a positive post-mitigation significance rating can be expected. If mitigation measures are not adhered to, the negative impacts will outweigh the positive impacts.

Pre-Mitigation/Management					With Mitigation/Management				
Dimension	**Duration**	Rating	Project Life (5)	The impact will cease after the operational lifespan of the Project.	Dimension	**Duration**	Rating	Beyond Project Life (4)	The improvements will remain for some time after the life of the Project.
	Extent		Limited (2)	Limited to the site and its immediate surroundings.		**Extent**		Very Limited (1)	Limited to specific isolated parts of the site.
	Intensity		Very Serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.		**Intensity**		Average (3)	Average, ongoing positive benefits, not widespread but felt by some.
	Probability		Almost Certain (6)	It is most likely that the impact will occur.		**Probability**		Probable (4)	Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		**Type**		Pos	Positive Impact (+)
Minor (negative) -72					**Minor (positive) -32**				

Mitigation/Management Actions

- No additional areas should be sourced for topsoil other than the existing topsoil stockpiles for rehabilitation as far as possible;
- Rehabilitation and decommissioning should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation;
- Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material and sedimentation;
- Implement and maintain an AIPs Management Plan for the duration of the rehabilitation phase and into closure;
- Rehabilitation must be completed as soon as any impacts are observed;
- Newly shaped and top soiled areas must be revegetated as soon as possible to prevent sedimentation and erosion;
- Ensure proper stormwater management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs;
- Continue with concurrent rehabilitation and implement land rehabilitation measures;
- Address compacted areas by deep ripping to loosen the soil, and revegetate the area;
- Plant indigenous vegetation to prevent erosion and newly rehabilitated areas and encourage self-sustaining development of a productive ecosystem and increased soil fertility; and
- The backfilled, reprofiled landscape should be topsoiled and revegetated to allow free drainage close to the pre-mining conditions.

8.2.3.2. Surface Water

8.2.3.2.1. Impact Description: Contamination of Watercourses

Runoff from contaminated catchments and surfaces will likely lead to the contamination of surrounding surface water bodies and nearest watercourse during rainfall events. Spills during the dry season (or when it is not raining) are unlikely to be significant as the spillage can be stopped, contained, and cleaned up without substantial impact, however, spills during rainy seasons could have impacts on water quality further downstream.

8.2.3.2.2. Impact Description: Sedimentation and Siltation of Watercourses

Sedimentation and siltation of nearby watercourses is likely to happen during the decommissioning and rehabilitation phase. This will potentially deteriorate the water quality of the surrounding rivers. Disturbance of soils through demolition and removal of surface infrastructure may increase the rate of soil erosion leading to sedimentation and siltation of the nearby rivers and their tributaries. Restoration of the topography and re-vegetation of other disturbed areas will intend to return the site to a pre-mining state, which should improve the drainage of the area

Table 8-75: Decommissioning Phase Impacts Ratings (Before and After Mitigation Measures) for the Use of Hydrocarbons

Activity: Use of hydrocarbons such as fuels, oil and grease during the removal of surface infrastructure and the removal and rehabilitation waste.									
Impact Description: Contamination of watercourses.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	3	Medium term: 1-5 years to reverse impacts.	**Dimension**	Duration	**Rating**	1	Immediate: Less than 1 month to completely reverse the impact.
	Extent		3	Local: Extending across the site and to nearby settlements.		Extent		2	Limited: Limited to the site and its immediate surroundings.
	Intensity		4	Serious medium term environmental effects.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		5	Likely: The impact may occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Minor (negative) -50					**Negligible (negative)-24**				
Mitigation/Management Actions									

- Strategic removal of surface infrastructure should be implemented so that potentially contaminated runoff is diverted away from designated clean water areas. This may be achieved by temporarily retaining stormwater infrastructure to divert dirty water from clean areas while the potentially contaminating sources are decommissioned;
- Contaminated runoff water from hazardous areas such as mine plant, storage areas of ore, concentrates, tailings shall be captured and treated prior to their release at the point of discharge;
- Use of accredited contractors for removal or demolition of infrastructure during decommissioning is recommended, this will reduce the risk of waste generation and accidental spillages;
- All mining personnel should be taught and trained to handle hazardous chemical waste to minimise spillages. The use of spill kits is highly recommended. All storage facilities should be bunded;
- Washing and servicing of vehicles and machinery should only be undertaken at designated, appropriately designed areas;
- Administer effective and timely clean-ups in the event of spillages occurring;
- Ensure maintenance and management of remaining infrastructure and stormwater infrastructure around the area to prevent water quality contamination from runoff from the remaining areas; and
- Ensure that the infrastructure (e.g., pipelines, fuel storage areas) are first emptied of all residual material before decommissioning.

Table 8-76: Decommissioning Phase Impacts Ratings (Before and After Mitigation Measures) for Decommissioning and Removal of Infrastructure

Activity: Decommissioning and removal of infrastructure, backfilling and rehabilitation of disturbed areas.									
Impact Description: Sedimentation and siltation of nearby watercourses.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	3	Medium term:1-5 years to reverse impacts.	**Dimension**	Duration	**Rating**	2	Short term: Less than 1 year to completely reverse the impact.
	Extent		3	Local: Extending across the site and to nearby settlements.		Extent		2	Limited: Limited to the site and its immediate surroundings.
	Intensity		4	Local: Extending across the site and to nearby settlements.		Intensity		3	Moderate, short-term effects but not affecting ecosystem function.
	Probability		5	Likely: The impact may occur.		Probability		4	Probable: Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)

Minor (negative)-50	Negligible (negative) -28
Mitigation/Management Actions	

- Minimise the footprint of disturbance, as far as possible. Demarcate the proposed areas for rehabilitation and closure works to minimise the unnecessary expansion of the footprint of disturbance;
- Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance and subsequent erosion;
- Regular monitoring of the storm water management structures must be undertaken, especially after large storm events to ensure that there are no blockages or breaches to berms. Should blockages or breaches occur, then immediate action should be undertaken to remove debris and/ or to repair breached areas.
- Demolition should be undertaken during the dry period to reduce sedimentation in the proximal watercourses since there will be minimal occurrence of rainfall during this period and ensure the immediate revegetation of cleared areas;
- Maintain the sediment and erosion control measures in place until the completion of demolition and rehabilitation activities to minimise entry of sediment into watercourses;
- Install silt fences and erosion blankets prior to soil stabilisation on steep surfaces to reduce the potential of erosion prior to vegetation establishment;
- Landscape re-profiling and revegetation must be undertaken to rehabilitate disturbed sites and to allow good drainage that mimics pre-mining conditions. However, the landscape may not fully replicate the original hydrological conditions, and some modifications to the natural system may persist;
- Keep the topsoil stockpile with a vertical slope of 1:3 to minimise chances of erosion;
- An earth berm should be constructed around the topsoil stockpile and vegetation should be allowed to grow to stabilise soils and control erosion; and
- Ensure that waste stockpiles are frequently collected and away from riverbanks.

8.2.3.3. Groundwater

Activities during the Decommissioning Phase that may have potential impacts are captured in Table 8-77

Table 8-77: Decommissioning Interactions and Impacts of Activity

Interaction	Impact
The Ramula pit to be retained as an open void. Construction of a safety/ security berm around the void perimeter as a barrier to limit access.	• Groundwater recovery • Potential Contamination Plume
Dismantling, demolition and removal of some of the infrastructure.	• Accidental spillages
Post-closure monitoring and rehabilitation.	• Groundwater recovery • Potential Contamination Plume
Rehabilitation of WRD	• Potential Contamination Plume
Rehabilitation of TSF and adjoining infrastructure	• Potential Contamination Plume

8.2.3.3.1. Impact Description: Accidental Spillages

Activities that take place during the decommissioning phase could potentially result in accidental spills of hydrocarbons or chemicals, which can infiltrate and contaminate the aquifers. Accidental spills are considered as unplanned and low risk events and have therefore been discussed under Section 8.4.

8.2.3.3.2. Impact Description: Groundwater Recovery

Groundwater levels will begin to recover to pre-mining (baseline) conditions, once dewatering of the pit ceases. During the first 20 years the radius of influence increases while the maximum drawdown depth becomes shallower. After the first 20 years the radius of influence decreases up to 100 years post-closure, for which a residual drawdown of about 0.5 m will remain within a radius of 375 m from the pit perimeter. Identified receptors within the radius of influence which are not destroyed as a result of the pit development include:

- 20-years post-closure - five hand dug wells (two new locations) and 14 springs (two new locations) are impacted along with streams and wetlands, based on a 1 m drawdown contour interval:
    - Four hand dug wells (Anambo, Andayi, Dutla, Antonji and Ang'ang'o) can expect between 1 m and 2 m drawdown. The other hand dug well (Omukoko) can expect between 3 m and 4 m drawdown.

- 50-years post-closure - one hand dug well and five springs are impacted along with streams and wetlands, based on a 1 m drawdown contour interval; and
- 100-years post-closure - three springs remain impacted along with streams and wetlands, based on a 0.5 m drawdown contour interval.

The baseline conditions of the wetlands are impacted, however the wetlands identified as being groundwater fed and therefore are sensitive to reduced yields from the groundwater resource.

- **Management Objectives**

The objective of the management measures is to ensure that groundwater dewatering impacts associated with extraction of gold ore are avoided, minimised and/or managed.

- **Impact Ratings and Management Actions**

The impact ratings (before and after mitigation measures) as well as the recommended mitigation measures are provided in the table below Table 8-78.

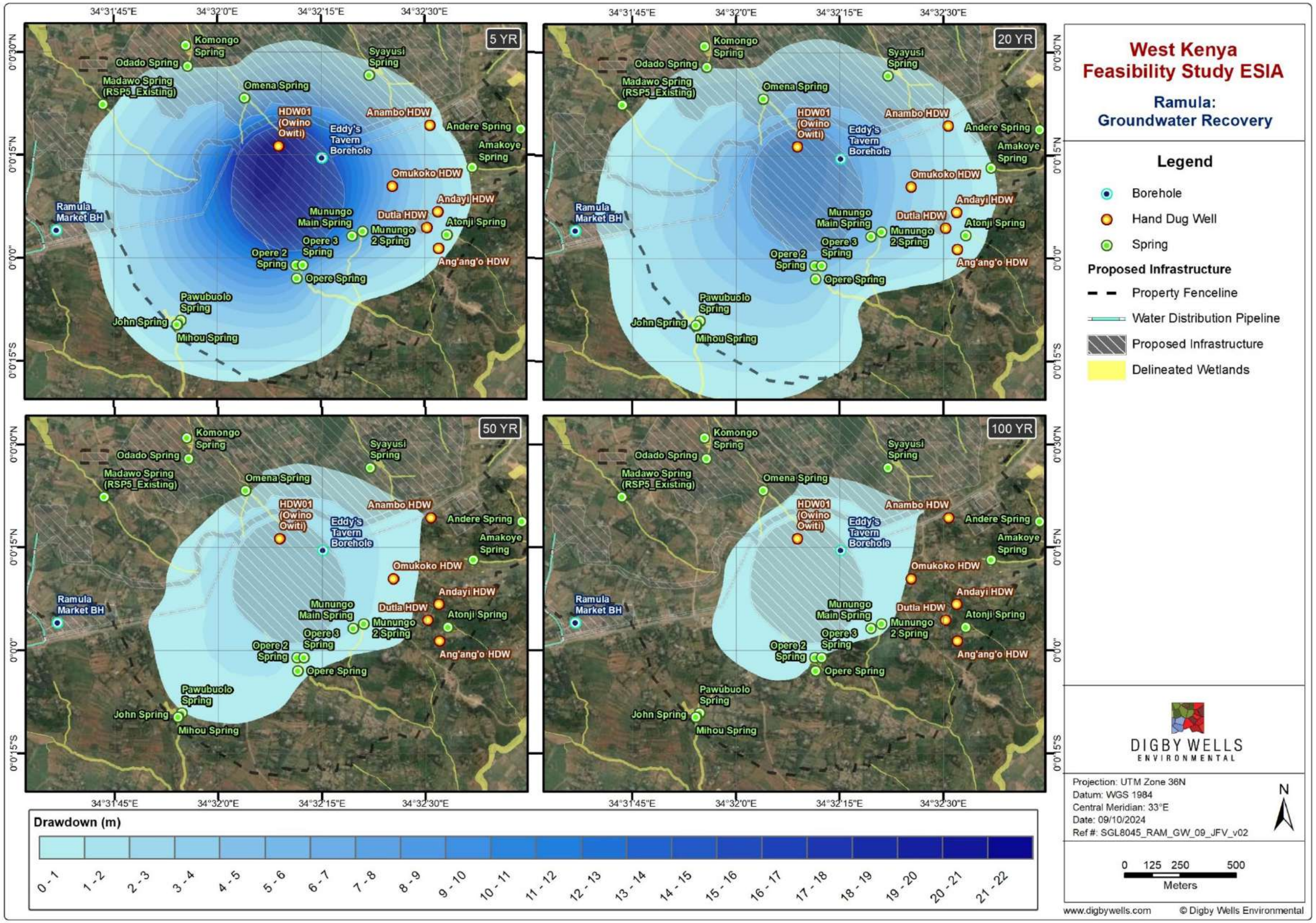


Figure 8-6: Post-Closure Groundwater Recovery

Table 8-78: Decommissioning Impacts for Groundwater Recovery

<table>
<tr><td colspan="10">Activity: Rehabilitation of open pits</td></tr>
<tr><td colspan="10">Impact Description:
Ceasing dewatering activities will allow the groundwater levels to recover close to baseline (pre-mining) levels or until and equilibrium is reached. Model simulations suggest that it would take 100 years to recover.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>6</td><td>Beyond Project Life</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>6</td><td>Beyond Project Life</td></tr>
<tr><td>Extent</td><td>1</td><td>Very limited</td><td>Extent</td><td>1</td><td>Very Limited</td></tr>
<tr><td>Intensity</td><td>2</td><td>Minor environmental impairment of ecosystem</td><td>Intensity</td><td>1</td><td>Limited</td></tr>
<tr><td>Probability</td><td>7</td><td>Certain</td><td>Probability</td><td>6</td><td>Almost Certain</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Minor (negative) 63</td><td colspan="5">Minor (negative) 48</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">• Groundwater level recovery should be monitored monthly during the first five years post closure to note deviations from the predicted recovery as soon as possible;
• Monitor the spring flow, to assess if pre-mine flow rates are established once groundwater levels recover;
• Assess the depth of the impacted hand dug wells to verify if the expected drawdowns will result in the wells becoming dry; and
• Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities.</td></tr>
</table>

8.2.3.3.3. Impact Description: Potential Contamination Plume

During the decommissioning phase, the groundwater levels will recover to near pre-mining levels within the pit. ARD which has formed in the pits during the operational phase has the potential to migrate into the aquifer, once groundwater levels have recovered and a steady state flow through system is re-established.

The simulated sulphate, iron and zinc concentrations for the WRD and TSF facilities extend up to 700 m downgradient based on a 5 mg/L (sulphate), 0.2 mg/L (iron) and 0.1 mg/L (zinc) concentration contour (Figure 8-7 to Figure 8-9).

The plume from the WRD migrates downgradient to the north until it reaches the Dhene River and associated wetlands. The plume from the TSF migrates towards the north, until the Dhene River, but also extends to the east and west of the TSF reaching the nearest streams as well as two springs (east of the TSF), and the associated wetlands. The maximum concentrations simulated for the saprolite at 100-years post-closure were as follows:

- Sulphate at 55 mg/L, which is below the Kenyan (EAS 12: 2014) limit of 400 mg/L but above the average baseline water quality of 4.9 mg/L. Concentrations of up to 25 mg/L sulphate could potentially reach the Dhene River. The springs could expect increases in sulphate concentrations of between 5 mg/L and 15 mg/L;
- Iron at 50.2 mg/L, which exceeds the Kenyan (EAS 12: 2014) limit of 0.3 mg/L, the IFC discharge limit of 2 mg/L and the average baseline water quality of 0.2 mg/L. The World Health Organisation (World Health Organisation, 2022) has not established a guideline value for iron. Concentrations of up to 20 mg/L iron could potentially reach the Dhene River. The springs could expect increases in iron concentrations of between 0.2 mg/L and 5.2 mg/L. Elevated iron concentrations could potentially be treated passively with aeration processes; and
- Zinc at 1.5 mg/L, which is below the Kenyan (EAS 12: 2014) limit of 5 mg/L but exceeds the IFC discharge limit of 0.5 mg/L and the average baseline water quality of 0.1 mg/L. Concentrations of up to 0.7 mg/L zinc could potentially reach the Dhene River.

- **Management Objectives**

The objective of the management measures is to ensure that groundwater contamination impacts associated with extraction of gold ore are avoided, minimised and/or managed.

- **Impact Ratings and Management Actions**

The impact ratings (before and after mitigation measures) as well as the recommended mitigation measures are provided in the table below Table 8-79.

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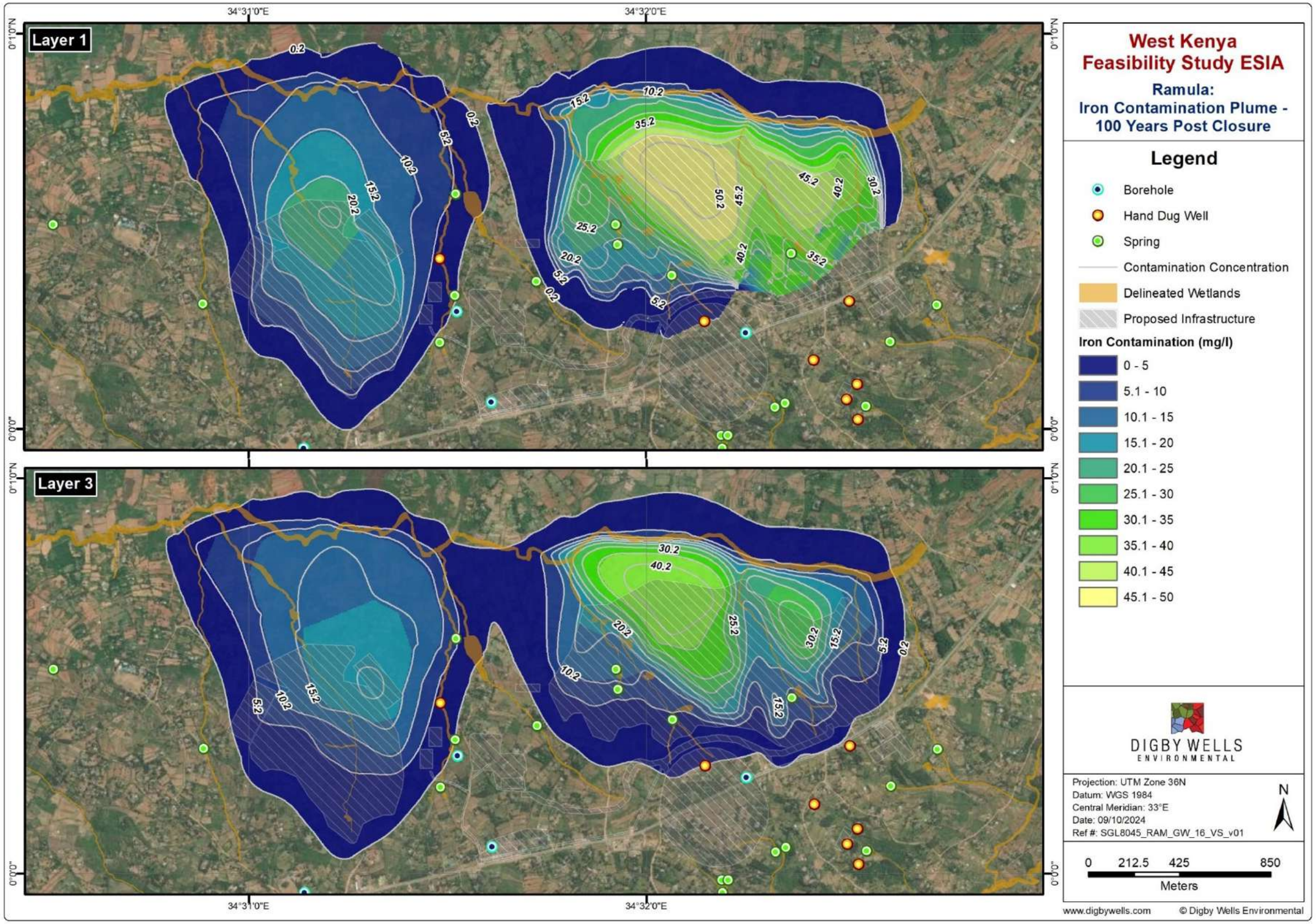

Figure 8-7: Iron Contaminant Plume 100-Years Post Closure

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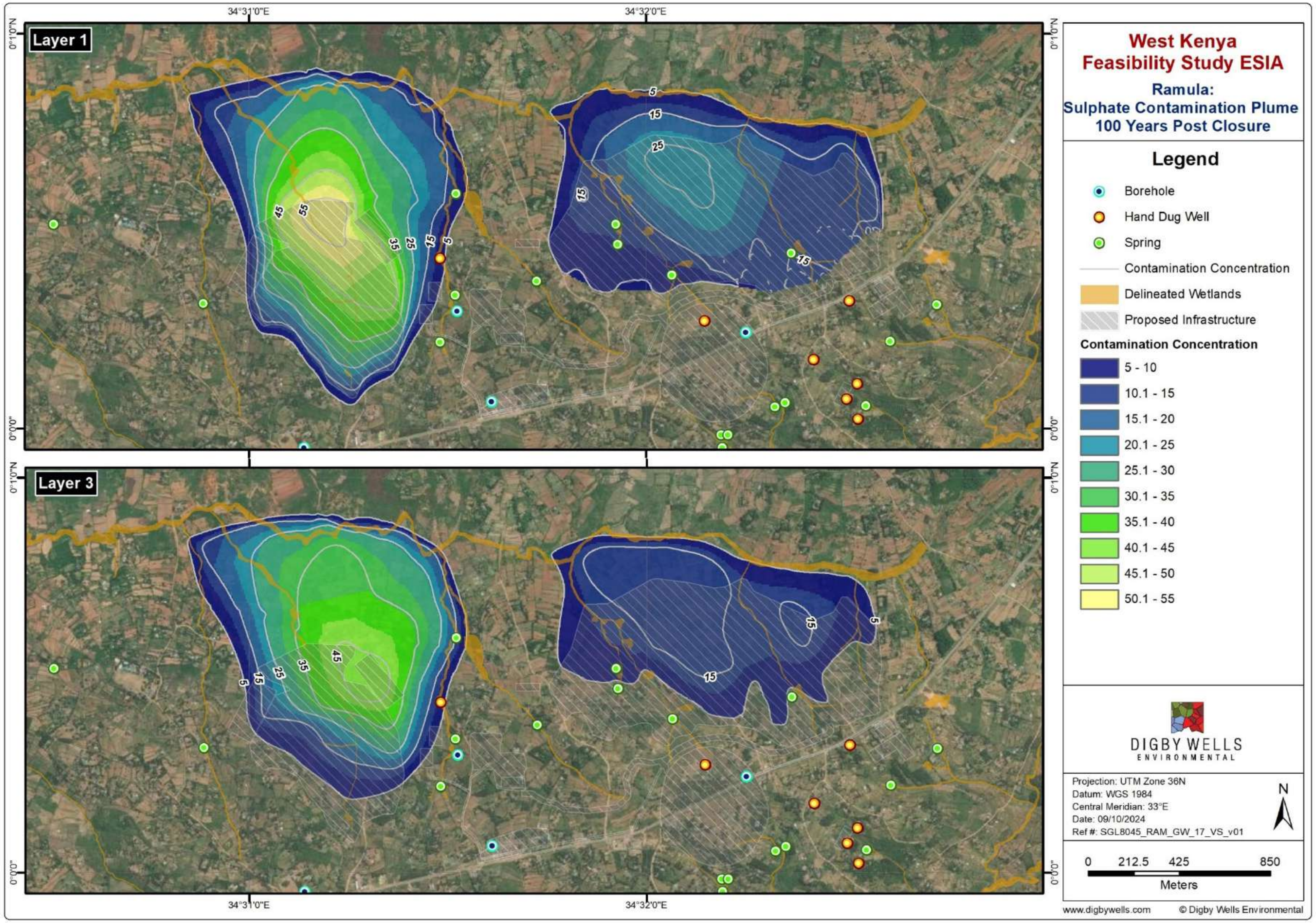

Figure 8-8: Sulphate Contaminant Plume 100-Years Post Closure

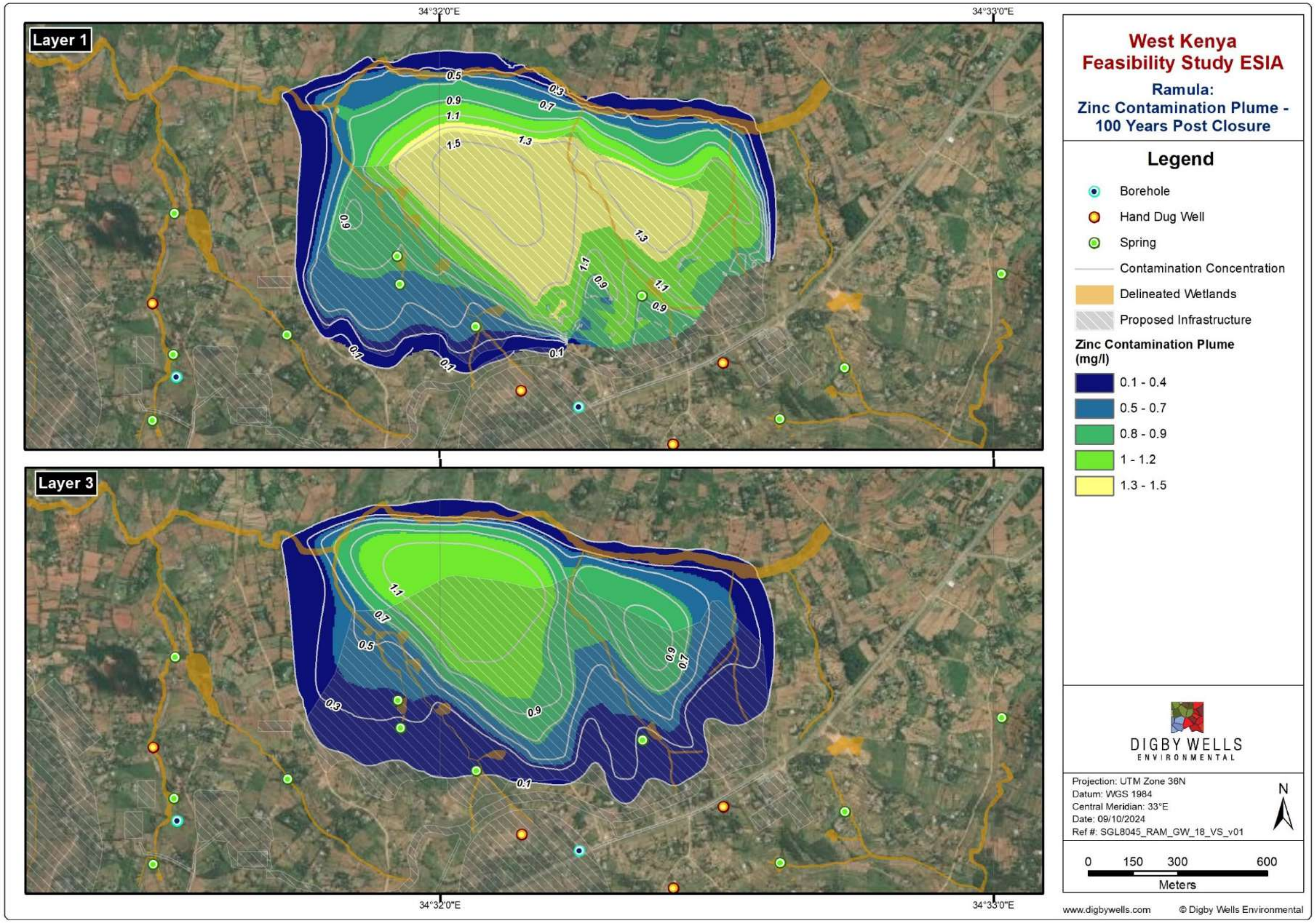

Figure 8-9: **Zinc Contaminant Plume 100-Years Post Closure**

Table 8-79: Decommissioning Impact for the Potential Contamination Plume

<table>
<tr><td colspan="10">Activity: Rehabilitation of open pits</td></tr>
<tr><td colspan="10">Impact Description: Exposing sulphide bearing minerals to ARD conditions. Once groundwater level recover post closure, contaminated water from the pits can migrate to the surrounding aquifer. ARD will continue seeping from the WRD and TSF and could potentially impact streams, wetlands and springs downgradient of the WRD and TSF. The potential for contamination from the pit, WRD and TSF is low based on the geochemistry assessment.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>6</td><td>Beyond Project Life</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>6</td><td>Beyond Project Life</td></tr>
<tr><td>Extent</td><td>3</td><td>Local</td><td>Extent</td><td>3</td><td>Local</td></tr>
<tr><td>Intensity</td><td>2</td><td>Minor effects</td><td>Intensity</td><td>1</td><td>Limited</td></tr>
<tr><td>Probability</td><td>7</td><td>Certain</td><td>Probability</td><td>6</td><td>Almost Certain</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">Moderate (negative) 77</td><td colspan="5">Minor (negative) 60</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">

Monitor the groundwater monitoring network quarterly for at least five years post closure, thereafter the frequency could be revised based on the long-term monitoring trends;
Implement recommendations from the geochemical and geotechnical assessment for the design of the WRD, to manage seepage quality and prevent failure of the WRD;
Update the geochemical assessments as mining progresses to increase the ARD knowledge for the waste rock material and verify the iron leachate results;
Should it be confirmed that the iron concentration in the leachate is as high as assessed with the geochemistry assessment, then water will need to be treated to meet the discharge or regional baseline limits;
Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities;
Rehabilitate the TSF, WRD and pit to recommended closure requirements; and
Monitor the spring flow from the springs underneath the WRD. This flow may need to be incorporated into the water balance for the project, if water quality indicates that water does not meet the discharge or regional baseline limits for the Project.

</td></tr>
</table>

8.2.3.4. Wetlands

Decommissioning and rehabilitation of the infrastructure areas may lead to exposed areas that will lead to erosion and sedimentation of the adjacent and downstream wetlands. During the activities, the area could potentially compact, leading to increased runoff and changes to the hydrological functioning of the wetlands which leads to erosion, decreased water and root penetration and loss of wetland functionality.

Decommissioning and rehabilitation may, however, lead to positive impacts on the wetlands through reintroducing wetland connectivity and natural flow paths where possible which will lead to an increase in wetland health and functionality. This will only be possible should the proposed mitigation measures be correctly implemented and monitored. If monitoring and maintenance are not properly controlled and managed, the activities could lead to impacts on the wetlands and freshwater systems. Impacts include loss of vegetation, increased AIPs, compaction and loss of topsoil through erosion due to exposed areas.

Similarly for decommissioning, if done correctly, positive impacts are inevitable. A change in land use from mining, open cast pits and ancillary infrastructure to bare land will increase wetland health. If management measures and mitigation measures aren’t adhered to, the negative impacts are expected to outweigh the positive impacts.

8.2.3.4.1. Impact Ratings

The pre-mitigation impact ratings during the decommissioning, closure and rehabilitation phases have all been scored “Minor-Negative” for decommissioning and rehabilitation/monitoring. These scores are expected to change to “Negligible-Positive” and “Minor-Positive” with the implementation of mitigation and management measures, as positive impacts are likely to outweigh negative impacts

Table 8-80: Decommissioning and Rehabilitation Impact for Backfilling Pits and Potential Demolition and Removal of Infrastructure.

Activity: Potential demolition and removal of infrastructure as well as rehabilitation of open pits (backfill of Ramula Open Pit, cover with overburden, landscape and re-vegetation).

Impact Description: During the decommissioning activities, the soils could potentially become compacted, leading to increased erosion, loss of effective rooting depth and decreased water and root penetration, water holding capacity and soil fertility. This will result in impacts to the hydrology of wetlands through increased run-off. It is however worth noting that these impacts are negligible compared to the positive impacts associated with the removal of infrastructure and backfilling of pits. Prior to decommissioning, the footprint areas will be characterised by mining-related land uses. These areas will at least be characterised by bare land post-decommissioning, indicating a positive change. A positive impact rating is only possible with the successful implementation of mitigation and management measures. Without these management measures the negative impacts will outweigh the positive impacts.

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	**Duration**	**Rating**	Beyond Project Life (6)	The impact will remain for some time after the life of the Project.	**Dimension**	**Duration**	**Rating**	Long Term (4)	6-15 years to reverse impacts.
	Extent		Limited (2)	Limited to the site and its immediate surroundings.		**Extent**		Local (3)	Extending across the site and to nearby settlements.
	Intensity		Moderate (3)	Moderate, short-term effects but not affecting ecosystem function. Rehabilitation requires the intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of significance.		**Intensity**		Average (3)	Average, on-going positive benefits, not widespread but felt by some.
	Probability		Likely (5)	The impact may occur.		**Probability**		Unlikely (3)	Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur.
	Type		Neg	Negative Impact (-)		**Type**		Pos	Positive Impact (-)
Minor (negative) -55					**Negligible (positive) +30**				

Mitigation/Management Actions

- Decommissioning should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation. Rehabilitation and revegetation should follow thereafter at the onset of the wet season;
- Actively landscape and re-vegetate disturbed areas as soon as possible to avoid prolonged exposed areas that may lead to erosion and increased flows;
- No material should be dumped/stockpiled within any wetlands or watercourses;
- Implement and maintain the AIPs Management Plan for the duration of the rehabilitation phase and into closure;
- Rehabilitation must be completed as soon as any impacts are observed;
- Ensure proper SWM design are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and the potential presence of AIPs;
- Continue with rehabilitation and implement land rehabilitation measures;

- The use of indigenous phyto-remediation specific grass, forb and tree species is encouraged;
- Plant indigenous vegetation to prevent erosion and encourage self-sustaining development of productive ecosystem services from the wetlands;
- The backfilled, reprofiled landscape should allow free drainage close to the pre-mining condition (mimic wetlands to encourage connectivity of the freshwater resources in the catchment and to remediate catchment yield);
- Monitor erosion, sedimentation, and the dewatering plume footprint; and
- Implement a monitoring programme to determine potential contaminants from the stockpiles and rehabilitated areas.

Table 8-81: Decommissioning and Rehabilitation Impact on Post-closure Monitoring and Rehabilitation.

Activity: Post-Closure Monitoring and Rehabilitation.

Impact Description: Rehabilitation activities could potentially lead to exposed surfaces, leading to sedimentation of the low-lying areas, potential spills from the equipment leading to contamination as well as contamination from the stockpiles. Monitoring may lead to the spreading of AIPs, compaction of areas and creation of preferential flow paths which will have a negligible effect on wetland health. If all mitigation and management measures are adhered to, the positive impacts are expected to outweigh the negative impacts.

Pre-Mitigation/Management					With Mitigation/Management				
Dimension	**Duration**	Rating	Project Life (5)	The impact will cease after the operational life span of the Project.	Dimension	**Duration**	Rating	Beyond Project Life (6)	The improvements will remain for some time after the life of the Project.
	Extent		Limited (2)	Limited to the site and its immediate surroundings.		**Extent**		Limited (2)	Limited to the site and its immediate surroundings.
	Intensity		Serious (4)	Serious medium term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of significance.		**Intensity**		Moderate (3)	Average, on-going positive benefits, not widespread but felt by some.
	Probability		Likely (5)	The impact may occur.		**Probability**		Probable (4)	Has occurred here or elsewhere and could therefore occur.
	Type		Neg	Negative Impact (-)		**Type**		Pos	Positive Impact (+)
Minor (negative) -55					**Minor (positive) +44**				

Mitigation/Management Actions

- Actively landscape and re-vegetate disturbed areas as soon as possible to avoid sedimentation of adjacent and downstream wetlands;
- Implement and maintain the AIPs Management Plan for the duration of the rehabilitation phase and into closure;
- Rehabilitation must be completed as soon as any impacts are observed;
- Ensure proper SWM designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs;
- Plant indigenous vegetation to prevent erosion and newly rehabilitated areas and encourage self-sustaining development of a productive ecosystem and wetland functionality;
- No vehicles should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the rehabilitation footprint and access roads;
- Wetland monitoring must be carried out during both the decommissioning and rehabilitation phases to ensure no unnecessary impact on wetlands takes place and to monitor the success of rehabilitation activities;

- Monitor erosion, sedimentation and AIPs;
- The use of indigenous phyto-remediation specific grass, forb and tree species is encouraged; and
- The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions. Landscaping should encourage wetland formation to restore wetland functionality and compensate for the wetlands lost during construction.

8.2.3.5. Terrestrial Ecology

Activities associated with the decommissioning and removal of infrastructure may result in disturbance of species that have adapted to or depend on these structures for shelter or nesting. During decommissioning, there may be increased wildlife interactions as animals explore and adapt to the changing landscape. Removal of infrastructure can lead to soil compaction and disturbance, affecting plant growth and establishment.

The shaping of WRDs and backfilling of pits may create barriers, restricting the movement of fauna across the landscape. The shaping of WRDs and stockpiles (overburden), as well as spreading topsoil, can lead to soil disruption and affect the establishment of new plant communities. Bare surfaces of soil will erode, become proliferated with unwanted invasive species, leaving inarable portions of land that will be difficult to rehabilitate. Furthermore, rehabilitation activities can disturb fauna during the establishment of new vegetation, potentially impacting nesting and foraging behaviours.

8.2.3.5.1. Impact Rating and Proposed Mitigation Measures

Table 8-82 presents the impact ratings associated with the decommissioning phase of the Project.

Table 8-82: Impact Assessment for the Decommissioning Phase

<table>
<tr><td colspan="10">Activity: Removal of infrastructure and rehabilitation activities</td></tr>
<tr><td colspan="10">Impact Description:
The decommissioning process entails various impacts, including habitat disruption and wildlife encounters, as well as soil disturbances and habitat loss. The decommissioning activities can lead to the disruption of wildlife movement, hindering their ability to navigate their habitats effectively. Additionally, soil and vegetation disturbances occur, with bare areas proliferated by AIPs, exacerbating habitat loss.</td></tr>
<tr><td colspan="5">Pre-Mitigation/Management</td><td colspan="5">With Mitigation/Management</td></tr>
<tr><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>6</td><td>Impacts can be permanent if not rehabilitated correctly such as soil erosion.</td><td rowspan="5">Dimension</td><td>Duration</td><td rowspan="5">Rating</td><td>2</td><td>Can be prevented with appropriate mitigation therefore short term.</td></tr>
<tr><td>Extent</td><td>3</td><td>Local: extending as far as far as the development site.</td><td>Extent</td><td>2</td><td>Local: extending as far as far as the development site.</td></tr>
<tr><td>Intensity</td><td>6</td><td>Irreplaceable loss if not correctly rehabbed.</td><td>Intensity</td><td>3</td><td>Moderate losses to the surrounding landscape.</td></tr>
<tr><td>Probability</td><td>7</td><td>The impacts will occur if mitigation measures are not correctly implemented.</td><td>Probability</td><td>4</td><td>Still probable to occur.</td></tr>
<tr><td>Type</td><td>Neg</td><td>Negative Impact (-)</td><td>Type</td><td>Neg</td><td>Negative Impact (-)</td></tr>
<tr><td colspan="5">-105 Moderate (negative)</td><td colspan="5">Negligible (negative) – 28</td></tr>
<tr><td colspan="10">Mitigation/Management Actions</td></tr>
<tr><td colspan="10">• Implement a phased approach to decommissioning to allow fauna to adapt gradually to the changing environment.
• Before removal of infrastructure, assess the presence of any protected or rare species and consider salvaging and relocating them to suitable habitats.
• Restore the decommissioned areas by replanting native vegetation to provide alternative habitats for fauna and to support plant diversity.
• When shaping the WRDs use gradual slopes and incorporate wildlife-friendly features, such as wildlife corridors, to minimize barriers to animal movement.
• Schedule rehabilitation activities during periods of lower wildlife activity, such as outside breeding seasons, to reduce disturbances to nesting and foraging wildlife.
• Ensure no areas are left bare and unvegetated, ensure to use native plant species for revegetation to support local biodiversity and provide suitable habitats for fauna.
• Incorporate non-invasive monitoring techniques such as remote cameras and acoustic sensors, to minimize direct contact with fauna.
• Use monitoring data to adjust rehabilitation efforts and address any unforeseen impacts on fauna and flora effectively.</td></tr>
</table>

8.2.3.6. Aquatics

The decommissioning, demolishing and closure of established infrastructures including the TSF, WRD and stormwater management infrastructure will require the use of heavy machinery near watercourses. Similar to the impacts identified during the initial Construction Phase, runoff through and/or from the target areas has the potential to increase sedimentation within the downstream environments as well as result in increased contaminants entering the associated watercourses. Adjacent lands and vegetation that has likely recovered or been rehabilitated throughout the life of the Project are expected to be affected and compacted to some extent through the use of heavy machinery for the infrastructure decommissioning and removal purposes. These areas will be prone to erosion and will also likely facilitate an increase in contaminants (e.g., hydrocarbons, oils, etc.) draining into watercourses.

Similarly, the final rehabilitation involving the backfilling of the open pits, ripping and spreading of overburden and topsoil, shaping of the impacted land/infrastructure areas including removed mineralised stockpiles areas, and revegetation of disturbed footprints, will also require the use of heavy machinery near watercourses and result in similar runoff-related impacts as identified during the initial Construction Phase.

8.2.3.6.1. Impact Ratings

The impact ratings pre- and post-mitigation for the Decommissioning and Rehabilitation Phase are detailed in Table 8-83 and

Table 8-84.

The pre-mitigation impact ratings during the decommissioning, closure and rehabilitation phase range from “Minor-Positive” to “Moderate-Positive” for decommissioning and rehabilitation/monitoring respectively. These scores are expected to decrease with the implementation of recommended mitigation (and increase in positive significance in the case of decommissioning) and management measures with all post-mitigation significance ratings expected to be positive. Rehabilitation and monitoring, if carried out successfully (adhering to mitigation and management measures) will ensure positive impacts towards the watercourses whereas decommissioning and backfilling of pits inevitably resulting in a positive impact due to the land capability change from “none”/developed to at least wilderness.

Table 8-83: Decommissioning and Rehabilitation Impact for Backfilling Pits and Potential Demolition and Removal of Infrastructure.

Activity: Demolition and removal of infrastructure as well as rehabilitation of open pits (backfill of Ramula Open Pit, cover with overburden, landscape and re-vegetation).									
Impact Description: Water quality and aquatic habitat deterioration.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	Rating	Medium Term (3)	Impact is only expected to continue during the Decommissioning and Rehabilitation Phase of the Project.	Dimension	Duration	Rating	Medium Term (3)	The impact is still expected to continue throughout the Decommissioning and Rehabilitation Phase of the Project.
	Extent		Local (3)	Extending across the site and to nearby settlements.		Extent		Site (2)	Should sedimentation and especially water quality-related impacts be mitigated then these impacts should only enter the local watercourse.
	Intensity		Moderate (3)	The intensity of the potential impacts are expected to be moderate due to indirect impacts to associated watercourses and downstream environments.		Intensity		Low (2)	The proposed mitigation measures are expected to reduce the intensity of the predicted impacts. It is worth noting that the landscape and associated watercourses are not likely to fully reflect pre-mining and/or natural conditions.
	Probability		Likely (5)	The likelihood of runoff-related impacts occurring is high, especially during the rehabilitation of the pit and stockpile areas.		Probability		Probable (4)	The probability of the impact is expected to be reduced if the mitigation measures are implemented correctly, especially if the water management systems are left in place until all other infrastructure has been removed and if the activities, including rehabilitation, take place during the dry season as far as practically possible.
	Type		Pos	Positive Impact (+)		Type		Pos	Positive Impact (+)
Minor (positive) +45					**Negligible (positive) – +28**				
Mitigation/Management Actions									

- Decommissioning and rehabilitation activities should be planned to occur during the dry periods/seasons to avoid high rainfall events that could lead to increased runoff, erosion, rapid spread of contaminants and sedimentation;
- Sediment and stormwater management infrastructures should be left in place and be the last infrastructures for decommissioning.
- Access to the target areas should be done by the use of a single roadway or route. Drivers and the use of heavy machinery should not be allowed to traverse freely throughout the Project area, creating new access routes, and throughout areas proposed for rehabilitation.
- Conduct routine maintenance on heavy machinery and prevent leaks of hydrocarbons into the Project area, as well as make adequate provision for on-site personnel to avoid littering.
- Ensure correct storage of construction chemicals on site as per the specific chemical's storage requirements.
- Ensure responsible recycling practices are implemented to avoid unnecessary landfill waste, and haphazard dumping of decommissioned material.
- Ensure there are trained staff on site who are able to apply and use appropriate spill kits.
- The backfilled pits must be reshaped and sloped to avoid preferential flow paths.
- The backfilled, reprofiled landscape should be topsoiled and revegetated to allow free drainage close to the pre-mining conditions.
- Continue with concurrent rehabilitation, and implement land rehabilitation measures.
- Conduct regular water quality monitoring and biological monitoring activities.

Table 8-84: Decommissioning and Rehabilitation Impact for infrastructure (including the TSF and WRDs and associated access roads) directly within watercourses

Activity: Decommissioning and Rehabilitation Impact for infrastructure (including the TSF and WRDs and associated access roads) directly within watercourses									
Impact Description: Direct modifications to riverine morphology and hydrology, with rehabilitation of first order streams and impacts to functioning of downstream systems.									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Medium term (3)	The impacts are difficult to rehabilitate, with 1-5 years to reverse impacts.	**Dimension**	Duration	**Rating**	Medium term (3)	The impacts are difficult to rehabilitate, with 1-5 years to reverse impacts.
	Extent		Municipal Area (4)	Due to the longitudinal and dynamic nature of rivers, impacts are likely to extend beyond the point of entry to the Dhene River. When considering long-term impacts to the natural flow regime and water quality associated with removal of TSF and WRDs, these impacts are expected to affect the whole municipal area.		Extent		Local (3)	The extent of the impact is likely to be reduced if the proposed mitigation measures are implemented, especially if construction takes place during the dry season and appropriate sediment and water quality mitigation is implemented.
	Intensity		Very serious (5)	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate.		Intensity		Serious (4)	The intensity of the impact is likely to reduce if the proposed mitigation measures are implemented correctly. May take several years to rehabilitate.
	Probability		Certain / Definite (7)	There are sound evidence based reasons to expect that the impact will definitely occur due to proposed demolition and rehabilitation activities taking place directly within the first order tributaries.		Probability		Highly Likely (6)	Impacts are still expected to occur as construction activities will take place directly within the tributaries despite implementation of the proposed mitigation measures. However, the probability of some impacts (e.g., bank instability and erosion and water quality) will be reduced.
	Type		Pos	Positive Impact (+)		Type		Pos	Positive Impact (+)
Moderate (positive) +84					**Minor (positive) +60**				
Mitigation/Management Actions									

- Minimal mitigation measures will be able to completely protect the tributaries from the demolition TSF and WRDs with protection occurring only after rehabilitation is implemented.
- Demolition activities should take place during the dry season to reduce erosion, surface runoff, and contaminated seepage from the demolition footprint areas especially when flow within the watercourses will be at its lowest.
- Only the designated access routes are to be used or accessed to reduce any unnecessary compaction and/or topsoil and vegetation disturbance around the watercourses.
- All unnecessary river crossings should be demolished and rehabilitated so as to reinstate the natural flow regime of the watercourse.
- Bare surfaces, especially those along the banks of the watercourses must be vegetated to limit erosion from increased surface runoff. This should coincide with the following point regarding slope of the rehabilitation area.
- A key mitigation measure to 'offset' and minimize the impact of the direct loss of the Dhene River tributaries, the banks of the reinstated watercourses where the TSF and WRDs and associated access roads were, should be redesigned in such a manner to reflect a more natural environment and can be considered as constructed wetlands.
    - This involves implementing natural embankments by rehabilitating the embankments, incorporating gentle gradients (1:3 slope) and hydroseeding with a mix of native vegetation (grasses, shrubs and trees). This will ensure the maintenance of topsoil, minimize erosion potential and improve phytoremediation (water polishing by established vegetation) capacity of the rehabilitated watercourse section. This inadvertently promotes protection of water quality entering the downstream Dhene River and supports biodiverse maintenance in these receiving sensitive receptors.
- Implement the water quality and soil management mitigation actions listed in Table 9 2.
- Regular monitoring and maintenance of the watercourses below the TSF and WRDs and associated access roads should take place to limit erosion and to further reduce sedimentation of the downstream environments.
- Plant indigenous vegetation to prevent erosion and newly rehabilitated areas and encourage self-sustaining development of a productive ecosystem and increased soil fertility.
- The backfilled, reprofiled landscape should be topsoiled and revegetated to allow free drainage close to the pre-mining conditions.
- Groundwater related studies will be required to assess the potential for mine related decant.

8.2.3.7. Visual

The demolition and removal of all infrastructure including rehabilitation activities will attempt to restore the visual character and sense of place of the area to the pre-development state. However, decommissioning activities may also result in negative visual impacts due to the operation of machinery and equipment such as cranes etc. during the demolition process and the subsequent stockpiling of rubble prior to dumping will result in negative visual impacts.

8.2.3.7.1. Impact Ratings

The noise impact during the Decommissioning, Rehabilitation and Post-Closure Phase of the Project has been assessed and is provided in Table 8-86.

Table 8-85: Impact Assessment for the Decommissioning, Closure and Rehabilitation Phaseof the Project

Activity:

- Decommissioning and removal of infrastructure.
- Rehabilitation activities.

Impact Description: The demolition and removal of all infrastructure including rehabilitation will attempt to restore the visual character and sense of place of the area to the pre-development state.

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Long term (4)	It will take several years to restore the area to an acceptable state.	**Dimension**	Duration	**Rating**	Long term (4)	No change post -mitigation
	Extent		Limited (2)	The visual impact associated with the demolition and clearing of infrastructure as well as rehabilitation activities will be limited to the site and its immediate surroundings.		Extent		Limited (2)	No change post-mitigation
	Intensity		Minor (2)	Minor visual impacts are anticipated during the decommissioning phase.		Intensity		Minimal (1)	Minimal visual impacts are anticipated during the decommissioning phase.
	Probability		Unlikely (3)	Visual impacts are unlikely to occur during the decommissioning phase as the area is being restored to an acceptable state.		Probability		Unlikely (3)	Visual impacts are unlikely to occur during the decommissioning phase as the area is being restored to an acceptable state.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Negligible (negative) – 24					**Negligible (negative) – 21**				

Mitigation/Management Actions

- Apply dust suppression techniques to limit the dust from the demolition area.
- Ensure all infrastructure is demolished and removed from the site.
- Limit the quantity and time that rubble is stored on-site.

8.2.3.8. Noise

The decommissioning phase will be short-term in nature; therefore, the predicted noise emission and impacts thereof will also be short-term. The decommissioning phase activities will occur in phases leading to minimal noise emissions. In addition, the removal of noise-generating infrastructure over time will lead to a positive impact on the NSRs. The man-made barriers (WRDs) would have reached maximum height and serve as a barrier between noise-generating sources and local communities. Therefore, noise emissions are unlikely to exceed the IFC-EHS guideline noise limits nor result in an increase in background levels at the NSRs above 3dBA or more.

8.2.3.8.1. Impact Ratings

The noise impact during the Decommissioning, Rehabilitation and Post-Closure Phase of the Project has been assessed and is provided in Table 8-86.

Table 8-86: Impact Assessment for the Decommissioning, Closure and Rehabilitation Phaseof the Project

Activity:

- Rehabilitation of open pits (backfill of Ramula Open Pit, cover with overburden, landscape and re-vegetation).
- Potential demolition and removal of infrastructure.

Impact Description: Noise will emanate from the equipment, machinery and vehicles operating during the decommissioning of the site and rehabilitation activities.

Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Short-term (2)	Activities associated with this phase will be short-term in nature therefore the duration of impact will also be short term.	**Dimension**	Duration	**Rating**	Short Term (2)	Activities associated with this phase will be short-term in nature therefore the duration of impact will also be short term.
	Extent		Limited (2)	It is expected that the noise impact will be limited to the Project site and its immediate surroundings.		Extent		Very Limited (1)	Noise emission will be limited post-mitigation to specific and isolated parts of the site.
	Intensity		Minor (2)	Minor impacts anticipated during the decommissioning phase.		Intensity		Minimal (1)	Minimal implications anticipated post-mitigation
	Probability		Unlikely (3)	Noise impacts at nearby receivers are unlikely to occur due to the simultaneous reduction in noise-generating Project-related sources.		Probability		Rarer / Improbable (2)	The possibility of noise impacts materialising post-mitigation is rare.
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Negligible (negative) – 18					**Negligible (negative) – 8**				

Mitigation/Management Actions

- Decommissioning activities (usage of heavy equipment / machinery) should be restricted to daylight hours where feasible.
- Decommissioning activities should be carried out in phases in accordance with the Mine Rehabilitation and Closure Plan.
- Machinery, equipment and vehicles should be switched off when not in use and not left idling unnecessarily.
- Where practicable, utilise low frequency / low sound reverse beepers on vehicles.
- Vehicles are to be serviced as per the OEM's requirements to limit noise emissions.
- Install exhaust mufflers (where applicable) on vehicles engine exhausts.
- Noise monitoring and the development of a mechanism to record and respond to noise complaints.

8.2.3.9. Air Quality

The activities conducted during this phase such as the dismantling of mine infrastructure and rehabilitation activities will be short-term and result in fugitive emissions, such as TSP, PM_{10}, $PM_{2.5}$ and gases from the use of off-road vehicles.

The management objectives are to ensure that airborne emissions are below the regulated limits on-site and at off-site receptors i.e. complaint with the WHO guideline limits protective of the environment, human health and wellbeing.

The decommissioning phase activities will require similar mitigation measures to those employed during the construction phase. The impact rating for this phase is discussed in Table 8-87.

Table 8-87: Significance Ratings for the Decommissioning, Closure and Removal of Mine Infrastructure and Rehabilitation of the Site

Activity and Interaction: Demolition of Mine Infrastructure and Rehabilitation of the Site									
Impact Description: Dust generation leads to poor ambient air quality									
Pre-Mitigation/Management					**With Mitigation/Management**				
Dimension	Duration	**Rating**	Short-term (2)	Dust generation will be short-term	**Dimension**	Duration	**Rating**	Short-term (2)	Dust generation will be short-term
	Extent		Limited (2)	Limited to the activity site and immediate surroundings.		Extent		Very Limited (1)	Emissions will be very limited post-mitigation
	Intensity		Minor (2)	Minor effect on surrounding air quality.		Intensity		Minimal (1)	Minimal impacts on ambient air quality on-site and at nearby receptors.
	Probability		Probable (4)	Probable that generated dust may impact ambient air quality.		Probability		Unlikely (3)	Unlikely impacts will occur post-mitigations
	Type		Neg	Negative Impact (-)		Type		Neg	Negative Impact (-)
Negligible (negative) – 24					**Negligible (negative) – 12**				
Mitigation/Management Actions									

- Implement localised / activity-specific surface watering to minimise emissions;
- Apply dust suppressants on exposed surface areas and the haul roads, where practicable;
- Limit high dust-generating activities (i.e. land clearing with bulldozers) to periods of low wind where possible (wind speed less than 5.4 m/s);
- Set maximum speed limits on-site and have these limits enforced;
- Minimise the footprint of disturbance as far as practicable; and
- Minimise the drop heights when loading onto trucks and at tipping points.
- Concurrent rehabilitation and vegetation of disturbed areas and re-vegetation.

8.2.3.10. Socio-economic

At the end of the mine's operational life, decommissioning and final rehabilitation activities will be undertaken. This may involve the backfilling of open pits, covering them with overburden, landscaping the area, and re-vegetation to restore the natural environment. Additionally, infrastructure may be demolished and removed as part of the site's reclamation. Post-closure monitoring will be implemented to ensure the success of these rehabilitation efforts and to mitigate any long-term impacts.

The socio-economic impacts anticipated to occur during the decommissioning, rehabilitation and closure phase which are assessed in this section are identified in Table 8-88.

Table 8-88: Summary of Impacts Expected During the Decommissioning Phase

Theme	Change Drivers	Principal Impacts
Physical mine closure	Ceasing of the mining operations	Occupation, Health and Safety (OHS) and nuisance disturbance (-) • Deterioration in workers' health due to prolonged exposure to dust, noise and vibrations (-) • Increased stress and fatigue among workers due to long shifts and strenuous work (-) • Increased incidents/injuries related to dismantling of equipment, remove of infrastructure etc (-)
		Community Health and Safety (CHS) and nuisance disturbance (-) • Increased traffic accidents (-) • Elevated noise levels from dismantling machinery and equipment (-)
Loss of employment and economic development	Ceasing of the mining operations	Decrease in household incomes and living standards (-) • Increased poverty levels and financial stress (-) • Increased out migration (-) • Reduction in local business revenue (-) • Increased vulnerability (-) • Deterioration in access to basic needs i.e healthcare and education (-) • Increased crimes and social issues (-)
Rehabilitation	Land restoration and rehabilitation efforts	New livelihood restoration opportunities (+) • Access to land (+) • Access to new water sources (dams) (+) • Opening of new access routes (+)

8.2.3.10.1. Impact Description: Exposure to Occupational Health and Safety (OHS) and Nuisance Disturbance

As mining activities draw to a close, there is likely to be a decrease in certain immediate safety risks to workforce, such as accidents related to active mining operations. However, the decommissioning process itself introduces new risks, including potential incidents or injuries related to the dismantling of equipment, removal of infrastructure, and site rehabilitation efforts.

Additionally, prolonged exposure to hazardous conditions such as dust, noise, and vibration may have already taken a toll on workers' health, leading to issues like respiratory problems and hearing loss. The final stages of work, often involving long shifts and strenuous tasks such as dismantling of equipment, could further exacerbate stress, fatigue among workers and expose them to dusts and noise, increasing the likelihood of accidents or injuries and impacting health. Managing these challenges requires careful planning and adherence to safety protocols to ensure that workers are protected throughout the decommissioning process and that their health and well-being are prioritized even as the mine prepares for closure

Table 8-89: Occupational Health and Safety (OHS) and Nuisance Disturbance

Exposure to Occupational Health and Safety (OHS) and Nuisance Disturbance				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Beyond project life (6)	It will continue for the duration of the Project and likely continue post mine closure.	Consequence: Moderately detrimental (-13)	Significance: Moderate - negative (-78)
Extent	Project footprint and immediate surrounds (2)	Will mostly affect the workers within the site-specific area.		
Intensity x type of impact	High - negative (-5)	Inadequate OH&S measures could lead to injury or death of workers, whilst poor working conditions could impact on worker physical and emotional well-being		
Likelihood	Highly probable (6)	Several factors (including prolonged exposure to hazards) will exacerbate the risk of this impact.		
MITIGATION				
• Continue to implement the corporate level OHS Policy until all activities are ceased; • Continue to implement the site-level Health and Safety Procedures until all activities are ceased; • Ensure all personnel are trained on decommissioning-specific safety protocols; • Provide appropriate personal protective equipment (PPE) to all workers involved in decommissioning tasks; • Implement a Fatigue management Procedure to ensure workers are not overextended during long shifts; • Adhere to the Health and Safety Requirements for Contractors throughout the decommissioning phase; • Maintain an on-site emergency response team to address potential incidents during decommissioning; • Retain warning signage at infrastructure areas that remain in place.				
POST-MITIGATION				
Duration	Long term (4)	As for pre-mitigation	Consequence: Slightly detrimental (-9)	Significance: Minor - negative (-45)
Extent	Project footprint and immediate surrounds (2)	As for pre-mitigation		
Intensity x type of impact	Moderate - negative (-3)	Impacts will still occur, albeit not to the degree it was initially expected		
Probability	Likely (5)	Appropriate mitigation will reduce the risk of this impact		

8.2.3.10.2. Impact Description: Community Health and Safety (CHS) and Nuisance Disturbance

The decommissioning process is anticipated to bring challenges to the surrounding communities. While the reduction in heavy machinery and transport activities from the operational phase might initially suggest a decrease in traffic accidents, the continued movement of vehicles during decommissioning could still pose a risk of accidents to the community. Additionally, elevated noise levels from the dismantling of machinery and equipment are likely to cause significant disturbances to nearby residents.

Table 8-90: Community Health and Safety (CHS) and Nuisance Disturbance

Community Health and Safety (CHS) and Nuisance Disturbance				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Beyond project life (6)	It will continue for the duration of the Project and likely continue post mine closure.	Consequence: Highly detrimental (-14)	Significance: Moderate - negative (-84)
Extent	Local (3)	Will mostly affect the population within the direct Project Affected Communities (PACs) and local road users.		
Intensity x type of impact	High - negative (-5)	Could place the lives of community members at risk, especially those using the initial access road. as well as exposure to dust and noise.		
Likelihood	Highly probable (6)	Several factors (including vehicle movement and dismantling works) exacerbate the risk of this impact.		
MITIGATION				
• Continue to implement the corporate-level OHS Policy until all activities are ceased; • Conduct thorough risk assessments before commencing decommissioning activities; • Undertake sensitization campaigns in the in the local study area on the health and safety risks associated with decommissioning and rehabilitation activities; • Restrict public access to working areas until they are completely rehabilitated; • Monitor and control dust, noise, and vibration levels throughout the decommissioning process; • Conduct post-closure site inspections to ensure all safety concerns are addressed. • Increasing police presence in crime hotspots • Improve infrastructure such as street lighting, and supporting community-led crime prevention programs.				
POST-MITIGATION				
Duration	Long term (4)	As for pre-mitigation	Consequence: Moderately detrimental (-10)	Significance: Minor - negative (-50)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Moderate - negative (-3)	Impacts will still occur, albeit not to the degree it was initially expected		
Probability	Likely (5)	Appropriate mitigation will reduce the risk of this impact		

8.2.3.10.3. Impact Description: Decrease in Household Incomes and Living Standards

The cessation of mining operations is expected to have significant negative impacts on the local community, primarily due to the loss of employment and economic opportunities. As mining activities come to an end, household incomes are likely to decline, driven by the retrenchment of employees working for SGKL. This in turn affects purchasing power and the mine's procurement of goods and services from the local area. This reduction in income will lead to a decline in living standards, increased poverty levels, and financial stress for many households.

The loss of jobs may also trigger out-migration, as individuals employed by SGKL seek employment opportunities elsewhere, which could further destabilize the local economy that was once bolstered by the mine's presence. The decline in disposable income will negatively affect local businesses, leading to a drop in revenues for both counties (Siaya and Vihiga), and contributing to broader economic decline. As financial pressures mount, households may struggle to meet basic needs such as healthcare and education, making them more vulnerable to economic hardships.

Furthermore, the economic downturn may exacerbate social issues, including increased crime rates, as individuals grapple with the consequences of unemployment and reduced livelihoods. The closure of the mine will particularly impact unskilled workers, who may find it more challenging to secure alternative employment compared to semi-skilled and skilled people. While some local employees may benefit from the experience gained at the mine, giving them a competitive advantage in seeking employment at other mining operations, they may still need to migrate to find new job opportunities, leaving the local community further depleted.

Table 8-91: Decrease in Household Incomes and Living Standards

Decrease in household incomes and living standards				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Permanent (7)	Effects of retrenchments/ mine closure will be long-lasting	Consequence: Extremely detrimental (-19)	Significance: Major - negative (-133)
Extent	National (6)	The impact will affect surrounding communities and the nation, as this is where the majority of workers will be recruited.		
Intensity x type of impact	Very high - negative (-6)	A substantial proportion of the population will, directly or indirectly, become reliant on the mine's continued operation as a source of income. This will not only affect the individuals, but the rest of their households, particularly any dependents.		
Likelihood	Certain (7)	Mining is not a permanent activity, and retrenchments will occur		
MITIGATION				
• Development of a social closure plan which emphasise the importance of providing transferrable skills to employees, with specific emphasis on local employees. This must include a retrenchment plan; • Early communication and planning with communities to prepare for the decommissioning and rehabilitation stage; • Facilitate skills training and capacity-building initiatives to help workers transition to alternative employment opportunities; • Work with local governments and NGOs to improve access to healthcare and education services. Support local economic development projects to diversify income sources and reduce dependency on mining; • Collaborate with community leaders and local authorities through the Stakeholder Engagement Plan to enhance community safety programs and address potential increases in crime and social issues; • Monitor and assess the social and economic impacts post-closure to address emerging challenges; and • Initiate temporary employment programs related to the decommissioning process, such as site rehabilitation and infrastructure dismantling.				
POST-MITIGATION				
Duration	Permanent (7)	As for pre-mitigation	Consequence: Highly detrimental (-16)	Significance: Minor - negative (-64)
Extent	National (6)	As for pre-mitigation		
Intensity x type of impact	Moderate - negative (-3)	Mitigation is likely to reduce the effects of retrenchments and loss of employment and economic livelihoods		
Probability	Probable (4)	Mitigation will reduce dependency of local economy of mining, reducing the probability of extensive negative effects		

8.2.3.10.4. Impact Description: New Livelihood Restoration Opportunities

The decommissioning phase will introduce new livelihood restoration opportunities, which are expected to have several positive socio-economic impacts on the local community. One of the key benefits will be improved access to land, as areas previously occupied by mining activities become available for agricultural and other land-based uses. This access will enable local residents to reclaim and utilize the land, potentially restoring and enhancing their livelihoods through farming and other productive activities.

Additionally, the decommissioning phase will open up access to new water sources, such as dams constructed during the operational phase, which can be used for irrigation, livestock, and domestic purposes. These water sources will not only improve the availability of water but also support agricultural activities and contribute to the overall well-being of the community.

Furthermore, the opening of new access routes as part of the decommissioning process will enhance connectivity within the local area, facilitating the movement of people and goods. This improved infrastructure will support economic activities and provide communities with greater access to markets, services, and resources, further contributing to the long-term socio-economic development of the area.

Table 8-92: New Livelihood Restoration Opportunities

New livelihood restoration opportunities				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
Dimension	**Rating**	**Motivation**		
PRE-MITIGATION				
Duration	Permanent (7)	Once the mine has closed, the land will be given back to the communities and access permanently restored	Consequence: Highly beneficial (14)	Significance: Moderate - positive (98)
Extent	Local (3)	Communities in the local area will be able to use the land and natural resources which were previously restricted		
Intensity x type of impact	Moderately high - positive (4)	Restoration of access will have a moderate beneficial impact by reducing pressure on other land and natural resources outside the project area		
Likelihood	Certain (7)	This impact will be realised with the closure of the project		
MITIGATION				
• Implement comprehensive land rehabilitation programs to restore land productivity, including soil restoration, re-vegetation, and erosion control; • Engage local communities in participatory planning to ensure that livelihood restoration efforts align with their needs and preferences; • Provide community training in sustainable agriculture and alternative livelihoods to maximize the use of restored land and water sources; • A detailed closure plan must be developed at least two years before decommissioning and include measures to reduce the workforce and look to complete sustainable development projects and programmes as part of closure; • Development of the detailed closure plan should include comprehensive stakeholder engagement to feed into rehabilitation measures to agree on the final land uses; and • Proactively assess and manage socio-economic impacts on sustainable community development programmes and projects by investing in skills development and agricultural training. Once the communities' access is restored, they will have the skills and the knowledge to enhance the productivity of the land through the implementation of new and innovative agricultural techniques.				
POST-MITIGATION				
Duration	Permanent (7)	As for pre-mitigation	Consequence: Highly beneficial (16)	Significance: Major - positive (112)
Extent	Local (3)	As for pre-mitigation		
Intensity x type of impact	Very high - positive (6)	By investing in skills development and agricultural training, once community access has been restored, they will have the skills and the knowledge to enhance the productivity of the land through the implementation of new and innovative agricultural techniques		
Probability	Certain (7)	This impact will be realised with the closure of the project		

8.3. Cumulative Impacts

Cumulative impacts are potential impacts arising from the influence of the Project combined with effects of known or anticipated future projects or actions. These are summarised in Table 8-93. Further details are provided in the specialist studies attached from Appendix E to Appendix V

Table 8-93: Cumulative Impacts

Environmental Aspect	Cumulative Impacts
Aquatics	The loss or alteration of water resources (source zone aquatic ecosystems that maintain high water quality for downslope aquatic systems when undisturbed), loss of interflow, and the resulting deterioration of the systems to provide necessary ecological services. Alterations to baseflow and surface water quantities and water qualities can be anticipated due to clean and dirty water separation. The cumulative deterioration (and disturbances) of the water resources and water quality deterioration is expected to result in the loss of sensitive aquatic biota and an overall decline in biotic integrity of the downstream watercourses. The expanses of the mining operation will contribute to the loss of water resources in selected areas. Following the implementation of appropriate mitigation, the cumulative impacts will serve as a Moderate (negative) risk significance rating. Furthermore, should seepage and spillage of mine residue (tailings and PAF materials from WRD) take place and be left unmitigated, further declines in biotic integrity and functioning of the systems can be expected with impacts expected in downstream river reaches within the region for decades. Proactive and reactive measures must be in place to deal with tailings spillages, to protect the biotic integrity of the receiving environment.
Surface Water	Farming activities (crop cultivation and animal grazing) as well as ASM actives occur within and around the area of interest. These activities will have the following cumulative impacts on surface water: • Water quality can be affected due to livestock as well as pesticides that will runoff into rivers during rainfall events; • Water quality will be affected by runoff from contaminated areas where there is extensive ASM taking place; and • Sedimentation and siltation will occur from both ASM and mining which can contribute towards streamflow reductions. • The proposed mitigations put forward in this report must be adhered to in order to limit the impacts of the Project and cumulative activities on the surface water resources.
Soils	The land potential within the AoI is characterised by high sensitivities. The largest part of the AoI is not impacted on by the current and historic ASM activities. Cumulatively the soil resources are largely affected by

Environmental Aspect	Cumulative Impacts
	subsistence farming which exposes soil resources to abnormal evaporation rates. Regardless, these impacts, cumulatively do not threaten the feasibility of the proposed Project. Emphasis should be on the proposed activities and the associated impacts, as these will result in a loss of soil resources and change the land capability from arable and grazing to wilderness, or no land capability where infrastructure and pits are proposed.
Wetlands	The majority of wetland systems identified within the AoI are characterised by “Seriously Modified” scores, which emphasise the impacts of current land uses on wetlands. These impacts are mostly associated with non-mining/non-ASM activities, in the form of Eucalyptus stands and cultivation. Even though a loss of wetlands is expected as a result of the proposed activities, the existing/cumulative impacts are likely to outweigh any future impacts if future impacts are mitigated according to the ESMP.
Terrestrial Ecology	The introduction of the Project at Ramula can have significant cumulative impacts on the local fauna and flora, exacerbating existing environmental pressures and further transforming the natural landscape. As the region is already experiencing the effects of ASM and current land use activities such as agriculture, the Project will compound these impacts, potentially leading to far-reaching consequences for biodiversity and ecosystem health. The opening of mining pits often leads to the destruction and fragmentation of natural habitats. This can result in the displacement or loss of local flora and fauna. The cumulative impact of numerous pit expansions exacerbates this habitat degradation. As mining operations expand, local communities may be displaced to accommodate these activities. The cumulative effect of pit expansions can lead to the displacement of numerous communities, disrupting their traditional livelihoods and cultural practices. The extraction and processing of ore can result in the release of contaminants and chemicals into nearby water bodies, causing water pollution. Cumulative impacts can significantly degrade water quality, affecting aquatic ecosystems and potentially posing health risks for local, as well as downstream, communities. The excavation and transportation of ore generate dust emissions, contributing to air pollution. As pit expansions occur across the region, the cumulative effect can lead to poor air quality, impacting the health of local residents and ecosystems. As mining operations expand, the demand for infrastructure such as roads, power, and housing also increases. This places added pressure on regional infrastructure development and services, which may struggle to keep pace with the rapid expansion of mining activities.

Environmental Aspect	Cumulative Impacts
	Communities in the Ramula often depend on mining for employment and livelihoods. The cumulative impacts of the Project can create economic dependence on the mining sector, making communities vulnerable to fluctuations in commodity prices and market demand.
Air Quality	Background measurement of PM10 and PM2.5 is ongoing at five monitoring locations: RA_AQM_001 to RA_AQM_005. These records were used to evaluate future cumulative impacts. The daily averages estimated were taken as the conservative background values, to which the model-predicted GLCs were added for the same locations (model prediction + the background). The final cumulative GLCs were above the WHO 24_daily guidelines for both PM10 and PM2.5 at all the receptors, except at RA_AQM_003. The background sources are contributing to the ambient levels, and these levels are high. Hence, the mine will have to ensure adequate mitigation measures are in place in order not to exacerbate ambient concentrations further.
Heritage	The Project will have a localised, and to some extent, regional cumulative effect on the cultural heritage resources of the area. The Project will result in excess dust generation, and to some degree, water pollution which both have the potential to impact cultural heritage sites (sacred ponds and forests). Other cumulative effects include the damage/destruction of cultural heritage sites of community and cultural importance from ongoing mining activities, as well as the destruction of graves/ grave sites.
Traffic	There are no latent development projects within close proximity of the Project site which would have cumulative impact effects on the study area intersection, road links and road safety elements.
Employment and Economic Development	Cumulative impacts in the area of employment and economic development are anticipated as a result of the mining project, alongside other existing and potential future developments. The creation of jobs through the mining project is expected to drive substantial economic development in both counties. Incremental benefits include increased local income through employment opportunities generated by the project. Additionally, the project is likely to enhance local procurement and supply chains, fostering the growth of local businesses. These combined factors are anticipated to contribute significantly to the economic upliftment of the community. The development of the project is also expected to place additional demand on local infrastructure, particularly in an area where good roads are scarce, and most people rely on walking or using bodabodas (motorcycle taxis) for transportation. The project could lead to long-term beneficial cumulative impacts through the upgrade of access roads. Improved roads, possibly widened and resurfaced, would significantly enhance the community's access to essential services, including

Environmental Aspect	Cumulative Impacts
	healthcare and markets, thereby supporting the broader economic benefits of the project. However, the cumulative influx of business and job seekers attracted by both the mining project and other developments in the area could lead to several negative impacts. This influx may result in the expansion of informal settlements, which could further strain the already limited local water supply. The increased demand for goods and services may lead to inflation, as local infrastructure struggles to keep up with the rising population. Moreover, certain populations could become more vulnerable, exacerbating social inequalities. Finally, the rapid growth of informal settlements and the associated population increase could lead to a rise in anti-social behaviours, challenging community safety and cohesion.
Increased Environmental Stressors Form Compounded Effects of Dust Emission, Groundwater Quality, and General Construction and Operational Activities on Community Health and Safety	Compounded effects of dust emissions, groundwater quality, and the physical reduction in habitat due to general construction and operational activities are likely to significantly impact community health and safety. The increase in environmental stressors in the local area may lead to several negative socio-economic consequences. Health-related problems are expected to rise, with a particular increase in waterborne and respiratory diseases due to deteriorating air and water quality. Access to clean water could be further reduced as surface water quality diminishes, exacerbating existing challenges. The loss of recreational areas due to habitat reduction will likely diminish the quality of life for local communities. Furthermore, the community's vulnerability to environmental changes will likely increase, placing additional stress on local populations. The heightened risks of accidents and injuries are also anticipated, stemming from ongoing construction and operational activities. Additionally, the loss of livelihoods is a concern, as reduced biodiversity impacts ecosystem services, such as agriculture, that local communities depend on. Agriculture is the major economic activity in the study area, the permanent and temporary loss of land could further exacerbate economic highlighting the need for comprehensive environmental and health management strategies to mitigate the adverse effects on the community and ensure long-term sustainability. It is therefore imperative that the recommended comprehensive mitigation measures in this report must be implemented to ensure negative impacts to the communities affected by Ramula-Mwibona’s operations are minimised and positive impacts are enhanced.
Groundwater	Impact associated with gold mining include drawdown of the aquifer and contamination of the groundwater resource. Dewatering of the ASGM operations will have localized impacts and therefore cumulative dewatering impacts would be negligible. The main cumulative impact would be

Environmental Aspect	Cumulative Impacts
	contamination of the Yala and Awachi Rivers. Both these rivers flow into Lake Victoria, which may also receive cumulative impacts from operations located within the other LVG areas

8.4. Unplanned and Low Risk Events

While the planned activities will have known impacts as discussed in Sections above, unplanned events may still occur, necessitating mitigation and management. To minimize attendant risks and ensure appropriate action in the event of an unplanned accident, robust project design, management, monitoring, and emergency preparedness and response procedures and training are essential.

Table 8-94Table 8-91 below provides a summary of the identified activities that may pose a risk. Important to note not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases

Table 8-94: Unplanned Events and Associated Mitigation Measures

Risk	Mitigation Measures
Hazardous substance spillage from pipelines, waste management facilities or stockpiles as well as hydrocarbon spillage from vehicles and machinery	• If a spill occurs it is to be cleaned up and treated (Drizit spill kit/ oil or chemical spill kit) immediately and reported to the appropriate authorities; • Pipes, if installed, (carrying sewage) must be checked regularly for leaks; • Ensure emergency response plans are in place; • Contractors must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site; • All machines are to be serviced and refuelled in demarcated bunded areas, workshops or at appropriate off-site locations; • Contaminated soils must be disposed of in an appropriate and licensed Waste Land Facility to avoid indirect contamination of downstream wetland areas; • Stockpiles should be maintained regularly to ensure stability, preventing erosion or runoff, and controlling vegetation growth. Maintenance activities also include monitoring for signs of instability, such as cracks or movement, and taking appropriate measures to prevent accidents or hazards.
Erosion from the surface infrastructure.	• Ensure proper stormwater management, including culverts and road design; • Monitor erosion; • Maintain infrastructure; and • Install silt traps, re-vegetate the area after construction and ensure proper slopes (avoid water ponding and steep slopes).
Stakeholder dissatisfaction with the resettlement process and/or other social impacts.	• Proactive and continuous engagement with stakeholders (through the framework of SGKL SEP) to explain rationale behind decision making.

Risk	Mitigation Measures
	• Continued implementation of the grievance mechanism to give stakeholders a platform for voicing concerns and having these addressed in a timely and transparent manner.
Increased antisocial behaviours associated with presence of mine followers such as prostitution, illegal gambling, illegal shebeens, drug uses, etc.	• Collaborate with the relevant government offices and partners to manage the increase in antisocial behaviours.
Infrastructure malfunction leading towards dirty water spillage or spontaneous combustion	• All infrastructure, machinery and associated setups are to be serviced and checked throughout the project life cycle; • All staff are to be informed about potential hazards and consequently prepared for malfunctioning; • Protocols are to be induced at every phase of the project life cycle; and • If such hazards were to incur, the appropriate authorities are to be notified and the incident recorded.
Erosion from the surface infrastructure.	• Ensure proper stormwater management measures are in place, including culverts and road design; • Monitor erosion; • Maintain infrastructure; and • Install silt traps, re-vegetate the area after construction and ensure a stable topography (avoid water ponding and steep slopes).
Blockage/breaches of storm water structures Spills / leaks from pipelines; and	• Frequent inspection of stormwater infrastructure and wastewater storage dams (e.g., return water dam) to ensure that it is regularly maintained and to identify concerns regarding the breach, failure, overflow or seepages;

Risk	Mitigation Measures
Excessive flooding from waste storage dams	• Ensure that there is an emergency response plan and spill kits should be in place and accessible to the responsible monitoring team in case of pipeline bursts, dam spillages, breaches or failure accidents; and • Water containment infrastructure should be far away from water courses.
Siltation and sedimentation of watercourses.	• Install silt fences and erosion blankets prior to soil stabilisation on steep surfaces to reduce the potential of erosion prior to vegetation.
Accidental exposure of previously unidentified heritage resources during the Construction Phase.	• Undertake a verification survey of the final development footprint prior to construction, where changes have been made to the infrastructure layout. • Develop CFPs for implementation during the Construction Phase of the Project.
Accidental exposure of *in situ* burial grounds or graves during the implementation of the Project.	• Undertake a verification survey of the final development footprint prior to construction. • Promote continuous consultation with the affected communities throughout the life of the Project. • Implement the CFP
Erosion from the surface infrastructure.	• Ensure proper stormwater management measures are in place, including culverts and road design. • Monitor erosion. • Maintain infrastructure. • Install silt traps, re-vegetate the area after construction and ensure a stable topography (avoid water ponding and steep slopes).
Impoundment, TSF and WRD failure	• Dam walls and TSF infrastructure must be designed and constructed to withstand a 1:100 year precipitation event (flood event).

Risk	Mitigation Measures
	• A stormwater management plan must be compiled and implemented for the impoundments, to protect the impoundment walls. • Vegetate and maintain all exposed impoundment walls to prevent erosion. First signs of erosion must be remedied and revegetated immediately. • Routine inspections as well as structural integrity assessments of the infrastructure should be done as often as practically possible (at least monthly).

9. Environmental and Social Management Plan

This section describes the mitigation and monitoring measures that will be carried out throughout the Project to mitigate the impacts and enhance the benefits discussed in Chapter 8

9.1. Environmental Management Plan Description

The Project Environmental and Social Management Plan (ESMP) outlines the specific actions that will be undertaken to ensure that the Project complies with all applicable laws and regulations related to environmental impacts and impact mitigation. The ESMP deals with all mitigation required for the physical, biological and socio-economic impacts and focuses on the impacts of higher significance.

The ESMP applies to, and will be implemented throughout, all phases of the Project: construction, operation, closure (temporary or final), and post-closure.

9.1.1. Objectives and Approach

The objective of the ESMP is to set out clearly the key components of environmental and socio-economic management for the Project and thereby ensure that the following concepts are realized throughout the construction, operation, closure and post-closure phases of the Project:

- Negative impacts on the physical, biological and socio-economic environments are mitigated;
- Benefits that will arise from the development of the Project are enhanced;
- Compliance with Kenyan legislation and consistency with international guidelines and best practice is achieved;
- Development programs are identified and implemented with the active involvement of the community and sustainable outcomes are achieved; and
- Good will and good relations with communities, civil society and governments at local and national levels are maintained.

The Project will endeavour to ensure that resources are available to implement the ESMP throughout all phases of Project development and closure.

9.1.2. Guidance Materials

Education and training of employees, contractors and others will be undertaken to ensure a high level of awareness of environmental management plan objectives and individual responsibilities. The following site-specific plans will be developed for the Project to complement the ESMP:

- Emergency preparedness and response plan;

- Environmental training manual for employees, contractors and visitors;
- Air resource management plan;
- noise and vibration management plan;
- Water resources management plan,
- Materials and waste management plan;
- Flora and fauna resource management plan;
- Mine Closure plan; and
- A process to support community development.

9.2. Environmental Management Plan Administration

9.2.1. Organization

The Project will establish an organizational structure with clearly defined lines of authority, areas of responsibility and accountability. The proposed management organization chart for the Project is presented in Figure 9-1. The Ramula-Mwibona Project will establish an Environment Department with the primary responsibility of implementing the environmental components of the ESMP. Also, a Community Development Group (CDG) will be established within the Community Development Department, responsible for overseeing and implementing the socio-economic components of the ESMP.

The ESMP is a tool utilised to ensure the mitigation and optimisation measures are effectively implemented and that any unforeseen or unidentified impacts of the Project are detected and addressed. To this end, the overarching objectives of the ESMP are as follows:

- Consolidate the management measures identified during the ESIA Process;
- Ensure effective implementation of the management measures, to minimise negative impacts and enhance positive impacts throughout the Project;
- Outline the roles and responsibilities for implementation of the identified management measures; and
- Ensure appropriate monitoring of the effectiveness of the management measures to implement corrective measures, if necessary

9.2.1.1. Environmental Department

The Project Environment Department will be led by a qualified environmental manager who will be an active member of the Project management team. The environmental manager will report to the Project Manager and assume responsibility for environmental management, mitigation and monitoring through all phases of the Project life cycle.

The environmental manager's primary responsibilities will be to ensure that all Project activities comply with applicable environmental regulations; that ESMP commitments are honoured and that qualified expertise is provided in a coordinated manner to all Project departments.

Other responsibilities of the environmental manager will include:

- Develop Environmental Management Systems.
- Supervising Environment Department staff, including consultants and contractors;
- Ensuring that both general and specific environmental training is provided to employees, contractors and visitors;
- Contributing to ensuring that emergency response teams are prepared to respond to environmental emergencies;
- Ensuring that environmental monitoring programs are carried out on schedule and correctly;
- Ensuring that environmental data is reviewed and, if necessary, appropriate corrective action is implemented;
- Ensuring that routine site inspections are conducted to assess the proper functioning of environmental management systems;
- Advising appropriate regulatory authorities in a timely fashion of the occurrence of significant environmental incidents such as spills or exceedances of applicable regulatory standards;
- Reviewing opportunities for water conservation and reuse;
- Ensuring that disturbed areas are rehabilitated as soon as practicable and that, if necessary, revegetation studies/ trials are conducted;
- Establishing and maintaining dialogue with appropriate regulatory authorities regarding environmental management;
- Reporting on a monthly, quarterly, and annual basis to the Project manager and Company's environmental management reporting requirements, as appropriate, regarding environmental management activities; and
- Preparing on an annual basis a comprehensive report detailing environmental management activity for distribution to the NEMA as required.

The Environmental Manager and subordinates/ assistants, will be hired before any construction activity is initiated.

9.2.1.2. Community Development and Relations Management

A qualified community development and relations manager will be engaged and report to the Project General Manager. With the support of community development assistants and appropriately qualified external resources, the community development and relations manager will be responsible for implementing socio-economic impact mitigation and benefit enhancement measures.

The community development and relations manager primary responsibilities will be to ensure that all socio-economic components of the EMP are honoured and that qualified expertise and support is provided as necessary to other Project departments.

Other responsibilities of the community development and relations manager will include:

- supervising Community Development Department staff, consultants and contractors;
- ensuring that both general and specific cross-cultural training is provided as necessary to employees, contractors and visitors;
- managing the consultation process and the grievance and dispute resolution mechanism, including maintaining consultation and grievance and dispute resolution databases;
- working with other project staff to implement measures expected to enhance the uptake of Project economic opportunities by people in the vicinity of the Project Area;
- working with the Environmental Department to implement measures intended to mitigate natural resource effects on people's livelihood resources;
- managing the planning and implementation of community level initiatives, including a community health program and a process to support community development;
- working with the Environmental Department to implement environment-related public education and training programs;
- ensuring that socio-economic monitoring programs are carried out on schedule and correctly, including the establishment and maintenance of a socio-economic database;
- ensuring that all the above activities are carried out in a coordinated and complimentary way with the activities of the group responsible for implementing resettlement planning.
- reporting on a monthly, quarterly, and annual basis to the Project manager regarding socio-economic management activities; and
- preparing on an annual basis a comprehensive report detailing socio-economic management activity for inclusion in EMP reporting to relevant ministry.

The community development and relations manager and subordinates will be hired before any construction activity is initiated.

9.2.2. Project Phases and Resources

SGKL will ensure the availability of the human and financial resources needed to conduct all environmental management, mitigation and monitoring activities throughout the construction, operation, closure and post-closure phases of the Project, including socio-economic impact and benefit management and monitoring. This will include the investment of capital, primarily during construction, to ensure that environmental monitoring and mitigation measures (e.g., pollution control equipment) are integrated into Project components. This will also include providing the resources needed to implement the Closure Plan and to discharge all post-closure long-term care and maintenance obligations.

This sections presents the ESMP for the Project along with additional supporting plans considered necessary for the management of environmental and social impacts identified in Chapter 8. The aim of the ESMP is to assist in delivering the intended environmental and social outcomes during the construction, operations, and closure and decommissioning phases of the Project.

9.3. Approach to ESMP

The ESMP has been compiled considering the following principles:

- **The precautionary principle**, which holds that, wherever there is doubt about the impacts an activity may have on the environment, precautionary measures should be taken, even if cause and effect relationships have not been established scientifically. Mitigation measures have been prescribed based on the scientific quantification of the identified potential impacts, as well as unplanned and low risk events.
- **The mitigation hierarchy** is listed as the primary objective in IFC PS 1 which stipulates “To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.” (Figure 9-1). The mitigation measures included in the ESMP aim to prevent the occurrence of identified potential impacts. Where impacts cannot be prevented, mitigation measures are prescribed with the intention of minimise/ reducing the significance of these impact.

Figure 9-1: The Mitigation Hierarchy as defined by the IFC

Table 9-1: The different Levels of the Mitigation Hierarchy Defined

Avoidance (or Prevention)	If impacts on the natural environment can be avoided, this is the best possible way of reducing impacts. Avoidance involves considering other options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, mining should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation.
Minimization	If impacts cannot be avoided, it is important that these are minimized. Minimization refers to optimising project location, siting, scale, layout, technology and phasing to reduce the footprint of the development on biodiversity, associated ecosystem services and people as far as possible.
Restoration (or Rehabilitation)	If there are still residual impacts, restoration or rehabilitation may be employed to increase the biodiversity value and/ or return impacted areas to near natural state (or an agreed post-development land-use after development activities). Rehabilitation may, however, fall short of replicating the diversity and complexity of natural systems
Offset (or Compensation)	If residual impacts remain after all efforts to avoid, minimize and restore have been taken into consideration, offsets may be needed. These include the setting aside of areas as corridors and conservation areas, either within the mining lease area or in other areas for conservation. Offsets are difficult to determine and manage, and a separate study is often needed in order to identify the best options and those which compensate identical (or as close as possible) biodiversity to that which was impacted by the development.

9.4. Management of Compliance of the ESMP

9.4.1. Personnel Responsible for the Implementation of the ESMP

All SGKL employees, contractors and their associated personnel have a responsibility to ensuring good environmental performance is upheld during the undertaking of their duties. Ultimately, the General Manager (GM) of the mine will be responsible for ensuring implementation of the ESMP with specific personnel responsible for environmental and social performance management. Typical duties and responsibilities of such personnel will include, but is not limited to:

- Ensure that environmental monitoring programs are carried out on schedule and correctly;
- Review environmental data and recommend appropriate actions;
- Monitor environmental compliance of all mine operations;

- Train others in the team and general personnel on mine environmental and social issues;
- Design and manage procedures for day-to-day environmental management;
- Establish, train and ensure readiness of the emergency response situations;
- Provide technical and environmental support to mining operations; and
- Periodically review the existing monitoring system and design.

9.4.2. Competence, Training and Awareness

Comprehensive awareness and training to inform employees and contractors of environmental risks which may result from the operations must continue to be undertaken. In general, the purpose of implementing an Environmental Awareness Plan is to optimise the awareness of those partaking in the mining and related activities which have the potential to impact negatively on the environment and in doing so, promote the global goal of sustainable development.

The awareness training of employees, supervisors, contractors and visitors ensures that co-operation in terms of environmental management will occur. This contributes to the successful implementation of the conditions set out in the ESMP and thus to the environmental sustainability of the Project.

9.4.3. Consultation and Disclosure

SGKL will hold regular meetings with the surrounding local communities including the administrative authorities, the ward and county and sub-county authorities, to discuss and address environmental, socio-economic and other issues where necessary. At national level, SGKL will meet with government agencies including those responsible for mining, industry, environment, water, OSHA and others where need arise. During the meetings, provision of general operation updates, environmental issues will be discussed, and decisions made regarding specific follow-up and/or corrective actions required

9.4.4. Rehabilitation Plan

As part of the ESIA, a conceptual Mine Closure Plan (MCP) has been prepared in line with the Kenyan's regulatory guidelines and relevant international standards (as summarised in chapter 12). As such, the proposed rehabilitation and closure inputs will be updated into the annual closure costing updates and into the overall MCP for the operation. Indicatively, the MCP comprises a series of activities which are scheduled including but not limited to: Shaping/ re-profiling of land portion, topsoil and laterite hauling and spreading, cross-ripping of the area through contour cutting to reduce water flow rate; and re-vegetation.

The Rehabilitation Plan will be based on the philosophy of continuous rehabilitation which forms part of the "MCP" and implemented through consultations with local authorities and relevant management authorities regarding this project

9.4.5. Environmental Audit Procedures

Auditing of the ESMP is imperative to ensure that the activities are undertaken in accordance with the objectives and commitments which have been set out. Audit should thus be undertaken periodically (recommended at least annually) to ensure the outcomes are being met.

Auditing against the ESMP also assists in reviewing the relevance of the ESMP as the operation progression and prompts improvements where required. ESMP audits will be well documented, and their outcomes communicated to all relevant personnel. Environmental auditing will seek to undertake the following, as a minimum:

- Review the relevant environmental legislation on health and safety, sustainable use of natural resources, and environmental management;
- Review applicable national standards and guidelines;
- Verify the level of compliance with the environmental management plan, as well as conditions of the Environmental Certificate and relevant permits;
- Review existing Project documentation related to all infrastructural facilities and design;
- Evaluate monitoring programs, parameters, and procedures in place for control and corrective actions in case of emergencies;
- Examine records of incidents and accidents and determine the likelihood of the future occurrence of the incidents and accidents;
- Inspect all major mining infrastructure components, including the open pit, WRDs, HME workshop, paste plant and magazine, as well as buildings, stores, disposal sites, premises and yards, and record all significant environmental risks associated with these activities;
- Examine and seek views on health and safety issues from the Project employees, the local and other potentially affected communities;
- Prepare a list of health and environmental concerns of existing and on-going activities;
- Prepare an audit report complete with photographic record and recommendation; and
- The final audit report, together with monitoring data for the preceding year, will be distributed to the relevant authorities.

9.5. Emergency Preparedness Response

SGKL will draft and maintain an Emergency Preparedness and Response Plan (EPRP) for the Project. The EPRP serves as a functional and effective tool to manage any hazards that might occur throughout the LoM. The components of EPRP cover the following:

- Emergencies and Accident;
- Injuries;
- Medical Emergency;
- Emergency Response Policy;
- Delegation of Responsibilities;
- Mine Rescue Equipment; and
- Mutual Agreement.

Personnel will be designated and trained to implement the Emergency Preparedness and Response Plan (EPRP) in reaction to on-site and off-site accidental releases, or other environmental emergencies that may occur. In addition to a designated incident commander and emergency response team members, other key staff involved in the implementation of the EPRP will include operations, environmental, ore processing plant, safety and security supervisory personnel. As well, contractors performing work Ramula-Mwibona Project will be appropriately trained and have ready access to equipment and supplies that would allow them to contain and control any accidental release until the arrival of an emergency response team.

9.6. Environmental and Social Management Plan

The environmental and social management measures required for the Project are presented in Table 9-2 (Construction phase), Table 9-3 (Operational phase) and Table 9-4 (Decommissioning, Rehabilitation and Closure phase) below. The prescribed measures have been informed by the Impact Assessment (Chapter 8, concerns and issues raised by stakeholders (Chapter 6) as well as existing environmental and socio-economic management structures currently being implemented at the SGKL.

Table 9-2: Construction phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
' Site/vegetation clearance for the placement of the main infrastructure including TSF, WRDs, Ramula Open Pit, processing plant and associated facilities, administration unit and camp area, ore stockpile and the HME workshop	Soil Resources	Loss of soil resource on bare surfaces and soil erosion Change of land use in the proposed Ramula-Mwibona mining area and loss of land capability (arable and grazeland to industrial)	Project footprint	• Minimise the footprint of disturbance as far as practicable. Demarcate the proposed areas for land clearance and earthworks to minimise unnecessary expansion of the footprint of disturbance; • Restrict movement of vehicles and machinery to designated haul and access roads, as far as practicable; • Rehabilitate disturbed areas (ripping soils and seeding) upon completion of construction activities; • Strip and store topsoil for future site rehabilitation activities; • Install silt fences, and erosion blankets prior to soil stabilisation on steep surfaces to reduce the chances of erosion; • As far as practicable, topsoil must be stripped when the soil is dry so as to reduce compaction as soils that are stripped when saturated are more likely to become compacted; • Maximise land clearance and earthwork activities during the dry period when proximal watercourses are dry and risk of erosion by water is limited; • Ensure topsoil stockpile areas are appropriately managed to maintain the quality of the topsoil (e.g., vegetating); • Clear and stockpile topsoil separately from subsoil/ fill material for use during rehabilitation; • Install sediment and erosion control measures around the construction areas to minimise erosion potential; • Carry out regular inspections for visual signs of erosion and implement appropriate remedial actions; and • Implement measures to minimise dust generation from exposed surfaces.	Soil stripping and stockpiling in accordance with Soil Management Guidelines; and Erosion Management Plan	Upon commencement and throughout the construction phase
	Surface water	Sedimentation and siltation of surface water resources reduce the flow regime within the streams and their tributaries.	Local Catchment	• Control fluvial erosion and sedimentation by establishing a stormwater management plan and carrying out regular inspections for visual signs of erosion • The surface water monitoring plans should be implemented at the start of the construction phase; • If possible, construction should take place during the dry season to reduce sedimentation of watercourses; • The proposed infrastructure and construction activities, including the movement of vehicles, should be confined within the footprint areas to minimise disturbance of soils and the probability of sedimentation and siltation of watercourses; • Implement a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses to ensure that the velocity of water flowing downslope is reduced; • Remedy through re-profiling disturbed channel geometry to try and mimic the natural river morphology; • The natural channel slopes should be maintained to limit or prevent increased flow velocity; • Establishment of a comprehensive water management plan to minimise downstream impacts;	Control by implementing proposed stormwater management plan and Monitoring of water quality to minimise impacts on the environment	During the construction phase
	Aquatics	Direct loss, potential fragmentation, and degradation of vegetation and topsoil, resulting in increased erosion events and subsequent sedimentation of	Local Catchment	• Natural flow regimes must be emulated as much as practically possible throughout the Construction Phase or prior to mining to facilitate both hydrological and biological connectivity within the associated watercourses. Supporting infrastructures to the Project must not hinder or alter flow within the associated aquatic environments. • Construction activities should be planned to occur during the dry periods of the study area. • Effective storm water management measures have been proposed, aiming to minimise direct surface inflow to the pits and associated infrastructure through storm water control systems such as using	Control by implementing proposed stormwater management plan and Monitoring of water quality to minimise impacts on the environment	During the construction phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
		receiving aquatic environments.		diversion trenches, berms, and the basic measure of constructing haul roads with cambering to divert storm water. However, this principals can be applied during construction at infrastructure areas in close proximity to riverine habitat lo reduce runoff from the construction footprint/s and into the associated river systems. These systems should be established prior to additional construction activities. • Implement efficient soil management measures and facilitated re-vegetation using securing mats, pegs (and/or mesh), to reduce extent of exposed soils within the construction areas and any bare areas between the construction footprint/s and river systems. • Limiting sedimentation during construction of the diversions will be a difficult task as the activities are expected to take place directly within the channel of the associated river systems. Focus should be paid on causing minimal disturbance to the associated banks and substrate during construction. • Heavy machinery should use single access routes wherever possible. • Routine maintenance checks on the access routes, river banks and adjacent landscape/s should be an on-going exercise to monitor for signs of erosion. Additional measures will need to be taken following identification of further erosion.		
	Terrestrial Biodiversity, Wetlands	AIP proliferation	Project footprint	• An AIP management plan should be developed, implemented and managed for the life of the proposed phases and should form part of the management plan; • AIPs identified must be removed timeously (preferably as seedlings before they reach seed-bearing age); • During removal of vegetation, key monitoring methods should be focused on the prevention of AIP proliferation during the construction and operational phase. Measures must be in place to prevent the spread of AIPs.	Project design (i.e., minimised footprint of disturbance); Erosion Management Plan; Alien Invasive Management Plan;	Life of Construction Phase
		Loss and displacement of terrestrial and wetland habitats		• Clearance must be limited to the required footprint to avoid unnecessary clearing of vegetation. Fragmented areas requiring rehabilitation should be revegetated with suitable indigenous plant species preferably with economic value (where possible) as determined by a qualified botanist; • Large trees that can be left in-situ should be avoided and maintained where possible; • Loss of biodiversity must be managed in accordance with the established Biodiversity Action Plan (BAP) as such SGKL is required to develop a standalone BAP for the Ramula- Mwibona Project area.; • Environmental officer/supervisor must be present during vegetation clearing to prevent unnecessary clearing of extensive areas not within the Project exclusion zone and demarcated footprint area; and • Areas of increased ecological sensitivity should be designated as “No-Go” areas and be off-limits to all unauthorized vehicles and personnel; • No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the footprint and access roads; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction; • Floral and faunal SCC located in areas of development should be marked/identified prior to commencement of construction. Necessary permits for relocations of protected species must be obtained from the relevant government department and approved by authorities. Sourcing representative and indigenous flora to rehabilitate the area, local nurseries and contractors should be contracted to supply the saplings and seed mixes;		
	Air Quality	Poor air quality due to the generation of dust	Local area	• Implement localised / activity specific surface watering to minimise emissions; • Apply dust suppressants on exposed surface areas and the haul roads, where practicable;	Ambient air quality monitoring and control through	Upon commencement and throughout

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Limit high dust-generating activities (i.e. land clearing with bulldozers) to periods of low wind where possible (wind speed less than 5.4 m/s); • Set maximum speed limits on site and have these limits enforced; • Minimise the footprint of disturbance as far as practicable; and • Minimise the drop heights when loading onto trucks and at tipping points.	implementation of air quality management plan	the construction phase
	Socio-economic	Physical and economic displacement caused by the extension of the security fence to accommodate additional infrastructure.		• Develop and implement a Resettlement Action Plan (RAP) in accordance with the Resettlement Policy Framework (RPF) developed for SGKL as part of the Ramula- Mwibona Project which is being developed against Kenyan legislative requirements and GIIP (i.e., IFC PS 5). This includes ensuring that all housing and basic socio-economic infrastructure as well as other assessment are compensated for equal or better value; • Detailed social surveys must be carried out to quantify displacement of 100% of affected households and an inventory of 100% of the assets of all affected parties; • Any grave relocation which is require must be undertaken in accordance with best practice principles; and • Develop and implement a Livelihood Restoration Plan (LRP) as part of the RAP, which indicates how the displacement of agricultural areas, crops, trees of economic importance, ASM sites and any other assets related to livelihood will be compensated for equal or better value.		
		In-flux of Jobseekers	Local area	• Develop and implement an Influx Management Plan (IMP), which considers appropriate objectives and interventions for influx management, incl. public consultation and monitoring methods; • Develop and implement a community-wide sensitization program to address potential grievances and conflicts arising from the influx of new residents; • Develop and implement Security Management Plan (SMP) to effectively monitor, mitigate and manage security risks • Conduct ongoing stakeholder engagements with local communities to foster peaceful coexistence and provide a clear grievance redress mechanism; • Enhance local infrastructure and social services to accommodate the increased population and mitigate strain on existing resources; • Increase capacity for healthcare services, particularly to address potential rises in communicable diseases; • Strengthen security measures to address potential issues of insecurity arising from the establishment of new residences; • Develop and promote health and safety programs focused on preventing the spread of communicable diseases, including regular health screenings and awareness campaigns.	Local Procurement Plan	Throughout the construction phase and on-going
		Wage-based Livelihoods	Local area	• Work Certificates or Certificates of Completion must be provided to local employees for the work and training undertaken; • Continue to implement the Stakeholder Engagement Plan and grievance mechanism • Develop the Local Employment Plan and prioritise employment and training of people living within the primary study area over outsiders especially for unskilled and semi-skilled positions; • Ensure local communities understand the project’s employment requirements in terms of skills and type of employment;	• SEP • Local Employment Plan	Throughout the construction phase and on-going

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Require subcontractors used for construction activities to recruit in accordance with the SGKL's recruitment policy and plan (i.e., through contractual obligations); and • Develop and maintain a candidate database for the local communities in collaboration with existing governance structures.		
		Training and Skills Development	Local area	• Prioritise training and capacity development for the least qualified workforce members. The training initiatives should consider the levels of education of the targeted workforce and the areas of interest; • Conduct a Workforce Skills Audit to better understand the current skills of the individuals and experience to identify gaps and propose programs to fill those gaps; • Using the information sourced from the audit, develop and implement the Multi-Skilled Workforce program focusing on ensuring that the workforce members receive the training required. As part of the program: • Ensure that time is set aside for each employee participating in the program to receive required on-the-job training; • Set achievable monitoring targets for each employee participating in the program to enable HR and team supervisors to track progress; and • All workers who participate and complete the program must receive certificates of completion.	• Local Employment Plan • Grievance Mechanism	Throughout the construction phase and on-going
		Social Differentiation	Local area	• Implementing a community-wide sensitization program that addresses the potential for jealousy, grievances and conflicts arising in the community; • Establish ongoing stakeholder engagements to promote peaceful co-existence and ensure access to a grievance redress mechanism; • Set up a community-based conflict resolution and mediation committee with respected members from various backgrounds to address disputes; • Implement strict policies and awareness programs to prevent gender-based violence, domestic violence, and sexual violence; • Partner with local NGOs to provide support services, including counselling and legal assistance for victims of violence; and • Monitor and control alcohol and substance use among workers to mitigate risks of violence.	• Local Employment Plan • Grievance Mechanism	Throughout the construction phase and on-going
		Demolition of Structures and Environmental Clearance	Local area	• Develop and implement an Influx Management Plan (IMP), which considers appropriate objectives and interventions for influx management, incl. public consultation and monitoring methods; • Develop and implement a community-wide sensitization program to address potential grievances and conflicts arising from the influx of new residents; • Develop and implement Security Management Plan (SMP) to effectively monitor, mitigate and manage security risks • Conduct ongoing stakeholder engagements with local communities to foster peaceful coexistence and provide a clear grievance redress mechanism; • Enhance local infrastructure and social services to accommodate the increased population and mitigate strain on existing resources; • Increase capacity for healthcare services, particularly to address potential rises in communicable diseases; • Strengthen security measures to address potential issues of insecurity arising from the establishment of new residences;	Influx Management Plan	Throughout the construction phase and on-going

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Develop and promote health and safety programs focused on preventing the spread of communicable diseases, including regular health screenings and awareness campaigns.		
		In-flux of Jobseekers	Local area	• Develop and implement a Local Procurement Plan; • Ensure that the policy or plan sets out guidance on targets for local businesses used by the Project and that these are monitored accordingly; • Adaptation of Project procurement documents to suit local businesses as far as possible within the standards required of the Project; • Provision of incentives for Project contractors to purchase locally and partner with local businesses, including tender requirements regarding local procurement; • Promotion of joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • •Partner with relevant organisations where available and appropriate (e.g., government agencies, civil society, and NGOs) to provide access for local businesses to finance and advisory services to develop their capacity to competitively supply to the Project • Empowerment of women in business opportunities; • Consider provision of loan to small registered groups within the villages with affordable interest; • Provide training to locals on entrepreneurship. • Implementation of the SGKL grievance procedure.	• Local Procurement Plan • SEP • Grievance Mechanism	Throughout the Project life
		Local Livelihood and Economic Growth	Local area	• Integration of SGKL Corporate OH&S policies, plans and procedures in Construction Environmental and Social Management Plan for occupational health and safety; • Establishment and implementation of the construction Health, Safety and Environment (HSE) Plan throughout the Project construction phase; • Strict task-based risk assessment before commencement of works; • Provision of HSE induction and periodic safety meetings and refresher training sessions for all construction labour; • Provision of appropriate Personal Protective Equipment (PPE) and safety measures to safeguard workers from hazards; • Regular assessment and addressing any potential hazards on the construction site; • Clearly define and communicate to employees, contractors, visitors, and suppliers (at each level) their responsibilities with respect to OH&S; • Ensure the participation and consultation of workers, and their representatives (when applicable) in the decision-making process for OH&S matters; • Routinely monitor and review the OH&S management systems and set performance objectives at all levels and functions to ensure continuous improvement with our operations. • Proper fencing, lighting, and security personnel should be employed at project sites to deter criminal activity and protect both workers and equipment. • Employees should be briefed on local security risks, including crime hotspots, and provided with safe transportation options, particularly for late-night shifts. • The project team should collaborate with local police stations to ensure heightened security patrols around the project area, particularly during periods of heightened criminal activity.	• SEP • Grievance Management • Construction HSE Plan (in alignment with the corporate-level Occupational Health and Safety Policy) • Personal Protective Equipment (PPE) and Clothing Procedure • Security Management Plan • Human Rights	Throughout the project lifecycle

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• An internal security monitoring system should be put in place to promptly address any incidents or threats to workers' safety. • Develop and implement a Security Management Plan (SMP) specifically designed to safeguard workers and project assets from local crime risks.	Management Plan	
	Topography and Visual Amenity	Alteration of the natural visual character, changing its baseline sense of place	Local area	• Limit the removal of vegetation to the infrastructure footprint to take advantage of the vegetation screening effect. • Implement a dust suppression programme. • Where practical, locate Project related infrastructure in the valley to take advantage of the screening effect of topography. • Use of neutral colours so that infrastructure blends in with the natural environment. • Concurrent rehabilitation of prominent features such as TSF and WRD to minimise the visual exposure of the features	Control - through the implementation of mitigation and management actions.	Upon commencement of the construction phase.
	Cultural and Archaeological Heritage	• Exposure of sub-surface sites, materials, and artefacts. • Restricted or loss of access to cultural heritage sites.	Local area	• Heritage Management Procedures • Application of local, regional and national legislation, regulations, planning and align with IFC Performance Standard 8 on cultural heritage for managing and mitigating impact on cultural heritage resources, i.e., both tangible and intangible cultural heritage resources • Implementation and monitoring of a CHMP for the identified cultural heritage resources, in consultation with relevant communities, based on the outcomes of cultural heritage risk assessments, to document the identified risks, impacts and preventative measures. • Implement a CFP as part of the CHMP to describe the actions required in the event of a chance find; • Monitor implementation of the CHMP and CFP, and any related plans and procedures to mitigate against impact on cultural heritage resources • Ensure that personnel involved in ground disturbance activities are trained to comply and work in accordance with the CHMP and CFP. • Safeguard against dust pollution to known cultural heritage resources • Ensure all activities are undertaken within approved areas of the Project; • Monitoring of demarcated areas or sites left in situ; and implement required consultation and permitting processes for the possible exhumation and relocation of human remains if encountered and avoidance is not possible.	Implementation of IFC SP 8, interpreted with Kenyan local, regional and national policies and legislation on cultural heritage.	Before and during Project construction activities.
General construction activities including use of vehicles and machinery as well as storage and handling of waste and hazardous material.	Aquatics, Surface water, terrestrial biodiversity, groundwater, Wetlands	Water contamination from spillages/ leaks of hydrocarbons from vehicles and heavy machinery or hazardous material or waste storage facilities.	Local area	• The water management strategy can reduce the contaminated runoff from entering the associated aquatic environments from the construction's sites. This is applicable with the major supporting infrastructures (e.g. magazine, stockpiles and WRD's); • Implement a clean and dirty water separation system around the stockpile areas and the WRDs to prevent contamination of topsoil and/or surrounding watercourses. Trenches can be constructed prior to additional construction events to capture potential runoff from the sites in close proximity to watercourses. • Ensure correct storage of construction chemicals on site as per the specific chemical's storage requirements. • Ensure there are trained staff on site able to apply and use appropriate spill kits. If any hydrocarbons and hazardous materials are stored at the construction site, these must be stored in bunded areas or properly sealed containers;	Implementation of Environmental Response Plan; and Waste Management Plan	

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Vehicles and heavy machinery must be re-fueled, serviced and checked at the established workshops in a demarcated bunded area; • Hydrocarbon spill kits must be available at the construction site where hydrocarbon spills could take place; and • If a considerable amount of fluid is accidentally spilled, the contaminated soil must be scraped off and disposed of appropriately. The excavation must be backfilled with uncontaminated soil.		
	Soil resources and Terrestrial biodiversity	Displacement and fatalities of fauna due to road kills, Increasing vehicle movement increasing soil compaction, habitat disturbance	Project footprint	• Make use of and upgrade existing roads to encourage minimal impacts/footprint to the Project area, this would limit the impacts proposed from the construction of the access roads and the preferred river diversion option; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction, • Monitor infrastructure to ensure no runoff, erosion, preferential flow paths and sedimentation; • If any erosion occurs on site and adjacent to the Project area, corrective actions and restoration (backfilling, erosion berms, culverts, silt traps) must be taken to minimise any further erosion from taking place; • Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility	Modify, remedy, control, or stop Concurrent rehabilitation through the life of mine	Upon commencement and throughout the construction phase
	Noise	Noise will emanate from the machinery and vehicles operating	Local area	• Construction activities should be restricted to daylight hours (6 am to 22 pm'); • Construction machinery and vehicles should be switched off when not in use; • Construction vehicles should have buzzer type reverse alarms (producing band-limited white noise) installed, rather than the conventional beeping type reverse alarms (which produce a tonal sound); • The mine should consider using the topsoil stockpile as a noise barrier for receivers that are closest to the mining activities; • Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the access and haul roads.	Noise control measures; and Noise monitoring.	Upon commencement of the construction phase
	Socio-economic	Community health and safety risks associated with additional movement of vehicles and heavy in the area to bring in construction material as well as potential increase in social ills associated with influx of job seekers.	Local area	• Access control must be maintained throughout the Construction Phase; • Personal Protective Equipment (PPE) must be worn by all staff and visitors to the Project area; • Stipulate and enforce speed limits on haul and access roads; • Limit construction activities to daytime hours, as far as practicable; • Continue to implement the Stakeholder Engagement Plan and grievance mechanism; and • Health and safety awareness campaigns should be carried out in the surrounding communities, focused on risks and consequences of unauthorised access to hazardous areas, anti-social behaviours etc.	OHS Plan; Stakeholder Engagement Plan; Recruitment Policies; RAP and LRP; and Development Initiatives.	Throughout Project life
		Increased noise and dust levels as well as visual intrusion causing a nuisance impact to nearby by receptors.	Local area	• Limit construction activities to daytime hours, as far as practicable; • Implement dust suppression measures to minimise dust generation from exposed surfaces; and • Any machinery used for construction activities must be switched-off when not in use to prevent unnecessary noise generation.		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
		Physical and economic displacement as a result of land acquisition within the proposed Project area.	Local area	• Develop and implement a Resettlement Action Plan (RAP) in accordance with Resettlement Policy Framework (RPF); • Detailed Social surveys must be carried out to quantify displacement of 100% of affected households and an inventory of 100% of the assets of all affected parties; • Any grave relocation which is required must be undertaken in accordance with best practice principles, including IFC PS 8; and • Develop and implement a Livelihood Restoration Plan (LRP) as part of the RAP, which indicates how the displacement of agricultural areas, crops, trees of economic importance and any other asset related to livelihood will be compensated for equal or better value.		
		Job opportunities for the execution of construction activities.	Local area	• Ensure local communities understand the project's employment requirements in terms of skills and type of employment; • Require subcontractors used for construction activities to recruit in accordance with the SGKL recruitment policy and plan (i.e., through contractual obligations); • Develop and maintain a candidate database for the local communities in collaboration with existing governance structures; • Maintain an employee database, including origin of employee, position, working hours, training received, wages/ benefits; • Provide appropriate training opportunities to employees and contractors; • Work Certificates or Certificates of Completion must be provided to local employees for the work and training undertaken; and • Continue to implement the Stakeholder Engagement Plan and grievance mechanism.		
Establishment of linear infrastructure (security fence, power lines, haul and access roads)	Soil Resources	Land Acquisition	Local area	• If the destruction of soils with a high sensitivity is unavoidable, the disturbance must be minimised and appropriately rehabilitated; • Land should be rehabilitated back to the pre-construction conditions or the preferred land capability of the local community (after consultation processes with the local community); and • All mine infrastructure and impacted areas should be rehabilitated to pre-construction conditions.		
	Terrestrial biodiversity	Direct loss of terrestrial and wetland habitats (inc. sensitive ecosystems), loss of flora and fauns SCC, displacement of fauna, AIP proliferation	Local area	• Wherever possible, surface infrastructure and vehicle movement should be placed outside wetlands to prevent impacts such as increased hardened surfaces, runoff, contamination, erosion and sedimentation; • All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off-limits to all unauthorised vehicles and personnel; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction; • If any erosion occurs on site and adjacent to the areas, corrective actions and restoration (backfilling, erosion berms, culverts, silt traps) must be taken to minimise any further erosion from taking place; The impact of loss of biodiversity must be managed in accordance with the established Biodiversity Action Plan (BAP) which needs to be developed; • An AIP management plan should be developed, implemented and managed for the life of the proposed phases and should form part of the management plan; • Ultimately where AIPs are identified, these plants must be removed timeously (preferably as seedlings before they reach seed-bearing age);		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Whilst the removal of vegetation is underway, key monitoring methods should be focused on the prevention of AIP proliferation during the construction and operational phase. Measures must be in place to prevent the spread of AIPs; • Make use of and upgrade existing roads to encourage minimal impacts/footprint to the Project Area, this would limit the impacts proposed from the construction of the access roads and the preferred river diversion option		
	Wetlands	Land acquisition in the exclusion zones and potential loss of ecosystem services		• Implement concurrent rehabilitation and restoration of wetlands and ecosystem services; • If the destruction of wetlands with high sensitivity is unavoidable, the disturbance must be minimised and appropriately rehabilitated; and • Wetlands should be rehabilitated and/ or Offset should be considered where not possible, to ensure appropriate ecosystem services lost during construction be reinstated.		
Reduced recharge from cleared footprints	Groundwater	Drawdown of the groundwater levels in the vicinity of the pits	Local area	• Keep vegetation clearance to the minimum required footprint required for the development of infrastructure; • Divert storm water runoff around and away from cleared footprints. Storm water collected in the contact water footprint must be directed to designated water storage facilities; and • Rehabilitate disturbed footprints at the earliest available opportunity.		

Table 9-3: Operational Phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
4) Ore mining, material handling (incl. establishment of WRDs and low-grade ore stockpile) and general operational activities	Soil Resources	Increases soil compaction, runoff potential and soil erosion and sedimentation	Project Footprint	• Drainage controls such as cut-off trenches and culverts must be used to ensure proper management of water runoff to prevent soil erosion and sedimentation; • Grow indigenous grass to form a vegetative barrier and protect the land from surface erosion; • Use low wire netting and jute geotextile fences with a thick mulch layer to slow and trap water runoff on steep to moderate slopes; and • Monitoring and maintenance should include: • Repair any damage caused by erosion; • Vehicular movement across rehabilitated areas should be limited where possible while the vegetation is established; • The area must be fenced, and animals should be kept off the area until the vegetation is self-sustaining; • Fertilize the grassed area with nitrogen-containing fertiliser after germination of seeds to promote good growth and development; • If soil is polluted, treat the soil by means of *in-situ* bioremediation; and • If *in-situ* treatment is not possible then the polluted soil must be classified according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Material and disposed of at an appropriate, permitted or licensed disposal facility.	Soil management plan	Throughout operational phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
	Surface water	• Reduced streamflow from the containment of precipitation and runoff • Sedimentation and siltation of nearby watercourses • Restoration of free drainage and runoff yield at least to a certain extent	Local Catchment	• Control fluvial erosion and sedimentation by establishing a stormwater management plan. • If possible, construction should take place during the dry season to reduce sedimentation • Site preparation and the movement of vehicles and machinery should be minimised as much as practically possible. • The proposed infrastructure should be confined within the footprint areas to minimise disturbance of soils and the probability of sedimentation and siltation of watercourses. • Install silt fences, and erosion blankets prior to soil stabilisation on steep surfaces to reduce the chances of erosion. • Implement erosion management at construction sites to ensure that the velocity of water flowing downslope is reduced. This can be done by implementing a series of berms across the construction site after vegetation clearance, which can be removed as construction progresses. • Establish appropriate compensation mechanisms should the result have significant water quality deterioration to downstream reaches • Implement a comprehensive water management plan to minimise downstream impacts. • Implementation of stormwater infrastructure to divert clean water to the nearest river	SWMP; and Water quality monitoring programme	Throughout operational phase
	Aquatics	Contaminated runoff and seepage from the mine workings, as well as erosion and sedimentation from increased runoff events and through the use of haul roads, have the potential to deteriorate wate and habitat quality within the receiving aquatic environments.		• The storm water management measures that should have been implemented during the construction phase can also be used in a similar manner to collect/trap contaminated seepage and runoff from selected infrastructure areas (e.g. stockpiles and pits). Clean water should be diverted or discharge into the natural systems/diversion/s. • Implement efficient soil management measures and facilitated re-vegetation using securing mats, pegs (and/or mesh), to reduce extent of exposed soils between infrastructures and river systems, including diversions. This will possibly limit runoff and sedimentation into the associated systems. • Silt traps should be installed at river crossing points, especially on the larger haul roads. Dust suppression efforts can also be undertaken. However, water utilised during these efforts should not be allowed to flow excessively, forming a gully into nearby river systems.	SWMP; and Water quality monitoring programme	Throughout operational phase
	Terrestrial biodiversity	Increased risk of faunal casualties due to increased vehicle movement, Increased noise and dust pollution, increased risk of firs during dry season, increased flow, erosion, runoff, soil compaction, sedimentation potential and deterioration of water quality – impacting wetlands	Local Area	• Ensure that the controls including vehicle speed limits, food waste disposal, hazardous waste disposal and human interaction with the ecology are monitored regularly and controls to prevent adverse conditions arising from the activities which are likely to affect avifauna are updated and implemented; • Ensure that a BAP reports on the actions taken; • Ensure bird electrocution prevention measures are in place, this will include engineering designs of towers, bird flappers/diverters, in specified areas of high density of birds; • All bare patches of soil should be vegetated, preferably with native grass species which will colonise open and disturbed patches quickly; • Implement concurrent rehabilitation and restoration of all sensitive environment including SCC areas, wetlands and priority ecosystem service areas and affected erosion sites; • Limit the footprint area of the operational activities to what is essential in order to minimise impacts as a result of vegetation clearing and compaction of soils; • All soils compacted as a result of operational activities should be ripped, profiled and revegetated; • A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding wetlands and watercourses; • No material may be dumped or stockpiled within any biodiversity sensitive areas;	Biodiversity Action Plan; Erosion Management Plan; and Alien Invasive Management Plan	Throughout the operational phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zone of regulation. All vehicles must remain on demarcated roads and within the Project footprint; • A SWMP should already be implemented. This should consider all wetlands and other watercourses adjacent to and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. • Monitor powerlines regularly for collision incidents; and • Ensure continuous environmental awareness training takes place.		
	Wetlands	Increased soil compaction, runoff and the creation of preferential flow paths and the onset of erosion	Local area	• Culverts, roads, powerlines and river crossings must be maintained, cleared and monitored; • A SWMP should already be implemented. This should consider all wetlands and other watercourses adjacent to and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey contaminated water to silt traps to limit contamination of the soils and groundwater; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; • Re-vegetate cleared areas and stockpiles to avoid wind and water erosion; • A suitable AIPs control program must be put in place to prevent further encroachment as a result of disturbance to the soil fertility, biodiversity and functionality; • Compacted areas are to be ripped and re-vegetated; and • Monitoring must take place regularly to access possible impacts on the wetlands.		
		Cultural Heritage Disturbance and Adjustment	Local area	• Develop and implement RAP to offset the • Implement measures proposed in the Archaeology and Cultural Heritage Assessment Study; • Cultural Heritage Management Plan; • Develop and implement a Chance Finds Procedure during construction activities; • Provision of mandatory basic training to all staff involved in construction activities to be able to report observed artefacts (as a compliance to CFP) on site; • Conduct Cultural heritage monitoring during construction activities; • Foster ongoing engagements and consultation with local communities to understand their cultural values and practices; • Invest in and support community-led initiatives aimed at preserving cultural heritage and promoting cultural activities; • If cultural sites cannot be preserved, provide fair compensation to affected communities and support for the relocation of cultural practices and sites; and • Continuously monitor and evaluate the cultural impacts of mining activities throughout the project.	RAP SEP Grievance Mechanism Cultural Heritage Management Plan	During construction phase and on-going
		Cultural Changes in the Community	Local area	• Develop and implement programs to raise awareness among both local residents and incoming migrants about cultural diversity, fostering mutual respect and understanding; • Form community-based committees that include local leaders and representatives from diverse cultural backgrounds to address and mediate tensions and conflicts;		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Engage local authorities and traditional leadership in monitoring in-migration and facilitating community integration efforts; • Through the Stakeholder Engagement Plan, conduct regular engagements between the project team, local communities, and in-migrants to ensure open communication and address grievances before they escalate; • Ensure transparent hiring practices that offer opportunities to both local residents and migrants to prevent perceptions of favoritism; and • Organize events that celebrate different cultural practices, promoting social cohesion and reducing the risk of cultural conflicts.		
	Intersection Traffic	• An intersection design life analysis has been undertaken to determine the life expectancy of each intersection based on the impact of the anticipated operational haulage vehicles in relation to a 10-year life of mine design horizon. This has been undertaken for all paved road intersections of impact. • It was found that all intersections would have excessive levels of remaining capacity even with the operational stage generated traffic volumes. No impact to road network performance is anticipated.	Local area	• Traffic management strategies to be introduced in order to mitigate impacts during the operational stage should include: • Travel demand management (TDM) campaign to inform the public on works and its effect on network operations • Operational Traffic Management Plan managing hours of work and haulage, haulage routes to be used with specific pinch point safety analysis, staff transport and staff parking, with the provision of on-site tool storage where practicable. • Relevant emergency services should be notified in advance prior to the movement of all hazardous/dangerous or oversize construction material and equipment. • Fatigue management measures should be introduced and enforced for all workers. • Regular maintenance and grading of the unpaved roads are required to minimise corrugation which reduces riding quality and impacts on safety. • Road Safety Mitigation Measures • The following road safety items are proposed to be implemented: • Vulnerable motorcycle and pedestrian activity occur at the intersections, and it is proposed that drivers of construction and operational traffic be made aware of such high usage during induction training and transport operating procedures. There are no formal pedestrian crossing opportunities evident and as such pedestrians across roads at random and at mid-block. • There is no lighting available at the intersection which may create a safety risk during low light and visibility conditions. It is recommended that all vehicles to be used during construction and operation stages be adequately maintained to ensure lights are in working condition. • Passing of heavy vehicles during construction and operational stages might increase dust production. Unchecked dust creation causes lung damage, crop damage, impedes visibility for drivers and workers and can be a nuisance for nearby villagers. Water should be applied at regular intervals in high-traffic and/or high population-density areas. This provision should be a clearly billed item and the Client/Consulting Engineer should ensure that the activity is carried out as per the contract specifications. • Consult the local public and encourage their participation in noise mitigating measures. • Consult local people and encourage their participation to protect public health and ensure safety. • Heavy vehicle turn signage should be provided to warn other modes of heavy vehicle conflict. • Vulnerable motorcycle and pedestrian activity occur at the intersection, and it is proposed that drivers of construction and operational traffic be made aware of such high usage during induction training and	Control - through the implementation traffic control	Operation phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				transport operating procedures. There are no formal pedestrian crossing opportunities evident and as such pedestrians across roads at random and at mid-block. • The surrounding community should be notified in advance of trip plans, construction activities and durations as well as operational haulage trip details and plans. • Steep edge drops are evident at some locations within the study area which may create a safety risk to road runoff. It is recommended that fatigue management plans be in place to ensure drivers are not at fatigue levels and concentration levels are adequate during work hours. • Heavy vehicles during both construction and operational stages might be using the gravel roads to and from the site. It is also recommended that the gravel roads be upgraded to a suitable gravel standard (cross section and layer works) sufficient to accommodate construction and operational traffic (as to be determined during engineering design stages). • It is recommended that sufficient clearance to fixed structures be provided for when the through road is formalised to ensure that vehicles do not collide with structures and objects. • Consult local people and encourage their participation to protect public health and ensure safety. • Basic left and right turn treatments would be sufficient to accommodate construction and operational traffic. • Any obstructions impeding on driver sight such as embankments, vegetation etc. should be removed prior to commencement of construction and operational activities to allow for clear sight envelopes. • Operating speed signs with speed limit of 60km/h along the access road to the Project and 70km/h along the major road used for transport during construction and operational stages. • Regular maintenance and grading of the unpaved roads are required to minimise corrugation which reduces riding quality and impacts on safety. • Grading works should be carried out on materials with proper moisture content to reduce dust build up in the air. Regular grading would also allow for a smooth road surface without grooves and cracks in order to keep the noise level to a minimum. • Grade and out-slope roadbeds to minimize water accumulation on road surfaces. The practice minimizes erosion and road failure potential. Out-sloping involves grading the road that it slopes downward from the toe of the road to the shoulder – the slope should be about 3-4%. • An increase in CO_2 emissions is anticipated as a result of the Project. The increase in construction and operational stage generated traffic would potentially increase CO_2 emissions. As such, the following mitigation measures are proposed to manage air impacts: • Select road alignments in such a way to avoid passing close to housing estates, schools, hospitals and workplaces especially where unformed gravel roads leading to the site are proposed to be formalised with possible new alignments. • Avoid steep grades and sharp curves since they promote deceleration and acceleration. • Manage the traffic in such a way that construction vehicles traverse the road network outside of background peak hour conditions in populated areas. • Machinery should be well maintained, and the most modern machines should be used, where possible. • Provide protective clothing to workers • Consult the affected local community and encourage their participation in the implementation of further mitigation measures. • Road Pavement Conditions		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Road pavement condition surveys are recommended to be carried out before any works are undertaken to determine the baseline of road quality. It is recommended that such surveys be undertaken at the end of every stage to monitor progressive pavement worsening whereas the road pavements would need to be rectified to the same standard (riding quality) as before the occurrence of any project stage works.		
	Geochemistry (Soils, Surface and Groundwater Quality)l	The pit wall and floor minerals will be exposed to oxidation, resulting in the formation of alkaline pit water with the CoCs including high pH, electrical conductivity, sulphate, fluoride, nitrates, barium, iron, copper, magnesium, scandium, sodium and zinc. Without proper management, this water has the potential to affect the soil, surface and groundwater within the pit catchments and groundwater drawdown zones, contingent upon site conditions.	Local area	• The goal is to minimize the volume of mine contact water generated during operations. To effectively manage water during open pit mining operations, the following measures should be implemented; • Separate Mine Contact Water from Clean Water: Implement stormwater channels and bunds to divert clean surface water away from the pit during seasonal rainfall events. This helps to minimize the amount of mine contact water by keeping clean surface water away from contaminated water; • Control Seepage and Runoff from WRDs: Install surface drains to redirect runoff from the WRDs away from the pit; • Regular Water Quality Monitoring: Continuously monitor pit water quality to assess its suitability for various purposes. The monitoring program should include the identified potential constituents of concern;	Stormwater Control by ensuring that clean water is diverted away from mine contact water	Life of Mine
		The release of alkaline seepage and runoff from the WRD can pose a risk to the soils, surface water and groundwater quality. The CoCs include high pH, electrical conductivity, sulphate, fluoride, nitrates, barium, iron, copper, magnesium, scandium, sodium and zinc.		During the wet season, high precipitation rates are expected to cause significant infiltration into the dump. The goal is to minimize the potential generation of seepage water from the waste rock dumps. To achieve this, the following measures should be implemented: • Channel Seepage and Runoff: Direct seepage and runoff from the WRD to leachate ponds for effective management. • Divert Clean Surface Water: Use runoff control channels to divert clean surface water away from the WRDs. • Continuous Monitoring: Monitor the toe seepage, surface water, and groundwater, focusing on the constituents of concern as outlined in the monitoring and management plan in Section 10. • Regular Inspection and Maintenance: Regularly inspect the WRD and monitor systems to identify issues or areas of concern. Ensure proper maintenance and timely repairs to maintain the effectiveness of the measures. • Rehabilitate WRDs: Rehabilitate the waste rock dumps from operation to closure by shaping, levelling, and compacting. • Long-Term Site Closure Plans: Integrate waste rock management into long-term site closure plans to ensure the stability and safety of the WRDs after mining activities have ended.	• Stormwater Control by ensuring that clean water is diverted away from mine contact water • Rehabilitation of the WRD by shaping throughout the operations,	Life of Mine
		The release of alkaline seepage and runoff from the TSF can pose risks to the soils, surface water and groundwater quality. The tailings exhibit high pH, total	Loca area	• The goal is to minimize the potential generation of contaminated water from the TSF. To achieve this, the following measures should be implemented: • Channel Seepage and Runoff: Direct seepage and runoff from the TSF during operations to a leachate pond for use at the Plant.	Stormwater control to ensure that the clean water is diverted away.	Life of Mine

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
		dissolved solids, electrical conductivity, sulphate, fluoride, nitrates, arsenic, barium, chromium, copper, iron, lead, magnesium, nickel, sodium and zinc.		• Divert Clean Surface Water: Use runoff control channels to divert clean surface water away from the TSF during rainfall events. • Continuous Monitoring: Monitor thetoe seepage, surface water, and groundwater, focusing on the constituents of concern as outlined in the monitoring and management plan in Section 10 • Rehabilitate TSF: Progressively rehabilitate the TSF from operation to closure by covering the surface with waste rock from the WRD to reduce dust emissions and improve stability. • Regular Inspection and Maintenance: Conduct routine inspections of the TSF and its monitoring systems to identify any issues or areas of concern. Perform necessary maintenance and timely repairs to ensure the continued effectiveness of the measures. • Long-Term Site Closure Plans: Incorporate tailings management strategies into the long-term site closure plans to ensure the stability and safety of the TSF after mining activities have ceased.	Dust control by using waste rock to cover the TSF. Inspection and Rehabilitation throughout operations until closure to prevent dam failures	
	Air quality	Poor air quality due to generation of dust	Local area	• Implement localised / activity specific surface watering to minimise emissions; • Apply dust suppressants on access and haul roads, where practicable; • Reclamation should take place towards the upwind direction (i.e. towards the north, north-northeast and northeast), mining upwind, moving against the wind; • Limit high dust-generating activities (i.e. sand excavation) to periods of low wind where possible (wind speed less than 5.4 m/s); • Set maximum speed limits on site and have these limits enforced; • Minimise the footprint of disturbance as far as practicable; • Minimise the drop heights when loading onto trucks and at tipping points; • Implement dust suppression equipment at the plant.	Ambient air quality monitoring and control through implementation of air quality management plan	Upon commencement and throughout the construction phase
		Release of volatiles as a result of the storage of hazardous substances will possibly result in reduced ambient air quality.	Local area	• Internal floating roofs and seals should be installed to minimize vaporisation of gaseous pollutants from fuel storage tanks; • Ensure chemicals, reagents or hydrocarbons are stored on impermeable surfaces with appropriate containment structures. Regularly inspect of storage areas (i.e., storage containers/ tanks and ancillary piping) to ensure they are not leaking or damaged; • Regularly inspect retention facilities/ structures (i.e., bunds, spill trays etc.) to verify their integrity; • Personnel should be trained in the spill response procedures for the chemicals, reagents or hydrocarbons used or stored in their area; • Personnel working with hazardous substances should be trained in the appropriate handling, storage, and disposal requirements; • Ensure chemical storage (magazine) containers are labelled, and that labels are intact and legible; and • Ensure MSDS sheets are provided at the point of storage and that these are intact and legible.	Material Safety Data Sheets	
	Surface water; Groundwater; Wetlands; Aquatic Biodiversity; and Soil contamination.	Hydrocarbon spills from vehicles and heavy machinery or hazardous materials or waste storage facilities. Leading to deterioration of water quality in the streams which will ultimately impact Yala River and tributes	Local area	• Hydrocarbons and hazardous materials must be stored in bunded areas within the wall boundary where access is controlled; • All refueling should take place at contained areas; • Drip trays must be utilised for vehicles and machinery being serviced; • All equipment will be handled by trained and certified equipment operators; • Emergency equipment including fire extinguishers, respirators will be put in place at vulnerable areas with potential to experience the hazard;	Water quality monitoring programme	Throughout the operational phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Ensure that oil and silt traps are well maintained; • Vehicles and heavy machinery must be serviced and checked in a demarcated area on a regularly basis to prevent leakages and spills; • Hydrocarbon spill kits must be available on site at all locations where hydrocarbon spills could take place; • Monitoring boreholes, particularly those located within the mine footprint area, have to be monitored for both water level and quality to detect any changes; and • If a considerable amount of fluid is accidentally spilled, the contaminated soil must be scraped off and disposed of at an acceptable dumping facility. The excavation must be backfilled with soil of good quality. • Emergency Response Team will be maintained onsite to respond to emergencies; • Ensure that waste is appropriately separated and disposed of in marked containers; • All domestic waste generate on site must be stored in containers and later be disposed of at the landfill site; and • Hazardous waste must be segregated and stored in appropriate containers and incinerated. Where incineration is not possible, hazardous waste must be disposed of at a permitted hazardous waste disposal site.		
	Noise	Noise will emanate from the machinery and vehicles operating during the operational activities.	Local area	• Machinery and vehicles should be switched off when not in use; • It should be considered to prescribe the installation of buzzer type reverse alarms (producing band-limited white noise), rather than the conventional beeping type reverse alarms (which produce a tonal sound) on machinery and vehicles employed in surface operations and haul roads; • Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; • Regulate vehicle speeds on the access and haul roads; • The generator and screening facility (if possible) should be enclosed; • The mine should consider using the topsoil stockpile as a noise barrier for receivers that are closest to the mining activities; • The concentration (i.e., number of machineries being utilised) of mining activities should be limited in close proximity to sensitive receivers; • The mine should plan and consider a mining schedule that limits the duration of mining activities in close proximity to sensitive receivers i.e., South (closest to receivers) to North (furthest from receivers) mining approach; and • The mine should implement a long term (48 hour) quarterly noise monitoring programme to detect any changes in ambient sound levels due to the activities of the mine.	Noise control measures; and Noise monitoring.	Upon commencement of the operational phase
	Topography and Visual Amenity	Alteration of the natural visual character, changing its baseline sense of place	Local area	• Implement a dust suppression programme. • Use of neutral colours so that infrastructure blends in with the natural environment. • Concurrent rehabilitation of prominent features such as TSF and WRD to minimise the visual exposure of the features where practical.	Control - through the implementation of mitigation and management actions.	Upon commencement of the operational phase.
	Cultural and Archaeological Heritage; and	• Exposure of sub-surface sites,	Local area	• Heritage Management Procedures	Implementation of IFC SP 8, interpreted with Kenyan local, regional	Operational phase.

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
	Community pattern of life	materials, and artefacts; • Restricted or loss of access to cultural heritage sites; • Physical damage/destruction to known cultural heritage sites; and • Pollution of cultural heritage sites.		• Apply local, regional and national legislation, regulations and planning, and align with IFC Performance Standard 8 on cultural heritage for managing and mitigating impact on cultural heritage resources, i.e., both tangible and intangible cultural heritage resources; • Develop, implement and monitor a CHMP for any identified cultural heritage resources, in consultation with relevant communities, based on the outcomes of cultural heritage risk assessments, to document the identified risks, impacts and preventative measures; • Implement a CFP as part of the CHMP to describe the actions required in the event of a chance find; • Monitor implementation of the CHMP and CFP and any related plans and procedures to mitigate against impact on cultural heritage resources; • Ensure that personnel involved in ground disturbance activities are trained to comply and work in accordance with the CHMP and CFP; • Safeguard against dust pollution to known cultural heritage resources; • Ensure all activities are undertaken within approved areas of the Project; • Monitoring of demarcated areas or sites left in situ; and implement required consultation and permitting processes for the possible exhumation and relocation of human remains if avoidance is not possible.	and national policies and legislation on cultural heritage.	
	Socio-economic	Increase in Household Incomes and Improved Living Standards	Local area	• Develop the Local Employment Plan and prioritise employment and training of people living within the primary study area over outsiders especially for unskilled and semi-skilled positions; • Develop and continuously update (throughout the LoM) an Employment Policy to increase local employment and transfer operational positions from migrant workers to people from within the study area; • Ensure local communities understand the project's employment requirements in terms of skills and type of employment; • Develop and maintain a candidate database for the local communities in collaboration with existing governance structures; • Maintain an employee database, including origin of employee, position, working hours, training received, wages/ benefits; • Provide appropriate training opportunities to employees and contractors; • Work Certificates or Certificates of Completion must be provided to local employees for the work and training undertaken; and • Implement the Stakeholder Engagement Plan and Community Grievance Management and Resolution Procedure..	OHS Plan; Stakeholder Engagement Plan; Recruitment Policies; and Development Initiatives.	Throughout Project life
		Training and Skills Development		• Prioritise training and capacity development for the least qualified workforce members. The training initiatives should consider the levels of education of the targeted workforce and the areas of interest; • Conduct a Workforce Skills Audit to better understand the current skills of the individuals and experience to identify gaps and propose programs to fill those gaps; • Appoint a Life-Coach/ Career Development Coach or mentor to assist and guide the workforce in their selection of education programs of their own interest; • Introduce an in-house Mentorship Program. The program will target the workforce who have existing qualifications which they are not using as part of their current job; • Develop the bursaries that will include non-mining related bursaries;		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Ensure provision of employment to at least 80% of the people who receive bursaries and or training through the mine; and • Develop a Workforce Grievance Procedure and encourage the workforce to use the Workforce Grievance Procedure should they be dissatisfied with the implementation of the program.		
		Social Differentiation		• Implementing a community-wide sensitization program that addresses the potential for jealousy, grievances and conflicts arising in the community • Establish ongoing stakeholder engagements to promote peaceful co-existence and ensure access to a grievance redress mechanism. • Set up a community-based conflict resolution and mediation committee with respected members from various backgrounds to address disputes • Implement strict policies and awareness programs to prevent gender-based violence, domestic violence, and sexual violence. • Partner with local NGOs to provide support services, including counselling and legal assistance for victims of violence. • Monitor and control alcohol and substance use among workers to mitigate risks of violence. • Implement measures to minimize environmental degradation, such as pollution control and land rehabilitation. • Develop an Influx Management Plan, which considers appropriate objectives and interventions for influx management, incl. public consultation and monitoring methods; • Develop and implement a community-wide sensitization program to address potential grievances and conflicts arising from the influx of new residents; • Conduct ongoing stakeholder engagements with local communities to foster peaceful coexistence and provide a clear grievance redress mechanism; • Enhance local infrastructure and social services to accommodate the increased population and mitigate strain on existing resources; • Increase capacity for healthcare services, particularly to address potential rises in communicable diseases; • Strengthen security measures to address potential issues of insecurity arising from the establishment of new residences; and • Develop and promote health and safety programs focused on preventing the spread of communicable diseases, including regular health screenings and awareness campaigns.		
		Occupation, Health and Safety (OHS) and Nuisance Disturbance	Local area	• Implement the Occupational Health and Safety (OH&S) Policy and related OHS procedures; • Immediately eliminate or control all serious hazards (hazards that will cause or are likely to cause death or serious physical injuries) through a hierarchy of controls; • Clearly define and communicate to employees, contractors, visitors, and suppliers (at each level) their responsibilities with respect to OH&S; • Maintain plant, equipment, and all infrastructure in a safe condition with documented safe work procedures, practices, and record management systems; • Ensure the participation and consultation of workers, and their representatives (when applicable) in the decision-making process for OH&S matters;		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Routinely monitor and review the OH&S management systems and set performance objectives at all levels and functions to ensure continuous improvement with our operations; and • Communicate the Health and Safety Policy to employees, partners, contractors, subcontractors, local communities, and other stakeholders affected by their operations, and making it available to the public. • Proper fencing, lighting, and security personnel should be employed at project sites to deter criminal activity and protect both workers and equipment. • Employees should be briefed on local security risks, including crime hotspots, and provided with safe transportation options, particularly for late-night shifts. • The project team should collaborate with local police stations to ensure heightened security patrols around the project area, particularly during periods of heightened criminal activity. • An internal security monitoring system should be put in place to promptly address any incidents or threats to workers' safety. • Develop and implement a Security Management Plan (SMP) specifically designed to safeguard workers and project assets from local crime risks.		
		Continued contribution to local economic development and infrastructure support.	Local area	• Continue to implement the Stakeholder Engagement Plan and grievance mechanism; • Keep a record of community issues and priorities to inform community development initiatives; • Maintain a record of commitments and track progress against these commitments; • Strengthen partnership with the relevant district and ward level authorities to ensure all investment and local development initiatives are in line with the priorities and needs of the local area; • Maintain partnerships with donor agencies, non-government organisations (NGOs) and development partners to promote success of community development initiatives; and • Ensure that initiatives include training and support opportunities for community beneficiaries so as to promote successful transition of community following closure.		
		Strain on Local Infrastructures	Local area	• Partner with local authorities to improve and expand road networks, particularly those most affected by increased traffic; • Provide financial or logistical support to local healthcare facilities and schools to accommodate increased demand. • Work with local utility providers to upgrade water, electricity, and waste management infrastructure to meet the rising demand; • Develop a comprehensive waste management plan for the mine's operations to prevent overwhelming local waste collection services; • Through Stakeholder Engagement Plan, continuous engagements should be done with local communities and authorities to monitor the impact of the project on infrastructure and services; and • Launch CSR programs that directly contribute to infrastructure development, such as building roads, clinics, or schools, to offset the pressures placed on local services and facilities by the project.		
		Continued procurement of local goods and services which will in turn contribute to local economic development.	Local area	• Update and disseminate the procurement policy that promotes preferential procurement of local suppliers; • Identify mechanism to enhance procurement of goods and services from the local communities and wider District; • Develop and maintain a database of relevant local vendors/businesses and their potential capacity to provide goods and services locally. Encourage them to participate in bids;		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Identify, track and record key project-related benefits generated including the recipients of the benefits and timeframes over which these were received; and • Require subcontractors to procure goods and services from the local area as far as possible.		
Potential discharge of pit related water into the streams	Aquatic	Water quality impairment, increased flow velocities and subsequent increase in erosion and sedimentation	Local area	• Discharge water should be treated to suitable conditions for aquatic life. • An 'armored' area to allow for the discharge to flow onto first prior to entry into the diversion should be constructed. This will limit the immediate erosion effects of discharge of the high volume and velocity. • The banks of the receiving watercourse should be regularly monitored to account for additional erosion events. • Banks should be revegetated wherever possible to improve stability of the associated watercourse.	Water quality monitoring programme	Throughout the operational phase
Open pit mining	Groundwater abstraction and drawdown	Groundwater	Operational	• Monitor abstraction volumes and the groundwater monitoring network. This will allow confirmation of the current model results and provide more information for numerical model updates; • Update the numerical model, with changes to the mine plan and/or if monitoring shows deviations from the current estimates; • Abstracted water must be accounted for in the mine water balance, to ensure adequate storage capacity for and management of the abstracted water; • Abstracted groundwater must meet regulatory discharge limits prior to being released into the environment. Where the regulatory discharge limits are exceeded by regional baseline water quality, discharged water should meet the regional baseline quality; • Monitor the spring flow, to assess potential loss of water to the downgradient receptors who rely on springs and associated stream flow for water supply; • Assess the depth of the impacted hand dug wells to verify if the expected drawdowns will result in the wells becoming dry; • Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities; and • Divert storm water runoff around and away from pit. Storm water collected in the contact water footprint must be directed to designated water storage facilities.	Water quality monitoring programme	Throughout the operational phase
Open pit mining, ore and mineral waste handling	Potential contamination plume	Groundwater	Operational	• Monitor the groundwater monitoring network. This will allow confirmation of the current model results and provide more information for numerical model updates; • Update the numerical model, with changes to the mine plan and/or if monitoring shows deviations from the current estimates; • Update the geochemical assessments as mining progresses to increase the ARD knowledge for the waste rock material and verify the iron leachate results; • Should it be confirmed that the iron concentration in the leachate is as high as assessed with the geochemistry assessment, then water will need to be treated to meet the discharge or regional baseline limits; • Implement recommendations from the geochemical and geotechnical assessment for the design of the WRD, to manage seepage quality and prevent failure of the WRD; • Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities; and	• Control through site planning and management, • Control through monitoring; • Remedy through rehabilitation • Stop through accidental spill response plan and procedures	

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Monitor the spring flow from the springs underneath the WRD. This flow may need to be incorporated into the water balance for the project, if water quality indicates that water does not meet the discharge or regional baseline limits for the Project. Culverts may be required if these springs have significant flows.		
Open pit mining (including blasting and drilling)	Wetlands	Open pit mining may lead to the dewatering of wetlands and the complete loss of wetlands. Mining may also lead to contamination, sedimentation and siltation of downstream wetlands, affecting the vegetation, habitat and overall functionality of the wetlands		• Ensure that sound environmental management is in place during the proposed operational phase; • Limit the footprint area of the operational activities along the pits to what is essential in order to minimise impacts as a result of vegetation clearing and compaction of soils; • Ensure that no incision and canalisation of the wetland features present takes place as a result of the proposed operational activities; • All erosion noted within and in the vicinity of the area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan; • All soils compacted as a result of operational activities should be ripped and profiled; • A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding wetlands and watercourses; • No material may be dumped or stockpiled within any wetland areas; • No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zone of regulation. All vehicles must remain on demarcated roads and within the Project Area footprint; • All vehicles must be regularly inspected for leaks and re-fueling must take place on a sealed surface area to prevent ingress of hydrocarbons; • Ensure spill kits (e.g., Drizit/Spilltech) are readily available in areas where chemicals are known to be used and all spills should be immediately cleaned up and treated accordingly.	Pit dewatering monitoring	Throughout the operational phase
	Geochemical, surface water and groundwater	Contamination of water and affecting water quality		• Mine contact water and clean water should be separated by diverting clean surface water away from the mining area using channels and bunds to minimise the volumes of water entering the pit; • Seepage and runoff from the WRD and ore stockpiles entering the pit should be minimised through installation of surface drains diverting runoff to the proposed ponds; and • The quality of pit water should continue to be monitored to figure out its potential for different uses or the requirement to treat this water before discharging.	Water quality monitoring programme	Throughout the operational phase
Operation and management of water management infrastructure (dams, trenches, silt traps, etc.).	Wetlands	The water management infrastructure may lead to the onset of erosion, sedimentation and siltation of the water courses as well as the creation of preferential flow paths		• Ensure separation of clean and dirty water as well as clean and dirty water before it is re-introduced back into the natural systems; • Implement a monitoring plan to monitor and remediate impacts immediately should they occur; • Maintenance of the water management infrastructure should be implemented regularly; and • If any erosion occurs on site and adjacent to the areas, corrective actions and restoration (backfilling, erosion berms, culverts, silt traps) must be taken to minimise any further erosion from taking place.	Water quality monitoring programme	Throughout the operational phase
Potential for discharge of treated effluent.	Wetlands	Impacts may include increased flow leading to the onset of erosion and deterioration of water quality, impacting the wetland's health and functionality.		• All erosion noted within and in the vicinity of the area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan; • Ensure the effluent has been treated before being discharged into the wetlands and surrounding environment; and • Promote the naturally diffuse flow of water through the landscape to prevent erosion (or channelisation), sedimentation and formation of preferential flow paths by considering sufficiently designed culverts and road crossings.		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
Operation and maintenance of river diversion.	Aquatics	Increased erosion events and sedimentation leading to habitat deterioration within the diversion/s as well as a decrease in connectivity within the system.		• Regular monitoring and maintenance of the diversion/s should take place to limit erosion and to further reduce sedimentation of the associated systems. • Heavy machinery or vehicle should not be allowed to drive near to the banks once established to maintain bank stability. No-go zones should be demarcated along the diversion to only be accessed by foot if needed and wherever practically possible. • Efforts must be made to reduce erosion and sedimentation. This can be done by vegetating banks, reducing stream flow at bends/meanders within the diversion by placing natural flow resistant structures (e.g. boulders) or gabions if needed.	Water quality monitoring programme	Throughout the operational phase
	Terrestrial biodiversity	Increased risk of AIP's proliferation, faunal casualties, erosion events and sedimentation leading to habitat deterioration within the diversion as well as decrease in connectivity within the system.		• Ensure that the controls including vehicle speed limits, food waste disposal, hazardous waste disposal and human interaction with the ecology are monitored regularly and controls to prevent adverse conditions arising from the activities which are likely to affect avifauna are updated and implemented; • Ensure that a Biodiversity Action Plan reports on the actions taken; • All bare patches of soil should be vegetated, preferably with native grass species which will colonise open and disturbed patches quickly; • Implement concurrent rehabilitation and restoration of all sensitive environment including SCC areas, wetlands and priority ecosystem service areas and affected erosion sites; • Limit the footprint area of the operational activities to what is essential in order to minimise impacts as a result of vegetation clearing and compaction of soils; • All soils compacted as a result of operational activities should be ripped, profiled and revegetated with native plant species preferably those with economic value; • A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding wetlands and watercourses; • A SWMP should already be implemented. This should consider all wetlands and other watercourses adjacent to and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. • Ensure continuous environmental awareness training takes place.	Biodiversity Action Plan; Erosion Management Plan; and Alien Invasive Management Plan	
	Wetlands	Increased vehicle movement in the area may lead to increased soil compaction, runoff and the onset of erosion and sedimentation of the water courses (wetlands and diversion). Hauling of the material may lead to soil and water contamination and deterioration of the watercourses (diversion) and wetlands downstream.		• No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the footprint and access roads; • The diversion, culverts, roads, powerlines and river crossings must be maintained, cleared and monitored; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities (hauling) is minimised as far as possible; • A suitable AIPs control program must be put in place to prevent further encroachment as a result of disturbance to the soil fertility, biodiversity and functionality; and • Compacted areas are to be ripped and revegetated to prevent erosion.	Enforcement of vehicle operation procedures	Throughout operational phase

Table 9-4: Decommissioning, Rehabilitation and Post-Closure Phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
Decommissioning and rehabilitation activities (removal of infrastructure and use of harmful substances/ chemical	Soil Resources	Decreased soil depth for root penetration, and increased runoff and sedimentation	Project footprint	• Rehabilitation and decommissioning should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation; • Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material and sedimentation; • Implement and maintain an AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Rehabilitation must be done as soon as any impacts are observed; • Newly shaped and top soiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; • Address compacted areas by deep ripping to loosen the soil, and revegetate the area; • Plant native vegetation to prevent erosion and newly rehabilitated areas and encourage self-sustaining development of a productive ecosystem and increased soil fertility; • The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions; and • Implement a monitoring plan for at least two years after closure..	Rehabilitation and Closure Plan; and Erosion Management Plan	Throughout the decommissioning and rehabilitation phase
	Surface water	Sedimentation and siltation of nearby surface water features caused by soil erosion runoff from operational surfaces where infrastructure is removed.	Local catchment	• Remedy through re-profiling and rehabilitation of previously disturbed landscapes • Control through water quality monitoring • Spill kits should be put in place, and mine workers trained in the use of these spill kits, to contain and immediately clean up any potential leakages or spills; and • Washing and servicing of vehicles and machinery should only be undertaken at designated, appropriately designed areas • Administer effective and timely clean-ups in the event of spillages occurring; • All mining personnel should be taught and trained to handle hazardous chemical waste to minimise spillages. The use of spill kits is highly recommended and only using accredited vendors. All storage facilities should be bunded	Control by implementing the proposed stormwater management plan, water quantity monitoring (flow meters. Water balance) and Monitoring of water quality	During the Decommissioning phase
		Runoff or seepage resulting in contamination of surface water resources	Local catchment			
	Groundwater	Mine dewatering and residual effect on rebounding groundwater levels		• Dewatering should cease as soon as possible after mining activities are completed to allow for groundwater level recovery; • As a minimum, groundwater level recovery should be monitored frequently (at least quarterly) during the first 5 years post closure to note deviations from the predicted recovery as soon as possible, and groundwater quality should be frequently sampled (at least quarterly) to establish if a contaminant plume is migrating; and • Groundwater monitoring should continue post-closure as per monitoring plan.	Water level monitoring	During the Decommissioning phase; Up to five years post-closure
	Aquatics	Water and habitat quality deterioration within the receiving aquatic environments		• Decommissioning and rehabilitation activities should be planned to occur during the dry periods/seasons to avoid high rainfall events that could lead to increased runoff, erosion, rapid spread of contaminants and sedimentation;	Water quality monitoring	During the Decommissioning phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Sediment and stormwater management infrastructures should be left in place and be the last infrastructures for decommissioning. • Access to the target areas should be done by the use of a single roadway or route. Drivers and the use of heavy machinery should not be allowed to traverse freely throughout the Project area, creating new access routes, and throughout areas proposed for rehabilitation. • Conduct routine maintenance on heavy machinery and prevent leaks of hydrocarbons into the Project area, as well as make adequate provision for on-site personnel to avoid littering. • Ensure correct storage of construction chemicals on site as per the specific chemical's storage requirements. • Ensure responsible recycling practices are implemented to avoid unnecessary landfill waste, and haphazard dumping of decommissioned material. • Ensure there are trained staff on site who are able to apply and use appropriate spill kits. • The backfilled pits must be reshaped and sloped to avoid preferential flow paths. • The backfilled, reprofiled landscape should be topsoiled and revegetated to allow free drainage close to the pre-mining conditions. • Continue with concurrent rehabilitation, and implement land rehabilitation measures. • Conduct regular infrastructure and water quality monitoring and biological monitoring activities. • Minimal mitigation measures will be able to completely protect the tributaries from the demolition TSF and WRDs with protection occurring only after rehabilitation is implemented. • Demolition activities should take place during the dry season to reduce erosion, surface runoff, and contaminated seepage from the demolition footprint areas especially when flow within the watercourses will be at its lowest. • Only the designated access routes are to be used or accessed to reduce any unnecessary compaction and/or topsoil and vegetation disturbance around the watercourses. • All unnecessary river crossings should be demolished and rehabilitated so as to reinstate the natural flow regime of the watercourse. • Bare surfaces, especially those along the banks of the watercourses must be vegetated to limit erosion from increased surface runoff. This should coincide with the following point regarding slope of the rehabilitation area. • A key mitigation measure to 'offset' and minimize the impact of the direct loss of the Dhene River tributaries, the banks of the reinstated watercourses where the TSF and WRDs and associated access roads were, should be redesigned in such a manner to reflect a more natural environment and can be considered as constructed wetlands. • This involves implementing natural embankments by rehabilitating the embankments, incorporating gentle gradients (1:3 slope) and hydroseeding with a mix of native vegetation (grasses, shrubs and trees). This will ensure the maintenance of topsoil, minimize erosion potential and improve phytoremediation (water polishing by established vegetation) capacity of the rehabilitated watercourse section. This inadvertently promotes protection of water quality entering the downstream Dhene River and supports biodiverse maintenance in these receiving sensitive receptors. • Implement the water quality and soil management mitigation actions listed in Chapter 10		

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Regular monitoring and maintenance of the watercourses below the TSF and WRDs and associated access roads should take place to limit erosion and to further reduce sedimentation of the downstream environments. • Plant indigenous vegetation to prevent erosion and newly rehabilitated areas and encourage self-sustaining development of a productive ecosystem and increased soil fertility. • The backfilled, reprofiled landscape should be topsoiled and revegetated to allow free drainage close to the pre-mining conditions..		
	Terrestrial biodiversity	Increased risk of faunal casualties due to roadkill and unsecured pit lake, Increased AIP proliferation without adequate control measures, increased erosion, runoff, soil compaction and sedimental potential, potential spillage of hydrocarbons, thus contamination of soils and surrounding grounds.	Project footprint	• The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions; • No vehicles or heavy machinery may be allowed to drive indiscriminately within any sensitive habitats including wetland areas and remain on demarcated roads and within the Project footprint. All vehicles must be regularly inspected for leaks and re-fueling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; • All existing litter, debris should be removed and littering should be prohibited on an ongoing basis. No material may be dumped or stockpiled within any biodiversity sensitive areas; • Ensure spill kits are readily available in areas where chemicals are known to be used and all spills should be immediately cleaned up and treated accordingly; • Do not disturb previously rehabilitated areas and confine activity to disturbed areas; • Ensure continuous environmental awareness training takes place; • Rehabilitate with indigenous native plant species and where possible use species of economic value which will subsequently add value to the local area and align with the Mine Closure Guideline (MCG) of 2020.A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding wetlands and watercourses; • A SWMP should already be implemented. This should consider all wetlands and other watercourses adjacent to and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. • Monitor powerlines regularly for collision incidents.	Biodiversity Action Plan; Erosion Management Plan; and Alien Invasive Management Plan	Life of Decommissioning and Rehabilitation Phase
	Wetlands	Impacts may include the onset of erosion and siltation of downstream wetlands and water courses. Disturbances may lead to increased AIPs, impacting the natural vegetation and health of the wetlands		• Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material and sedimentation; • No material should be dumped/stockpiled within any wetlands or watercourses; • Stored mine-affected water should be treated before decommissioning any mine-related water retention areas, such as PCDs and wastewater facilities; • Implement and maintain an AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Rehabilitation must be done as soon as any impacts are observed; • Newly shaped and top soiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs;	Water quality monitoring	During the Decommissioning phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Address compacted areas by deep ripping to loosen the soil, and revegetate the area; • Plant native vegetation to prevent erosion and newly rehabilitated areas and encourage self-sustaining development of a productive ecosystem and increased soil fertility.		
	Air quality	Dust generation and reduction in ambient air quality	Local area	• Implement localised / activity specific surface watering to minimise emissions. Note: this may be appropriate for short term mitigation, but the high evaporation rates during the dry season mean this technique is unlikely to be effective in larger areas. • Apply dust suppressants on exposed surface areas, where practicable; • Limit high dust-generating activities to periods of low wind where possible (wind speed less than 5.4 m/s); • Set maximum speed limits on-site and have these limits enforced; • Minimise the footprint of disturbance as far as practicable; and • Minimise the drop heights when loading onto trucks and at tipping points; and • Proper rehabilitation of disturbed areas to allow for vegetation establishment.	Dust monitoring	During the Decommissioning phase
	Noise	Noise will emanate from the machinery and vehicles operating during the closure activities	Local area	• Restrict decommissioning activities to daylight hours; • Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers; • Regulate speed limits on access roads; and • Switch off equipment when not in use.	Noise control measures; and Noise monitoring.	Upon commencement of the decommissioning phase.
	Socio-economic	Community health and safety risks associated with additional movement of vehicles and heavy in the area to remove demolished material.		• Access control must be maintained throughout the Decommissioning, Rehabilitation and Closure Phase; • Stipulate and enforce speed limits on haul and access roads; • Limit activities to daytime hours, as far as practicable; and • Continue to implement the Stakeholder Engagement Plan and grievance mechanism.	Stakeholder Engagement Plan	During the Decommissioning phase
		Loss of employment opportunities		• Develop and implement a detailed Closure Plan as legislated, that includes a retrenchment plan for Project staff. • Develop and implement the required Human Resource systems to provide references for employees. • Ensure that employment contracts release employees from non-compete clauses following the closure of the Project; and • Proactively assess and manage the social and economic impacts on employees where retrenchment and/or closure of the Project are certain.		
Rehabilitation of open pits, WRDS (backfill of Ramula- Mwibona Pit, management of overburden,	Soil resources, Terrestrial biodiversity	Soil compaction, increased runoff potential, changes to landscape with subsequential removal of faunal habitats and loss of biodiversity/SCC, potential spillage of hydrocarbon thus		• Ensure that the controls of noise, dust, waste generation, vehicle speed limits, food waste disposal, hazardous waste disposal and human interaction with the ecology are monitored regularly and controls to prevent adverse conditions arising from the activities which are likely to affect fauna are updated and implemented; • Do not disturb previously rehabilitated areas; • Complete a residual Impact assessment;	Biodiversity Action Plan; Erosion Management Plan; and Alien Invasive Management Plan	Life of Decommissioning and Rehabilitation Phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
landscape and re-vegetation		contamination of soils and surrounding grounds, potential for achieving set closure completion criteria and targets for the approved MCP		• Confine activity to disturbed areas; • The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions; • Ensure continuous environmental awareness training takes place; and • Rehabilitate with indigenous pioneer plant species in order to avoid erosion of open areas.		
	Geochemical	Refilling the open pit with water on cessation of dewatering activities will result in the formation of a pit lake. The water quality in the pit lake could potentially affect the quality of surface and groundwater.	Local area	The goal is to prevent contaminated water from surface runoff and pit walls from entering the pit lake. To achieve this, the following measures should be implemented: • Retention Berms: Retain the berms around the open pit to minimize the entry of surface water runoff into the pit at post-closure. • Post-Closure Monitoring: Continue monitoring of the pit lake water and surrounding monitoring boreholes for a minimum of five years. This monitoring will assess the predicted water quality and effectiveness of associated management measures. • Monitoring of Decant Points: Continuously monitor potential decant points established for the project post-closure to assess water quality. • The rehabilitation and closure of the open pits should align with the prescribed rehabilitation and closure plan. • Consider using the waste rock for inpit deposition. .	• Inpit deposition using waste rock • Stormwater control to ensure that the clean water is continuously diverted away from the pit.	End of Life of Mine, closure to post closure
		The established WRDs will undergo infiltration, weathering, and erosion, resulting in alkaline runoff and seepage during rainfall events. This has the potential to impact the quality of soil, surface and groundwater.	Local area	The primary objective is to minimize the potential generation and volumes of contaminated water from the WRD. To ensure proper management and rehabilitation of the WRDs, the following measures should be taken: • Berm Maintenance: Maintain the berms around the WRDs, designed to divert clean water away from the facilities, even after closure. This will help prevent clean water from contamination with seepage and runoff fromthe WRDs. • Progressive Rehabilitation: Implement progressive rehabilitation of the WRDs through activities such as shaping, levelling, and compacting. • Ongoing Water Quality Monitoring: Continue regular monitoring of water quality emanating from the WRDs for a minimum of five years after the final rehabilitation. This monitoring will detect any changes in water quality and assess the effectiveness of rehabilitation efforts. If contamination is detected, additional measures should be investigated and implemented promptly to mitigate any adverse impacts. • Dust Suppression Systems: Employ dust suppression systems. This proactive approach ensures effective control of dust during the initial stages of rehabilitation until the site is closed. • The rehabilitation and closure of the WRD should align with the prescribed rehabilitation and closure plan. • Use the waste rock for inpit deposition.	• Monitoring of seepage from the waste rock • Rehabilitation by shaping, levelling and compacting. • Stormwater control to ensure that the clean water is continuously diverted away from WRDs. • Deposit the waste rock in the pit.	
		The established TSF will not be lined. Once deposition stops, the pool water is expected to recede, with minimal seepage and runoff anticipated after closure during the dry season, but		To ensure proper management and rehabilitation of the TSFs, the following measures should be implemented: • Covering with soil and vegtetation: Cover the tailings with soil and vegetate with indigenous plant species.	• Cover the tailings with soil and vegetate with indigenous plant species.	Minimum of 5 years post closure

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
		there will be seepage in the wet season		• Berm Maintenance: Maintain the berms around the TSF to continue diverting clean water away from the facilities even after closure. This helps prevent clean water from entering the TSF footprint and potentially becoming contaminated. • Ongoing Water Quality Monitoring: Continue regular monitoring of water quality from the TSF for at least five years after final rehabilitation. This monitoring will help detect any changes in water quality and evaluate the effectiveness of rehabilitation efforts. If monitoring detects contamination, additional measures should be promptly investigated by the mine and implemented to address any adverse impacts. • Dust Suppression Systems: Use dust suppression systems. This ensures effective dust control during the initial stages of rehabilitation until the site is closed. • The rehabilitation and closure of the TSF should align with the prescribed rehabilitation and closure plan.	• Stormwater control to ensure that the clean water is continuously diverted away from TSF until post-closure.	
	Wetlands	Rehabilitation activities may lead to residual and unforeseen impacts to the wetlands, such as erosion, contamination and increased AIPs, however, rehabilitation should improve the wetland connectivity, functionality and overall health and ecosystem services delivery.		• Rehabilitation should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation; • Rehabilitation must be done as soon as any impacts are observed; • An AIP management plan to be implemented and managed for the life of rehabilitation, closure and post-closure phases; • All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses; • Preventative measures such as hessian sheeting should be used in steep re-seeded areas where high erosion potentials exist; • Address compacted areas by deep ripping to loosen the soil, and revegetate the area; • The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions; • The use of indigenous phyto-remediation specific grass, forb and tree species is encouraged; • No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas. All vehicles must remain on demarcated roads and within the project area footprint; • All vehicles must be regularly inspected for leaks and re-fueling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; • All existing litter, debris should be removed from the wetland areas and littering should be prohibited on an ongoing basis; and • All spills should be immediately cleaned up and treated accordingly.	Water monitoring programme	Life of Decommissioning and Rehabilitation Phase
	Groundwater	Groundwater recovery	Decommissioning and Post-Closure	• Groundwater level recovery should be monitored monthly during the first five years post closure to note deviations from the predicted recovery as soon as possible; • Monitor the spring flow, to assess if pre-mine flow rates are established once groundwater levels recover; • Assess the depth of the impacted hand dug wells to verify if the expected drawdowns will result in the wells becoming dry; and • Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities.	• *Control through site planning and management,* • *Control through monitoring;* • *Remedy through rehabilitation* • *Stop through accidental spill*	Continue monitoring for at least five years post-closure, thereafter the frequency can be re-evaluated based on long term trends.

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
					response plan and procedures	
		Potential contamination plume	Decommissioning and Post-Closure	• Monitor the groundwater monitoring network quarterly for at least five years post closure, thereafter the frequency could be revised based on the long-term monitoring trends; • Implement recommendations from the geochemical and geotechnical assessment for the design of the WRD, to manage seepage quality and prevent failure of the WRD; • Update the geochemical assessments as mining progresses to increase the ARD knowledge for the waste rock material and verify the iron leachate results; • Should it be confirmed that the iron concentration in the leachate is as high as assessed with the geochemistry assessment, then water will need to be treated to meet the discharge or regional baseline limits; • Provide an alternative supply of water to private groundwater users, who are proven to be impacted by the Project. Alternative water supply must be provided at the area selected to relocate the impacted individuals and communities; • Rehabilitate the TSF, WRD and pit to recommended closure requirements; and • Monitor the spring flow from the springs underneath the WRD. This flow may need to be incorporated into the water balance for the project, if water quality indicates that water does not meet the discharge or regional baseline limits for the Project.	• *Control through site planning and management,* • *Control through monitoring;* • *Remedy through rehabilitation* • *Stop through accidental spill response plan and procedures*	Continue monitoring for at least five years post-closure, thereafter the frequency can be re-evaluated based on long term trends.
	Geochemistry (Surface and Groundwater Quality)	Refilling the open pit with water on cessation of dewatering activities will result in the formation of a pit lake. The water quality in the pit lake could potentially affect the quality of surface and groundwater.	Local area	The goal is to prevent contaminated water from surface runoff and pit walls from entering the pit lake. To achieve this, the following measures should be implemented: • Retention Berms: Retain the berms around the open pit to minimize the entry of surface water runoff into the pit at post-closure. • Post-Closure Monitoring: Continue monitoring of the pit lake water and surrounding monitoring boreholes for a minimum of five years. This monitoring will assess the predicted water quality and effectiveness of associated management measures. • Monitoring of Decant Points: Continuously monitor potential decant points established for the project post-closure to assess water quality. • The rehabilitation and closure of the open pits should align with the prescribed rehabilitation and closure plan. • Consider using the waste rock for inpit deposition.	• *Monitoring the pit lake quality* • *Inpit deposition using waste rock* • *Stormwater control to ensure that the clean water is continuously diverted away from the pit.*	Minimum of 5 years after closure
		The established WRDs will undergo infiltration, weathering, and erosion, resulting in alkaline runoff and seepage during rainfall events. This has the potential to impact the quality of soil, surface and groundwater.		• The primary objective is to minimize the potential generation and volumes of contaminated water from the WRD. To ensure proper management and rehabilitation of the WRDs, the following measures should be taken: • Berm Maintenance: Maintain the berms around the WRDs, designed to divert clean water away from the facilities, even after closure. This will help prevent clean water from contamination with seepage and runoff fromthe WRDs. • Progressive Rehabilitation: Implement progressive rehabilitation of the WRDs through activities such as shaping, levelling, and compacting. • Ongoing Water Quality Monitoring: Continue regular monitoring of water quality emanating from the WRDs for a minimum of five years after the final rehabilitation. This monitoring will detect any changes in water quality and assess the effectiveness of rehabilitation efforts. If contamination is	• *Monitoring of seepage from the waste rock* • *Rehabilitation by shaping, levelling and compacting.* • *Stormwater control to ensure that the clean water is continuously*	Minimum of 5 years post closure

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				detected, additional measures should be investigated and implemented promptly to mitigate any adverse impacts. • Dust Suppression Systems: Employ dust suppression systems. This proactive approach ensures effective control of dust during the initial stages of rehabilitation until the site is closed. • The rehabilitation and closure of the WRD should align with the prescribed rehabilitation and closure plan. • Use the waste rock for inpit deposition.	*diverted away from WRDs.* • *Deposit the waste rock in the pit.*	
		The established TSF will not be lined. Once deposition stops, the pool water is expected to recede, with minimal seepage and runoff anticipated after closure during the dry season, but there will be seepage in the wet season	Local area	• To ensure proper management and rehabilitation of the TSFs, the following measures should be implemented: • Covering with soil and vegtetation: Cover the tailings with soil and vegetate with indigenous plant species. • Berm Maintenance: Maintain the berms around the TSF to continue diverting clean water away from the facilities even after closure. This helps prevent clean water from entering the TSF footprint and potentially becoming contaminated. • Ongoing Water Quality Monitoring: Continue regular monitoring of water quality from the TSF for at least five years after final rehabilitation. This monitoring will help detect any changes in water quality and evaluate the effectiveness of rehabilitation efforts. If monitoring detects contamination, additional measures should be promptly investigated by the mine and implemented to address any adverse impacts. • Dust Suppression Systems: Use dust suppression systems. This ensures effective dust control during the initial stages of rehabilitation until the site is closed. • The rehabilitation and closure of the TSF should align with the prescribed rehabilitation and closure plan.	• *Cover the tailings with soil and vegetate with indigenous plant species.* • *Stormwater control to ensure that the clean water is continuously diverted away from TSF until post-closure.*	Minimum of 5 years post closure
Restoration and Post-closure monitoring (including diversion)	Soil Resources, Terrestrial biodiversity	Soil compaction and increased runoff and erosion, increased AIPs (decreased soil fertility, land capability and land use	Project footprint	• Implement and maintain an AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; • Implement a monitoring programme to determine potential contaminants from the stockpiles and rehabilitated areas. The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions; and • Implement a monitoring plan for at least two years after closure.	Soil management	During the Decommissioning phase
		Increased rehabilitation land capability and potential land use			Soil management ; and Rehabilitation plan	During the Decommissioning phase
	Wetlands	Final rehabilitation has the potential to lead to minor impacts on the wetlands, such as increased AIPs and erosion, however should be positive and lead to increased wetland health, functionality and ecosystem services		• Implement and maintain an AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; • Monitor erosion, sedimentation and possible contamination of downstream wetlands. Where water is contaminated it should be treated using an in-situ passive treatment system to get purified water for discharge to the natural environment or other beneficial uses; and	Biodiversity management plan	Throughout rehabilitation and closure phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Implement a monitoring programme to determine potential contaminants from the stockpiles and rehabilitated areas.		
	Socio-economic	Economic decline as a result of the cessation of Ramula-Mwibona Open Pit mine..		• Rehabilitation must be undertaken according to the SGKL's conceptual Mine Closure Plan which considers social closure strategies; • Ongoing community stakeholder engagement for communication of issues around closure; • Develop and implement a Retrenchment Plan that identifies the schedule for retrenchment, legislative requirements, approach to engagement with unions and employees/ contractors, and measures to assist those being retrenched with finding alternative employment; • Implement training measures during the Operational Phase; and • Implement the community development measures during the Operational Phase (especially alternative livelyhood projects)	Stakeholder engagement plan	Throughout closure phase
	Topography and Visual Amenity	Alteration of the natural visual character, changing its baseline sense of place.	Local area	• Apply dust suppression techniques to limit the dust from the demolition area. • Ensure all infrastructure is demolished and removed from the site. • Limit the quantity and time that rubble is stored on-site.	Control - through the implementation of mitigation and management actions.	Throughout closure phase
	Cultural and Archaeological Heritage	• Uncontrolled disposal and storage of decommissioned infrastructure in areas with known heritage resources; and • Uncontrolled/ unguided reclamation and rehabilitation may damage/destruction known cultural heritage site.	Local area	• Apply local, regional and national legislation, regulations, planning and align with IFC Performance Standard 8 on cultural heritage for managing and mitigating potential impacts resulting from infrastructure decommissioning and disposal; • Implement and monitor CHMP known in consultation with relevant stakeholders to prevent measures associated with Project decommissioning and rehabilitation phase; and • Implement policies and procedures on waste management and storage.	• Implementation of IFC SP 8, interpreted with Kenyan local, regional and national policies and legislation on cultural heritage; and • Implementation of waste management procedures.	Throughout closure phase
	Socio-economic environment	• Exposure to Occupational Health and Safety (OHS) and Nuisance Disturbance • Exposure to Occupational Health and Safety (OHS) and Nuisance Disturbance	Local area	• Continue to implement the corporate-level OHS Policy until all activities are ceased; • Continue to implement the site-level Health and Safety Procedures until all activities are ceased; • Ensure all personnel are trained on decommissioning-specific safety protocols; • Provide appropriate personal protective equipment (PPE) to all workers involved in decommissioning tasks; • Implement a Fatigue management Procedure to ensure workers are not overextended during long shifts; • Adhere to the Health and Safety Requirements for Contractors throughout the decommissioning phase; • Conduct thorough risk assessments before commencing decommissioning activities; • Undertake sensitization campaigns in the in the local study area on the health and safety risks associated with decommissioning and rehabilitation activities;	• SEP • Grievance Mechanism • Health and Safety Plan	Throughout closure phase

Activities	Affected Environmental Aspect	Potential Impact	Size and scale of disturbance	Mitigation/Management Measures	Recommended Action Plans	Time period for implementation
				• Restrict public access to working areas until they are completely rehabilitated; • Monitor and control dust, noise, and vibration levels throughout the decommissioning process; • Conduct post-closure site inspections to ensure all safety concerns are addressed • Maintain an on-site emergency response team to address potential incidents during decommissioning; • Retain warning signage at infrastructure areas that remain in place.		
		• Decrease in Household Incomes and Living Standards	Local area	• Development of a social closure plan which emphasise the importance of providing transferrable skills to employees, with specific emphasis on local employees. This must include a retrenchment plan; • Early communication and planning with communities to prepare for the decommissioning and rehabilitation stage; • Facilitate skills training and capacity-building initiatives to help workers transition to alternative employment opportunities; • Work with local governments and NGOs to improve access to healthcare and education services. • Support local economic development projects to diversify income sources and reduce dependency on mining; • Collaborate with community leaders and local authorities through the Stakeholder Engagement Plan to enhance community safety programs and address potential increases in crime and social issues; • Monitor and assess the social and economic impacts post-closure to address emerging challenges; and • Initiate temporary employment programs related to the decommissioning process, such as site rehabilitation and infrastructure dismantling.	• SEP • Social Closure Plan (including retrenchment plan)	To commence in the operational phase (at least two years before decommissioning) and continue through decommissioning and closure
		• New Livelihood Restoration Opportunities	Local area	• Implement comprehensive land rehabilitation programs to restore land productivity, including soil restoration, re-vegetation, and erosion control; • Engage local communities in participatory planning to ensure that livelihood restoration efforts align with their needs and preferences; • Provide community training in sustainable agriculture and alternative livelihoods to maximize the use of restored land and water sources; • A detailed closure plan must be developed at least two years before decommissioning and include measures to reduce the workforce and look to complete sustainable development projects and programmes as part of closure; • Development of the detailed closure plan should include comprehensive stakeholder engagement to feed into rehabilitation measures to agree on the final land uses; and • Proactively assess and manage socio-economic impacts on sustainable community development programmes and projects by investing in skills development and agricultural training. Once the communities' access is restored, they will have the skills and the knowledge to enhance the productivity of the land through the implementation of new and innovative agricultural techniques.	• SEP • Social Closure Plan	To commence in the operational phase (at least two years before decommissioning) and continue through decommissioning and closure
		•		•	•	

9.7. Emergency Preparedness Response

SGKL will implement and maintain and regularly update the existing Emergency Preparedness and Response Plan (EPRP) as part of the SGL's operations in Tanzania which will extend to the proposed Project. The EPRP serves as a functional and effective tool to manage any hazards that might occur throughout the LoM. The components of EPRP cover the following:

- Emergencies and Accident;
- Injuries;
- Medical Emergency;
- Emergency Response Policy;
- Delegation of Responsibilities;
- Mine Rescue Equipment; and
- Mutual Agreement

10. Environmental and Social Monitoring Plan

This section outlines the monitoring and reporting program to be implemented during the construction, operations and post-closure phases of the Project. The monitoring plans have been developed based on the mining activities that will be carried out, the potential impacts identified and assessed in Chapter 8, and relevant legislation, standards and guidelines described in Chapter 3.

The principal purpose of the monitoring and reporting program is to provide information necessary to determine the Project's operational and environmental performance within and around the Project area. Regular monitoring serves as an indication of the efficiency of the mitigation and management measures, as well as compliance with standards, guidelines and permit conditions imposed by EMCA.

The monitoring and reporting program has been designed to:

- Comply with applicable Kenyan legislation, standards, and guidelines;
- Adhere to good international industry practices relating to environmental monitoring; and
- Allow periodic reassessment of the Project's impacts (and subsequent review of mitigation and management measures).

The Project will undertake regular monitoring and reporting throughout the LoM and ensure that sufficient resources are available for effective program implementation. Where appropriate, external contractors or parties may be engaged for the provision of additional support in implementing the monitoring and reporting program.

SGKL's environmental team will be responsible for implementing an environmental Monitoring Programme. The principal purpose of the monitoring Programme is to provide information necessary to determine the Project's operational and environmental performance within and around the proposed mining area. Regular monitoring serves as an indication of the efficiency of the mitigation and management measures, as well as compliance with standards, guidelines, and permit conditions imposed.

The monitoring and reporting program is designed to:

- Comply with applicable national legislation, standards and guidelines;
- Adhere to internationally acceptable good environmental monitoring practices;
- Allow periodic reassessment of the Project's effects and subsequent review of mitigation and management measures;
- Be simple to implement and report results; and
- Be auditable.

The key environmental aspects which form the monitoring programme are:

- Surface water (quality and quantity);
- Groundwater (quality and quantity);
- Air quality;
- Noise;
- Vibration;
- Biodiversity;
- Traffic
- Social economic aspects
-
- Wetlands
- Soils, land, closure and rehabilitation; and
- Heritage.

A summary of the aspects of the monitoring programme are provided in the Table 10-1 below. Detailed monitoring programmes have been prescribed in each of the specialist investigations carried out.

Table 10-1: Monitoring and Management of Environmental and Social Impacts

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
All activities throughout the Project life cycle	Water quality	• Ensure water quality monitoring as per sample monitoring locations as well as parameters ; • It is also recommended to monitor water quality within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge; • Review the relevance of monitoring sites throughout the project and adapt as necessary; and • Surface water monitoring points should have records, photographs and descriptions.	Monthly monitoring during construction, operation, decommissioning and for at least three years after closure, or until rehabilitation has reached a sustainable state with no further changes.	Environmental Officer
	Water quantity	• Streamflow monitoring should be conducted to detect any changes in the flow regime that might be resulting from project related activities; • Streamflow monitoring should be conducted using a flow probe or V-notch to detect any changes in the flow regime that might be resulting from project related activities; • Flow monitoring should also be conducted on surface water circuits and storage dams at the mine to update/calibrate the water balance with accurate figures as mining progresses; and • If there are weirs, they can be used to monitor the discharge volumes in the river; or • Real-time streamflow data loggers can be used to capture real-time flows	• Monthly streamflow monitoring and daily flow monitoring in the mine circuit and storage facilities; and • Daily flow meter data records from the mine circuit should be kept in areas with an automatic monitoring system	Environmental Officer and Mining Department for flow meter reading
	Physical structures and Storm Water Management Infrastructure performance	• Mine personnel should carry out regular inspections around the SWMP facilities to determine their condition and identify any anomalies such as leaks or water levels, overflows and system malfunctions; and • Pipelines or drains should be inspected for hydraulic integrity; and the overall SWMP performance must be monitored on a regular basis; and • A record should be kept with date of inspection, location and site pictures, name of the inspector and identified anomalies.	Storm water channels and mine dams are to be inspected for siltation and blockages at least once a month. A record should be kept with date of inspection, location and site pictures, name of the inspector and identified anomalies.	Environmental Officer
	Sedimentation	• Inspect construction sites, sites where infrastructure is demolished and rehabilitated sites for traces of erosion to ensure no entrance of sediment occurs into nearby watercourses, especially after rainfall events; and	After rainfall event, until the establishment of vegetation on all rehabilitated sites.	Environmental Officer

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
		• Temporary silt fences and soil stabilisation blankets should be installed and maintained until vegetation is established.		
	Meteorological data	• Real-time rainfall measurements using a tipping bucket rain gauge, if possible; and • Alternatively, a bulk rain gauge can be used to capture the total amount of rainfall for each event.	Daily and after a rainfall event	Environmental Officer
	Wetland health and existing conditions compared to the baseline conditions (i.e., PES, EcoServices)	• Wetland update report and recommendations for impact mitigation, if any.	Annually during the Construction phase (considering short duration) and every second year (fixed time of the year) during the Operational and Rehabilitation Phases	Environmental Department Wetland Specialist
	Wetland physical attributes (vegetation, erosion, habitat, open water extent)	• Take photos of adjacent and downstream wetland areas and record any impacts seen. • Analyse permanent plots/ fixed-point analysis. • Determine the rehabilitation's success and provide recommendations if impacts are observed.	Every second year (fixed time of the year) during the Operational and Rehabilitation Phases	Environmental Department Wetland Specialist
	Infrastructure (i.e., Including crossings, erosion, sedimentation, preferential flow paths, fragmentation, culverts and road crossings) and all other infrastructure affecting wetlands at monitoring points	• Monitor infrastructure and residual impacts on the wetlands. This should be carried out to the specifications listed above this table, including fixed-point photography, calculation of PES and EcoServices.	Every second year (fixed time of the year) and after storm events larger than 1:10 year events	Environmental Department Wetland Specialist
	Soil health and fertility	• Soil update report and recommendations for impact mitigation, if any.	• Once-off following construction and annually (fixed time of the year) during operation and rehabilitation. • Minimum 3 years after Rehabilitation	Environmental Department Soil Scientist
	Soil physical attributes (Vegetation, erosion, sedimentation)	• Take photos of impacted areas and record any impacts seen.	Once during construction and after storm events larger than 1:100 year events during construction and Annually (fixed time of the year) during operation and rehabilitation. • Minimum 3 years after Rehabilitation	Environmental Department Soil Scientist
	Soil contamination assessment (If and when applicable)	• Take soil samples for laboratory analysis, measuring potential harmful elements. Measure against the baseline data and SSV.	Only after a spill has occurred. Quarterly sampling until the land is rehabilitated	Environmental Department Soil Scientist

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
	Environmental Noise	• It is recommended that noise monitoring be undertaken to calibrate the observed model results and determine the actual extent to which Project related emissions impact the baseline levels at the various NSRs. • Parameters should include but not limited to LA_{min}, LA_{max} and LA_{eq}. In addition, noise monitoring should be conducted in line with the requirements of the IFC-EHS guidelines at selected monitoring locations.	It is recommended that quarterly noise monitoring from the commencement of the construction phase should be undertaken.	Environmental Officer
	Limit degradation and destruction of the natural environment to designated Project areas. Monitor the impact of the Project activities on the vegetation communities (mixed woodland and riverine habitats)	• Keep the footprint of the disturbed area to a minimum and only designated areas. Vegetate areas of construction activity. • Monitor permanent plots/ fixed-point analysis across the Project area of directly impacted habitats and sensitive areas adjacent to the infrastructure areas.	Annually (fixed time of the year).During construction, operation, and rehabilitation.	Environmental Team
	Rehabilitation	Implementation of mitigation measures. • Save plants of reasonable size and transport to the nursery, investigate possible species to use for rehabilitation through a trial nursery and rehabilitation trials. Monitor the regrowth of rehabilitated areas by recording the density of the basal growth. This can be undertaken by doing regular vegetation condition assessments.	Bi-annually (twice a year) and after storm events larger than 1:100 year events during construction and operation	Environmental Team
			Annually (fixed time of the year) during rehabilitation	Environmental Team
	Restrict alien invasive plant (AIP) establishment	• During the stripping of soils and dumping operation. As these areas will be at risk AIP recruitment. Continuous and early detection for weed recruitment will control the spread. • Report any irregularities to the Environmental Officer for assessment and mitigation/remediation measures	Bi-annually (twice a year) (fixed time of the year) during construction and operation	Environmental Team
			Annually (fixed time of the year) during rehabilitation	Environmental Team
	Presence of threatened or rare fauna species	• Maintain a monitoring programme for the species, to isolate 'no-go' areas and actively aid in protection. • Further investigations should be undertaken to ascertain the extent of the SCC habitat and identify movement corridors. • Update the existing BMP to include a monitoring programme for the confirmed SCC.	Annually (fixed time of the year) during construction and operation	Environmental Team
	Infrastructure (e.g., Including pipeline crossings, erosion, sedimentation, preferential flow paths, fragmentation, culverts and road crossings)	Implementation of mitigation measures. • Monitor infrastructure and residual impacts on the surrounding habitats and ensure no further degradation is occurring.	Annually (fixed time of the year). During construction, operation, and rehabilitation.	Environmental Team

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
	CH Sites	• CH sites should be monitored, photographed and reported every six months, as well as before commencement of different Project phases.	Monitoring once every six months for the duration of the Project, as well as prior to commencement of different Project phases (construction, operation, decommissioning) until rehabilitation has reached a sustainable state with no further changes.	Environmental Officer
	Graves and Grave Sites	• Graves and grave sites within 50m from access roads, or who are otherwise at risk of potential impact, should be monitored, photographed and reported every six months, as well as before commencement of different Project phases.		
	Pit Wall and Waste Rock	Geochemical characterisation of waste rock and pit wall materials (laboratory static)	As required, especially if there is an expansion	Environmental Officer
	Pit Water	Parameters should include but not be limited to high pH, electrical conductivity, sulphate, fluoride, nitrates, barium, iron, copper, magnesium, scandium, sodium and zinc.	Monthly monitoring during operation, decommissioning and for at least five (5) years after closure, or until rehabilitation has reached a sustainable state with no further changes.	Environmental Team
	Waste Rock Dump/ Tailings Storage Facility	Mass/volumes of waste rock/Tailings	Daily	Processing Team
		Inspection of the WRDs, its surroundings, and the drainage/seepage[5]	During rainfall events	Geotecnical Engineering Team
	Toe Seepage from the Waste Rock Dump/Tailings Storage Facility	Monitor the toe seepage, especially during the wet season and the parameters should include but not be limited to high pH, electrical conductivity, sulphate, fluoride, nitrates, barium, iron, copper, lead, magnesium, nickel, scandium, sodium and/or zinc	Monthly monitoring during operation, decommissioning and for at least five (5) years after closure, or until rehabilitation has reached a sustainable state with no further changes	Geotechnical Engineering and Processing Plant Teams
	In situ & Ex situ water quality	*In situ* assessment of the following parameters using calibrated handheld water quality meters: temperature, pH, electrical conductivity, dissolved oxygen concentration and percentage saturation. Ex situ (physical-chemical) chemical analysis (i.e., organics/inorganics, heavy metals, etc.) at an accredited laboratory.	Aquatic monitoring reports are expected to be produced on a bi-annual basis unless the monitoring requirements are amended as noted in the proposed frequency section of the monitoring programme. Due to the largely seasonal conditions of the watercourses, the proposed aquatic monitoring programme and assessment of the proposed monitoring indicators should take place on a bi-annual basis and include both the dry and rainy season.	Suitably qualified aquatic ecologist with experience in assessing the ecology of Kenyan river ecosystems.
	Diatom assemblages	Diatom assemblage assessment and determination of the Present Ecological State Class by means of the Specific Pollution-sensitivity Index (SPI) to supplement the macroinvertebrate data		
	Adapted Integrated Habitat Assessment System	According to McMillan (1998; Version 2).		

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
	Macroinvertebrate assemblages	Sampling protocol according to an adapted version of the TARISS and use of the Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies) taxa richness metric (Barbour et al., 1998).	The frequency of monitoring can be reduced to every second year if deemed acceptable by a suitably qualified aquatic ecologist. This can only take place after a minimum of three years of monitoring from the commencement of the Operational Phase. The water quality monitoring, however, should be conducted monthly during periods when surface water is present. This is for the duration of the project life cycle.	
	Fish assemblages	Using standardised electrofishing and netting techniques and comparison to established baseline conditions.		
	Groundwater Flow	Install flow meters to monitor abstraction volumes from dewatering boreholes and in-pit sumps	Daily	Environmental Office
	Groundwater Levels	Abstraction Boreholes	Daily	Environmental Office
		Monitoring Boreholes	Monthly	Environmental Office
		Community Wells and Boreholes	Monthly	Environmental Office
	Groundwater Quality	**Project Boreholes** pH, TDS, TSS, EC, alkalinity, major cations and anions (calcium, magnesium, sulphate, sodium, chloride and potassium), fluoride, nitrate and nitrite as N, ammonia, ammonium, phosphate and total and dissolved metals (zinc, nickel, aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, scandium)	Quarterly	Environmental Office
		Community Wells or Boreholes Same parameters as for the Project with additional total coliforms and E. coli	Monthly	Environmental Office
	Rainfall	Install a rain gauge at the Project Area	Daily	Environmental Office

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
	Affected dwellings/PAPs	RAP and LRP reports, PAC complaints, site inspection	Once before onset of construction works	SGKL & Contractor
	Direct employment	Number of people from the affected communities being directly employed by the Project, payrolls, complaints received	Throughout Project lifecycle	SGKL
	Training and skills development opportunities	Training records, training and awareness programmes, training needs assessments	Quarterly during construction, bi-annual during operation	SGKL & Contractor
	Business opportunities created	Number of local businesses providing goods and services for the Project, supply chain reports	Quarterly	SGKL & Contractor
	Tension, expectations, public relations	Grievances/complaint received, sensitization and awareness programmes initiated, stakeholder engagement reports	Monthly	SGKL
	Crimes	Inspections, observations, local police reports, complaints received	Daily	SGKL & Contractor
	Assaults/harassment, GBV cases	Site observation, complaints, police reports, number of sexual harassment cases reported	Daily	SGKL
	Health and education facilities capacities	Medical reports, complaints, site visit	Monthly	SGKL
	Influx levels	Sub-location/village government reports, observations, complaints received	Monthly	SGKL
	PPE, Accidents, injuries	Daily OHS reports, inspections, clinical records	Daily	SGKL & Contractor
	Complaints about disturbance from excessive noise, vibration, water pollution and emission/dust	Complaints concerning excessive dust, noise from neighbouring residents, clinical records	Bi-monthly	SGKL
	Vulnerable groups	Complaints received, inspection reports	Quarterly	SGKL & Contractor
	Grievances	Number of complaints received	Weekly	SGKL

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Frequency and Duration of monitoring	Responsibility
	Livelihood activities	Stakeholder engagement reports, awareness programmes, grievances received	Quarterly	SGKL
	Community Health and Safety	Number and severity of traffic incidents on community roads in and around the Project site. Grievances raised through the grievance mechanism.	Monthly	SGKL
	Resettlement Monitoring	Monitoring and evaluation measures outlined in the RAP to be developed.	Pre-construction and up to three years post-resettlement	SGKL & Contractor

11. Cost Benefit Analysis

11.1. Introduction

This chapter describes the analysis of the social and environmental costs and benefits of the proposed Project in SGKL.

The Cost-Benefit Analysis of the proposed Project can be directly linked to the Impact Assessment Provided in Chapter 8, which covered all possible impacts consolidated from several specialist studies appended to this report.

Cost Benefit Analysis (CBA) is a procedure for evaluating the desirability of the Project by weighing benefits against costs. CBA is used for efficiency assessment of a Project, which refers to analysis made for the purpose of identifying how to use scarce resources to obtain the greatest benefits from them.

The intervention can be in the form of new investment in infrastructure, new development, adoption of a new policy or services, etc. The types of economic impacts can be:

- Positive, through creation of jobs, generation of business sales and value added, improved quality of life, increase in disposable income, and growth of government revenue in the form of taxes and royalties; and
- Negative, through the loss of foregone alternative livelihoods/business activities and negative social and environmental externalities.

The proposed Ramula- Mwibona Open Pit Mining Development is a greenfield Project, and the objective of the feasibility study is to ascertain the proposed Project viability and also seek to ensure the Project plays a significant role in Kenya’s economy.

Economic Impact Assessment in mining deals with the evaluation of potential impacts of a particular project on the economic environment of the receiving area. It analyses potential changes in production output, Gross Value Added, and employment during the relevant life cycle phases of the proposed mining project. Assessment of the economic impacts requires knowledge of expenditure on the construction of the mine and operating costs borne once mining commences.

On the other hand, CBA is a procedure for evaluating the desirability of the project by weighing benefits against costs. CBA is used for efficiency assessment of a project, which refers to analysis made for the purpose of identifying how to use scarce resources to obtain the greatest benefits from them.

The Section, therefore, describes the possible benefits and costs to the mine in terms of its proposed open cast mining operations at the Ramula- Mwibona concession area, community and environment according to policies and guidelines of CBA.

11.2. Adopted Methodology

At present, Kenya does not have a formal CBA framework for an Environmental Impact Assessment. As such, the Cost Benefit Analysis Guidelines provided by the Queensland Government – Department of Infrastructure and Planning – "Project Assurance Framework – Cost benefit Analysis" (QG-DIP, 2011), have been adopted for this report.

The premise of the Project Assurance Framework is that if the costs and benefits of a Project can be reasonably measured (including those which can be thought of as social and environmental) it is possible to gauge the impact of a Project on the economic welfare of a community (QG-DIP, 2011).

The Project Assurance Framework (QG-DIP, 2011) identifies the steps in the decision-making process for a CBA. These steps have been modified to focus primarily on the economic viability of proposed mining option only as this has already been identified as the best option in the Project Alternative chapter (see Chapter 7). The steps include:

- Outcome identification;
- Project viability evaluation through calculation of costs and benefits of the Project, including:
  - Financial evaluation;
  - Identification of stakeholders and determining the relative benefits and costs to various stakeholder groupings (stakeholder identification for this Project is available in Chapter 6, Stakeholder Engagement); and
  - Analysis of the costs and benefits of the Project to; the social environment (e.g., education, health and culture), ecological environment (e.g., habitats, flora, fauna, air and water quality) and financial (i.e., if revenues will cover costs (on a cash basis) and if there will be return on capital invested).
- Assessment of costs and benefits.

Aspects pertaining to the social environment, such as employment opportunities and social impacts, have been incorporated into this analysis using a qualitative approach, due to the difficulty in quantifying all of the costs and benefits of this Project on the environment in monetary terms.

11.3. Outcome Identification

It has been assumed that the desired outcome of the Project is to generate a positive Net Present Value (NPV) through introduction of the gold mining Operations; where revenue covers the total costs of investment; and appropriate contributions can be made towards environmental protection and remediation activities to offset impacts to the ecological and social environments.

11.4. Economic Overview

11.4.1. Brief Economic Overview of Kenya

According to the 2023 World Bank Kenya Economic Update (KEU), Kenya's economic grew by 5.9% in 2023, up from 4.3% in 2022. This increase is attributed to a recovery in agriculture, which had experienced two consecutive years of decline, alongside the resilience of the services sector. Manufacturing, on the other hand, was negatively impacted by rising production and borrowing costs, a weakening shilling, and political tensions, which moderated overall industrial activity. Additionally, tourism sector expanded in the first half of 2023, though at a slower pace.

Inflation eased to 6.8% by November 2023 due to improved food supplies and tighter monetary policies, but challenges like high electricity tariffs and increased taxes persist. Public debt rose to 71.4% of GDP in FY2022/23, with fiscal consolidation efforts ongoing. Kenya's real GDP growth is projected to range between 4.5% and 5.2% in 2024, supported by private sector investment and easing inflation. However, external financing challenges remain a risk to the economy (ibid).

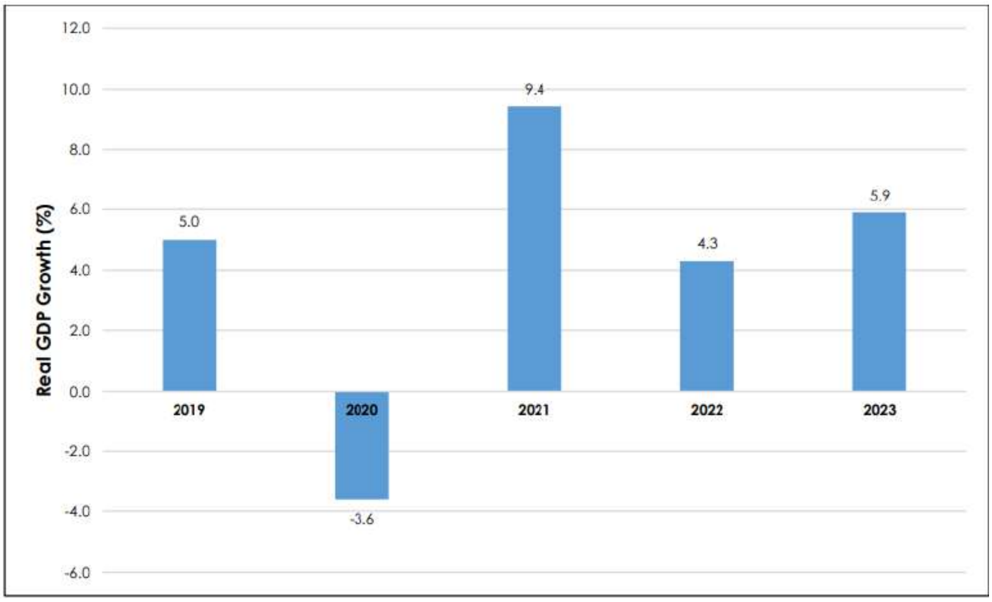

Figure 11-1: Kenya's GDP Growth rate for period of 2019-2023

Source: Kenya Gross Domestic Product Report, 2023

Furthermore, The Kenyan Shilling appreciated against major currencies, while the average yield rate for 91-day Treasury Bills rose to 16.68%. The Nairobi Securities Exchange saw a significant surge, with the Nairobi Securities Exchange (NSE) 20 Share Index increasing by 14.1%, driven by higher trading volumes and turnover.

11.4.1.1. Brief Socio- Economic Profile of Siaya County

The Siaya County is situated in the Western part of Kenya within Nyanza region and covers a land surface area of approximately 2,530 km² and water surface area of approximately 1,005 km². Siaya County neighbours Vihiga and Kakamega Counties to the North-East, Kisumu County to the South-East, Busia County to the Northwest and Homa Bay County across the Winam Gulf to the south.

The county has a diverse economy primarily driven by agriculture, trade, and fishing. According to the Gross County Product Report (2021), Agriculture is the backbone of the county's economy, employing a significant portion of the population and contributing approximately 60% of the Gross County Product (GCP), which was estimated at Ksh. 15.4 billion in 2021 (Contributing to 1% of the GDP). The county's proximity to Lake Victoria makes fishing another vital economic activity, providing livelihoods for many residents and significantly contributing to local food security and income. Additionally, the trade sector is growing, with urban centers serving as commercial hubs for agricultural products, household goods, and services.

11.4.1.2. Brief Socio- Economic Profile of Vihiga County

Vihiga County is one of the four counties with its headquarters located in Mbale Town. It is situated in the Lake Victoria Basin in the Western Kenya Region. The county borders Nandi County to the east, Kisumu County to the south, Siaya County to the west and Kakamega County to the North and covers an area of 563.7 km².

The county's major economic activities include cottage industries, small scale subsistence farming, tea farming, wholesale and retail trade, as well as quarrying and mining. Vihiga County recorded a Gross County Product (GCP) of Kshs 101. 8 billion contributing to 0.8 % of the GDP mainly supported by the agricultural sector and Small, Medium and Micro Enterprises. The growth was mainly driven by a rebound in the agricultural sub-sector.

Both Siaya and Vihiga counties are members of the Lake Region Economic Bloc (LREB). The bloc aims to leverage economies of scale, optimize the utilization of shared resources, and maximize the competitive and comparative advantages of member counties to accelerate economic growth and improve the livelihoods of the region's people.

Details of the counties and project specific socio-economic profile are discussed in Section 5 of this report. Most inhabitants depend on agriculture and livestock keeping for earning their income, other economic activities include petty business and small-scale mining.

11.5. Justification of Cost Benefit Analysis

CBA is a tool used to either rank projects or to choose the most appropriate option. The ranking or decision is based on expected economic costs and benefits. The rule is that a project should be undertaken if lifetime expected benefits exceed all expected costs.

The art of the analysis process comes in the measurement of these impacts, their adjustment for market failure, and for the effects of time, income distribution, incomplete information and potentially irreversible consequences. A principle of western economics by Adam Smith is 'that the market knows best'. In a perfect world, the market would ensure that land, labour and capital were allocated in a way that would maximize both profits, and the welfare of society. Ours is an imperfect world, but CBA is a tool that allows the analyst to mimic the welfare optimizing behaviour of the market. Although complexities arise when costs and benefits are being measured and corrected, CBA is a simple tool with numerous uses and applications, especially in the environmental assessment sphere. Its use increases accountability and consistency in decision-making.

11.6. Stakeholders to the Project

The stakeholders to the proposed Project were identified and their views towards the Project discussed in chapter 6. This section looks at the cost and benefits of the Project to the various groups of stakeholders. The Costs/Benefits to Project Stakeholders are summarised in Table 11-1

Table 11-1: Summary of the Project Benefit to Stakeholders

Project Stakeholders	National Stakeholders	County stakeholders	Local Stakeholders
• Project will be in an already established area; • Provision for employment opportunities; • Development of skilled labour; • Contribution to the nation's GDP and industrialization; • Overall Investment costs; • Contribution to government; and • Minimal loss to the habitat.	• Taxes and royalties; • Increase in national GDP; • Foreign investment; • Reduction in poverty due to trade-led economic growth; • Increased skilled labour; • Increase of international trade; • Employment opportunities for the nation; • Small business development; and • Increase in Foreign Exchange.	• More District recognition; • Increase in regional GDP which could boost local income growth; • Potential for small business owners to grow; and • Employment for district citizens.	• Employment opportunities; • Increased skilled labour; • Business opportunities for small-scale traders; • Community Investment from the Project; and • Reduction in poverty due to trade-led economic growth.

11.7. Assessment of Costs and Benefits

11.7.1. Financial Analysis

Consideration of the financial and economic impacts of the proposed Project is a key requirement for CBA. This analysis weighs the costs and benefits from an internal (proponent) perspective and from an overall (community/government/national) perspective.

The financial costs and benefits of the Project are presented in Table 11-2. This financial summary has been compiled based on the current Project description economic and financial summaries supplied by SGKL.

Table 11-2: Summary of financial costs and benefits

Item	Ramula
Production Rate	1500 tpd
Initial Capital Period	3 years
Production Period	5.5 - 6 years
Gold Sold	305 – 330koz
Initial Capex (Pre-Production)	$100M - $137M
Sustaining Capex	$19M - $24M (~$4M/yr)
Average Total Opex ($/t)	$87/t (~$48M/yr)
- Mining	$38/t
- Processing	$20/t
- Admin	$14/t
- Selling & Royalties	$15/t

(Source: SGKL*, 2024)*

The above analysis indicates that there will be substantial contributions to the national economy through expenditure and wages to national and local businesses and staff, as well as contributions to government in the form of royalties and taxes. The financial contributions to the national economy are expected to bolster economic growth in the region through local wages and expenditure by nationals and expatriates within Kenya. The contributions to government will be indirectly beneficial to the Kenyan population and more specifically to the local communities within the Project affected areas and the relevant counties, as the contributions are allocated to develop social schemes and infrastructure.

11.7.2. Environmental Analysis

11.7.2.1. Ecosystem services

While the financial costs and benefits of a Project will ultimately dictate its profitability, the costs and benefits to communities and the environment in which Projects are undertaken are often not accounted for in such financial assessments. Identifying the value of the natural environment contributes towards better decision-making and ensures that the costs and benefits to the natural and social environment are considered. In making these decisions, the understanding of the ecosystems as a dynamic complex of plant, animal, and microorganism communities and the non-living environment, are interacting as a functional unit in which humans are an integral part.

To a large extent, the ecosystem services refer to the environmental benefits people obtain from ecosystems. These include more direct services such as food, water and cultural services such as spiritual, recreational, and cultural benefits. There are also indirect services which include regulating services such as flood and disease control and supporting services, such as nutrient cycling that maintain the conditions for life on Earth.

Valuing ecosystem services can be achieved by using two complementary frameworks. These are:

- **Millennium Ecosystem Assessment (MEA) 2007**: widely accepted framework for categorising all ecosystem services. Table 10.2 provides examples of the different types of ecosystem services within the four broad categories of ecosystem services; and
- **Total Economic Value framework (TEV)** (Brander et al., 2010): methodology used to value changes in ecosystem services. Determine the use and non-use values individuals or society gains or losses from marginal changes in ecosystem services.

Table 11-3: Millennium Assessment ecosystem service categories

Category	Description	Examples of ecosystem services provided
Provisioning services	Products obtained from ecosystems	• Food (e.g., crops, fruit, fish); • Fuel and fibre (e.g., timber, rope, and firewood); • Biochemical, natural medicines and pharmaceuticals; and • Genetic resources (e.g., genetic diversity of crop and livestock).
Regulating services	Benefits obtained from the regulation of ecosystem processes	• Climate regulation: e.g., land cover can affect local temperature and precipitation globally; ecosystems affect greenhouse gas sequestration and emissions; • Water regulation: ecosystems can affect the timing and magnitude of runoff, flooding, etc.; • Erosion control: vegetative cover plays an important role in soil retention/prevention of land/asset erosion;

Category	Description	Examples of ecosystem services provided
		• Water purification/detoxification: ecosystems can be a source of water impurities but can also help to filter out/ decompose organic waste; • Natural hazard protection: e.g., from storms, floods, landslides; and • Bioremediation of waste: i.e., removal of pollutants through storage, dilution, transformation, and burial.
Cultural services	Non-material benefits that people obtain through spiritual enrichment, cognitive development, recreation etc.	• Spiritual and religious value: many religions attach spiritual and religious values to ecosystems; • Inspiration for art, folklore, architecture etc.; • Social relations: ecosystems affect the types of social relations that are established e.g., fishing societies; • Aesthetic values: many people find beauty in various aspects of ecosystems; • Cultural heritage values: many societies place high value on the maintenance of important landscapes or species; and • Recreation and ecotourism.
Supporting services	Necessary for the production of all other ecosystem services	• Soil formation and retention; • Nutrient cycling; • Primary production; • Water cycling; • Production of atmospheric oxygen; and • Provision of habitat.

(Source: Millennium Ecosystem Assessment 2007)

1.1.1.1 Total Economic Value Framework

Total Economic Value (TEV) is a concept in cost benefit analysis that refers to the value derived by people from a natural resource, a man-made heritage resource or an infrastructure system, compared to not having it. The framework is summarised in Figure 11-2 and Table 11-4 gives a typology of those values (Brander et al., 2010).

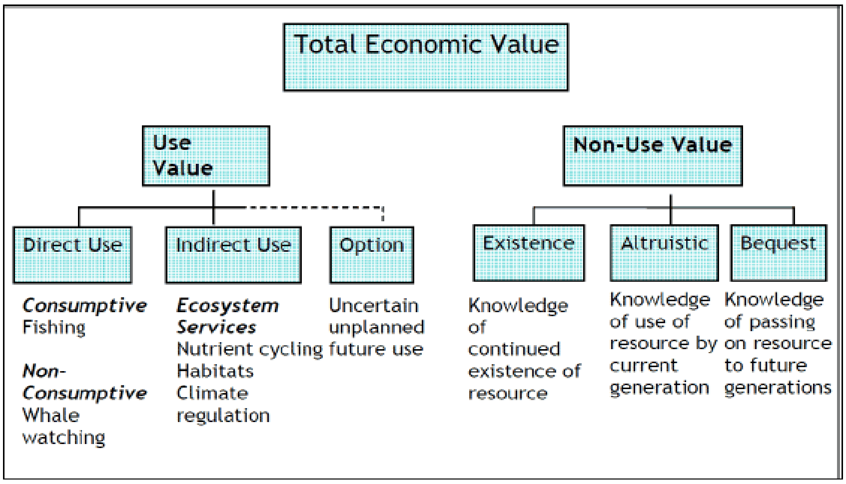

Figure 11-2: Total economic value framework

(Source: (Potts & Hastings, 2012)

Table 11-4: A typology of values

Value type	Value sub-type	Meaning
Use values	Direct use value	Results from direct human use of biodiversity (consumptive or non-consumptive).
Indirect use value	Derived from the regulation services provided by species and ecosystems	
Option value	Relates to the importance that people give to the future availability of ecosystem services for personal benefit (option value in a strict sense).	
Non-use values	Bequest value	Value attached by individuals to the fact that future generation will also have access to the benefits from species and ecosystems (intergenerational equity concerns).
Altruist value	Value attached by individuals to the fact that other people of the present generation have access to the benefits provided by species and ecosystems (intra-generational equity concerns).	
Existence value	Value related to the satisfaction that individuals derive from the mere knowledge that species and ecosystems continue to exist.	

(Source: Brander et al., 2010)

The Millennium Ecosystem Assessment (MEA) and TEV are complementary and shows how these two approaches can be combined to value ecosystem services.

Table 11-5: Valuing ecosystem services using the MA and TEV frameworks

MA Framework		TEV Framework			
MA Group	**Service**	**Direct Use (D)**	**Indirect Use (I)**	**Option Value (O)**	Non-use Value (N)
Provisioning	Food; Fibre; Fresh water supply; and Land Use	√			
Regulating	Air Quality; Climate; Water; and Natural Hazard.		√		
Cultural	Cultural Heritage; Recreation; Tourism; and Aesthetic	√			
Supporting	Primary production; and Nutrient cycling	Valued through the other ecosystem services categories			

(Source: Millennium Ecosystem Assessment (2007); Brander et al., 2010)

11.7.3. Prediction of Costs and Benefits

11.7.3.1. Environmental Project Costs

In this sub-section, we look at the qualitative cost predictions of the Project on the environment through the ecosystem services, looking at both internal and external ecosystem services of the Project area. Table 11-6, show this analysis.

Table 11-6: Qualitative Cost Analysis on Key Ecosystem Services

Ecosystem Service Category	**Ecosystem Service Role**	**Nature of Value**				**Predicted Cost Effect/ Value**	**Description**
		D	I	O	N		
Regulating	Air Quality Maintenance	√		√	√	-	Project has the potential for atmospheric emissions such as dust and combustion emissions that are likely to occur during construction and operation.

Ecosystem Service Category	**Ecosystem Service Role**	**Nature of Value**				**Predicted Cost Effect/ Value**	**Description**
		D	I	O	N		
	Climate regulation (e.g., carbon sequestration by indigenous vegetation)	√			√	-	Greenhouse gases will be released during Project activities
	Water regulation (e.g., Groundwater & Hydrogeology)	√		√		-	Constructions proposed will contact groundwater supplies or interact with hydrogeology
	Water regulation (e.g., Surface water & Hydrology)		√	√		-	Potential for surface water quality and drainage to be affected (i.e., increased surface water turbidity, wastewater generation, etc.) by construction and operation of the Project
	Soil Regulation (e.g., Soil Quality and Topography)	√	√			-	Potential for accidental leaks or spills which could affect soil quality
	Erosion Control		√		√	-	Substantial land clearing and ground upgrade since it is a greenfield project
	Terrestrial Biodiversity & Habitats		√		√	+	There are no sensitive terrestrial biodiversity receptors within the Project area due to Project area
	Aquatic Biodiversity & Habitats		√	√	√	-	Potential effect to the aquatic habitats during the construction and operation phase to the downstream environment
Provisioning	Food (e.g., plants, Fish, Other Animals)	√			√	+	Project has no effect on food productivity (edible plants) since will not affect the size of agricultural land.
	Fibre and fuel (e.g., wood, carving material)		√			-	No site clearance for the Project development

Ecosystem Service Category	Ecosystem Service Role	Nature of Value				Predicted Cost Effect/ Value	Description
		D	I	O	N		
	Land use and Acquisition	√			√	-	There will be resettlement/ acquisition of land to allow development of the proposed infrastructure
	Genetic resources (e.g., Genetic diversity of plants and animals)	√				?	No evidence of extensive provisioning of genetic resources in the Project area
	Ornamental resources (e.g., wetlands, Shells, plants)	√			√	0	No evidence of extensive provisioning of ornamental resources in the Project area
Cultural	Aesthetic Value (e.g., Landscape and visual)		√		√	-	The Project will create any additional landscape and visual effects in the immediate vicinity of the Project site
	Cultural Heritage	√			√	-	Cultural heritage features have been identified in the Project site
	Spiritual and Religious value	√			√	+	Project will in no way result in relocation of local ritual areas as the Project is within the existing footprint
	Inspiration for art, folklore, architecture, etc.	√			√	+/-	There is potential for an influx in job seekers in the area which will have influence on the existing local cultural values. (NB: This could also increase relations which would augment the local cultural values)
	Social Relations	√			√	0	There is no anticipation in the change of the community social relations
Supporting	Nutrient Cycling	Valued through the other categories					
	Soil Preservation						
	Water Cycling						

Ecosystem Service Category	Ecosystem Service Role	Nature of Value				Predicted Cost Effect/ Value	Description
		D	I	O	N		
	Production of Atmospheric Oxygen						
	Provision of Habitat						
	Primary Production						

D – Direct Use

I – Indirect Use

O – Optional Value

N – Non-Use Value

+ Likely Positive Effect

- Likely Negative Effect

0 Likely no effect or insignificant

? Uncertain Effect

The Environmental Project qualitative cost analysis shows that the predicted effects/costs and benefits of the Project have an array of ecosystem values from insignificant effect to likely positive effect. In relation to the above combination of MAE and TEV framework method, the Project is expected to have some negative effects on the Project with majority of the ecosystem service role having no effect or having a positive effect to the ecosystem.

Nevertheless, the negative effects on the ecosystem can be reduced or eliminated through the preparation of mitigation measures. The benefits of the Project can be greatly enhanced by allowing more employment opportunities for the residents and Tax benefits for the Government. (See Chapter 9 for mitigation measures).

11.8. Assessment of Costs and Benefits

This section presents the results of the cost benefit analysis and incorporates the financial costs and benefits and those environmental Project costs and benefits that will still remain post-mitigation. The qualitative results are displayed in Table 11-7

Table 11-7: Qualitative costs and benefits to the Ramula – Mwibona Open Pit Mining Project

Cost / Benefit	Cost / Benefit Bearer			Justification
	Prop[1]	Com[2]	Env[3]	
Capital and operating costs to implement the Project	–	+		**Tangible costs** to the proponent: • Capital costs of US $ 137 million to establish and operate the Project; • Operating costs of US$ 45 million per annum (LOM average) for the operation of the Project; • Royalties of US $ 2.6 million/annum to be paid to the government; • government contribution of US $ 1 million/annum: Total Contribution to the government (USD M/year)
Loss of agricultural land to Community use/provision of habitat/food/fibre and fuel		-	-	A total of 175 ha will be required for the implementation of this Project.
Increased resource pressure due to in-migration		–	–	**Tangible cost** to the community and the environment: The county will experience an influx of people especially youth from rural to urban centres. In-migration of job seekers will put pressure on the water, education, and health resources. This will also lead to increased environmental impacts such as tree-felling for construction and firewood; charcoal burning.
Deterioration of values that benefit human health		–	–	**Intangible cost** to the community and the environment: The development and operational stages of the Project will result in the additional deterioration of air quality through increased emissions of gas, fumes and particulate matter, and increased noise emissions. Vibrations resulting from blasting activities may lead to nuisance and structural damages.
Altered hydrological regimes		_	_	There is a potential for limited contamination of groundwater is expected to be encountered during open pit mining operations.
Loss of habitat		–	–	**Intangible cost** to the community and the environment: The Project will require large area to be cleared to allow the proposed infrastructure development.

Cost / Benefit	Cost / Benefit Bearer			Justification
	Prop[1]	Com[2]	Env[3]	
Loss of cultural amenities		–	–	There will be community relocation to allow the proposed infrastructure development
Decrease in visual amenity		-		The current visual form on the surface will be altered from the proposed infrastructure development
Benefits to local stakeholders: • Employment of nationals and locals. • Increased training opportunities; • Increased local expenditure		+		**Intangible benefit** to the community: Local stakeholders will accrue benefits through additional wages (income) gained through employment during the construction and operation phases of the Project. Technical staffs will need to be employed. Informal job opportunities will be made available with emphasis on the surrounding villages
Increased business linkages		+		**Intangible benefit** to the community: Additional mining activities will have its associated multiplier effect in the ongoing business influence in the Vihiga and Siaya Counties from the proposed Project operation. This will enable the communities (local and district level) to benefit directly from the Project.
Benefits to local, regional, and national stakeholders		+		**Intangible benefit** to the community: • Education and training services. • Economic incentives through community development programmes.
Increased community identity.		+		**Intangible benefit** to the community: The expected economic growth stimulated by the Project will raise the profile and identity of the area at a local, regional, and national scale.
Increased acceptance of mining activities.	+	+		**Intangible benefit** to the proponent and the community: The contributions of the Project to the economic welfare of locals will likely lead to better acceptance of mining practices. This may improve the perception of mining operations and companies and open the doors for future Projects. Any future mining Projects in the region will

Cost / Benefit	Cost / Benefit Bearer			Justification
	Prop[1]	Com[2]	Env[3]	
				have flow-on benefits to the community with further economic growth.
Increased indirect employment opportunities.		+		**Intangible benefit** to the community: The development of the Project is most likely to generate and support increased employment in services not directly necessary for the Project, i.e., shops, hairdressers, suppliers etc. This will benefit communities and individuals that are not employed by the Project.

1. Proponent.
2. Community, which includes the community at the national and local scales; and the government and economy because benefits to these will be filtered down to the community level.
3. Environment.
– Cost
+ Benefit

The payment of royalties and taxes by the proponent will be converted to benefits to the community as these funds are filtered into social schemes and infrastructure within Tanzania. Similarly, capital and operating costs may benefit Kenyan businesses that supply goods and services required for the development and operation of the Project.

The development of the Project will require the relocation of some settlements to allow the development of the proposed infrastructure. However, the Project implementation will lead to less impact to the environment and increased pressure on socio-economic facilities through the mitigation measures proposed for this project (Chapter 8). Wages to local and national staff will be captured in the local and national economies, as it already is the case in the on-going operation leading to increased economic growth. There will be an increase in business developments at the local and national level, where new businesses are made to exploit new niches, and existing businesses expand into new markets. Reusable and recyclable items will be salvaged and provided to other similar operations or the community during closure.

Although the Project will result in impacts, these costs will be minimised through the implementation of mitigation measures and on-going management of issues over the life of the Project (see Chapter 8 and 9).

Furthermore, in compliance with the Mining (Community Development Agreement) Regulation, SGKL will be required to enter into formal agreement with Project affected communities and share an additional 1% of the value of gold produced. Similarly, capital and operating costs may benefit Kenyan businesses that supply goods and services required for the development and operation of the Project

A Conceptual mine closure and rehabilitation plan has been developed as part of this project and aims at identifying strategies to ameliorate environmental costs and determination of the final land use of the area. The benefits accruing from the proposed Project, in allowing the proposed project by SGKL will be beneficial to the surrounding communities through employment, community development programmes and stimulation of the local economy and others outlined above. Hence this indicates that the proposed Project is economically feasible, technically viable and socially desirable. Provided that all of the environmental safeguards outlined in this report are adhered to, the Project should continue to benefit both the local people and the country

12. Rehabilitation and Decommissioning Plan

This section provides an introduction on conceptual mine closure and rehabilitation planning that will take place over a mine's lifetime. In accordance with Kenyan and international requirements, the Project is obliged to undertake continuous site rehabilitation during the life of the Project and prior to closure.

Further details pertaining to the Mine Closure Plan (MCP), associated costs and risk assessments are included in the specialist report, Appendix Y. The subsections below describe the soils and land use characteristics of the Project Area.

12.1. Background- Closure Context

SGKL's West Kenya Project comprises seven Prospecting Licences issued by the Government of Kenya and covers a current area of 580 km^2 across parts of the counties of Siaya, Vihiga, Kakamega and Kisumu in Western Kenya. The licences are collectively termed the West Kenya Project.

All the seven Prospecting Licences have been explored concurrently as one integrated regional exploration programme termed the West Kenya Project. The exploration has so far resulted in the discovery of two gold resources, Ramula-Mwibona, and Bushiangala- Isulu.

The Ramula-Mwibona resource, the subject of this report, sits within PL/2019/0222. The life of the project is expected to be eight (8) years. This Closure Costing has been prepared as part of the EIA, to address the planned / life of mine closure and rehabilitation actions, assumptions and associated costs of the project which includes all disturbed areas, mining landforms, plant and other built infrastructure within the project tenements.

12.2. Closure Design Principles

Mine closure is an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining activities to a state acceptable to the Regulators and to post mining land users. The activities associated with mine closure are designed to prevent or minimise adverse long term environmental impacts, and to create a self-sustaining natural ecosystem or alternative land use based on an agreed set of objectives. The objective of mine closure is to obtain legal (government) and community agreement that the condition of the closed operation meets the requirements of those entities, whereupon the SGKLs' legal liability is terminated.

Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation is implemented during the operational phase in conjunction with the operational activities. Concurrent rehabilitation aims to limit the extent of surface disturbances, reduce cumulative impacts and decrease the cost of rehabilitation measures required during decommissioning and closure. Concurrent rehabilitation must be carried out within the context of the approved environmental management plans and incrementally address the objectives of the MCP. The following typical closure principles have been adopted as a framework for this MCP and can be refined and developed further as final closure approaches:

- Safeguard the safety and health of animals and humans;
- Promote long term physical and chemical stability;
- Encourage a smooth economic transition, as far as practical, from the socio-economic conditions during mining to what will prevail after mining;
- Rehabilitate land to ensure a functioning post mining ecosystem on a desired trajectory and aligned with the planned post closure land use;
- Limit risk exposure (safety, environmental, community, financial, legal, etc.) through active management and planning; and
- Implement cost effective measures, reducing the need for long term care and maintenance to achieve relinquishment

12.2.1. Closure Objectives

The initial closure vision is to ensure that SGKL leaves a safe and stable environment for both humans and biodiversity that is sustainable in the long-term following the closure of the proposed Project. The vision will be implemented through continual/progressive improvement and implementation of a Rehabilitation Plan throughout the LoM.

Digby Wells recommends the following closure objectives be adopted in support of the overarching closure vision. The initial closure objectives are based on the good practice guide on integrated mine closure published by the ICMM, and include the following:

- Ensure that disturbed mine land is returned to sustainable post-mining land use in agreement with end land users;
- Ensure that any surface mine infrastructure that cannot be used by a subsequent land user or a third-party, post-closure, is removed. Where such infrastructure can be used by a third party, transfer agreements must be put in place to ensure their long-term sustainable use, furthermore, such agreements should also confirm that the remaining infrastructure post-closure is contamination-free and safe for use by third-party end land users;
- Ensure that the management of impacts directly caused by physical mining and/or related chemical contaminants promotes an environment not adversely affected by mining-related activities;
- Ensure that the process of closure is progressive and integrated into the short and long-term mine plans (i.e., concurrent rehabilitation actions) that will assess the closure impacts proactively at regular intervals throughout the LoM;

- Ensure the prevention of soil, surface water and groundwater contamination through proactive water management on-site during operations and during the post-closure monitoring period;
- Ensure that the required monitoring and maintenance of indigenous vegetation re-establishment over rehabilitated areas is undertaken timeously and that the monitoring criteria align with the required site relinquishment criteria and end land use plan;
- Ensure that an Alien and Invasive species eradication plan is developed to assist in the monitoring and maintenance of rehabilitated areas;
- Ensure compliance with national mine closure and rehabilitation regulatory requirements as well as with the good practice guide on integrated mine closure published by the ICMM (2019 and 2021) and accepted good practice in the industry;
- Ensure the promotion of sustainable social closure through the upliftment of the social well-being of mine-affected communities through the LoM to build community resilience post-closure and the avoidance of any inconvenience to these communities as a result of mine closure;
- Establish an ongoing closure planning governance committee to review and update the closure plan regularly throughout the LoM; and
- Ensure that an appropriate stakeholder engagement process with all interested and affected parties (I&APs) and authorities is followed throughout the LoM.

12.2.2. Guidelines and Information Sources

The following methodology and process were undertaken to develop this report:

- Conduct a desktop review of the specialist studies undertaken as part of the ESIA to confirm the site battery limits and to inform identification of rehabilitation and closure risks and the development of the suitable closure measures required for successful closure outcomes;
- Compile an initial Closure Risk Assessment (CRA) based on the document review and, apply appropriate risk rankings and mitigation measures aligned with specialist input;
- Propose preliminary end land uses based on available information;
- Develop initial closure measures based on the mitigation measures identified in the CRA;
- Compile a draft Closure Cost Assessment (CCA) based on available specialist studies, site layout plans, available infrastructure Bills of Quantities (BOQ) and closure measures developed;
- Develop site relinquishment criteria based on the envisioned final land use;
- Develop a high-level post closure monitoring plan to ensure successful rehabilitation implementation and align with the proposed relinquishment criteria;

- Identify potential residual and latent risks that may manifest on site that will need further investigation to quantify; and
- Identify potential gaps and a forward working plan to improve the resolution of the closure planning and associated cost estimate.

A high-level overview of the mine closure planning processes is presented in Figure 12-1

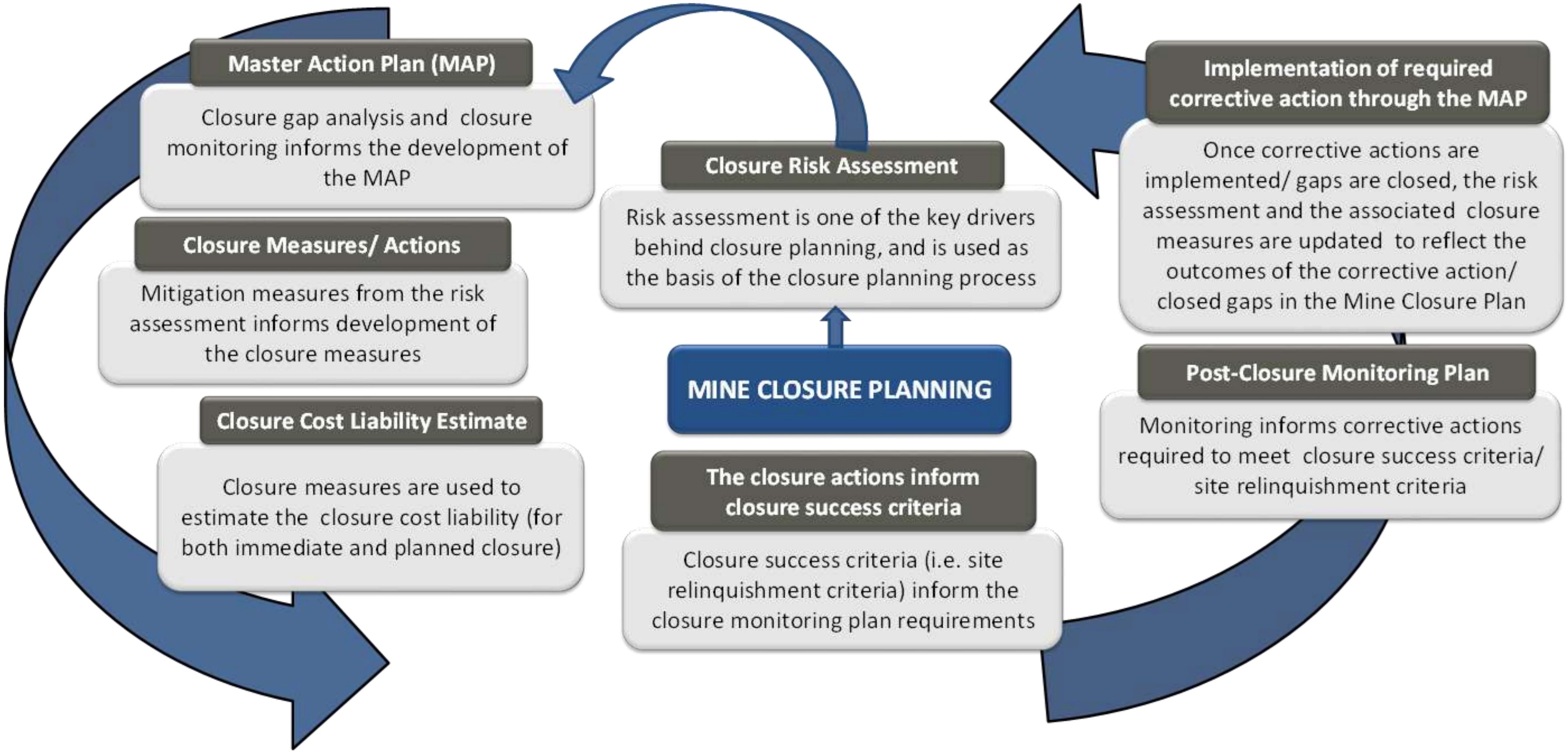

Figure 12-1: High-Level Mine Closure Planning Process

12.2.3. Assumptions Made in the Closure Plan Development

The compilation of this MCP is based on the following assumptions and limitations:

- The information contained within this MCP is based on the specialist studies and conceptual engineering design completed for Shanta Gold Ramula;
- Information, mitigation measures and recommendations provided in this report are based on the specialist studies completed as part of the ESIA;
- Recommendations from the specialist assessments will be considered for implementation to reduce project risks, to improve the current body of information and ensure legal compliance;
- All infrastructure on site will be demolished unless these assets can be legally transferred to a third party and a formal contract is in place detailing the conditions of transfer;
- Decommissioning and rehabilitation activities will follow directly after the cessation of mining;
- The rehabilitation activities will follow once the detailed engineering designs are complete, and the necessary authorisations have been obtained;
- The recommendations in this report currently exclude any comments or issues raised by stakeholders and/or Interested and Affected Parties (I&APs). Comments from stakeholders or I&APs will be incorporated into subsequent annual updates as and when received;
- Vegetation monitoring and maintenance will take place for five years post-closure. Similarly, groundwater and surface water monitoring for five years post-closure; and
- This report should be considered as a dynamic document and should be updated as additional information becomes available and as monitoring and rehabilitation progresses.

12.3. Overview of Mine Closure and Rehabilitation

The ICMM regards mine closure and rehabilitation planning as being an imperative preliminary step for sustainable closure, which should continue to be developed progressively through an integrated and systematic process during the operational life of a mine (Figure 12-2). Planning for mine closure and rehabilitation must be sufficiently flexible to allow for operational changes as well as changes in technology and/or regulatory requirements. Closure planning will ensure:

- That the post-mined landscape is safe and is stable from physical, geochemical and ecological perspectives;
- The quality of the surrounding water resources is protected;

- The agreed sustainable post-mining land use is established and clearly defined to the satisfaction of the community and government;
- That local communities and stakeholders are consulted throughout the closure planning process; and
- Success criteria are agreed with relevant stakeholders, monitored, and reported to stakeholders.

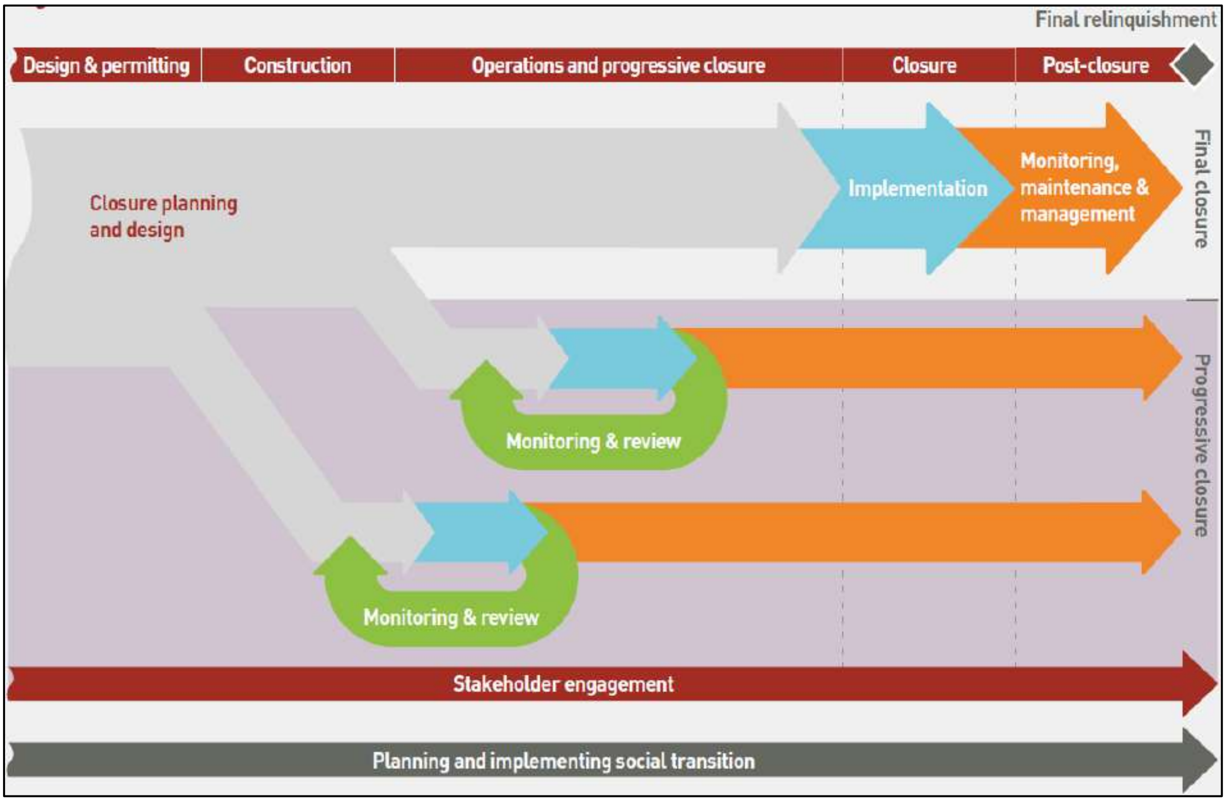

Figure 12-2: Closure Planning [source: (ICMM, 2019)]

This section outlines the closure actions and associated closure costs for the proposed Project and would require further updates and inclusion in the annual cost update as the Project develops.

12.4. Relevant Legislation, Standards and Guidelines

There are several overarching Good International Industry Practice (GIIP) standards which provide recommendations on how rehabilitation and closure should be undertaken to meet best practices. For the purpose of the CP, the following overarching guideline documents were considered:

- Tailings Management, Good Practice Guide, International Council on Mining and Metals, (ICMM, 2021); and

- Integrated Mine Closure, good practice guideline 2nd edition. International Council of Mining and Metals, 2019 (ICMM, 2019).

The Project also aims to comply with the World Bank Criteria by complying with the International Finance Corporation (IFC) Standards and Equator Principles detailed below.

12.4.1. International Standards and Guidelines

It is important to note that the need for the MCP to be compliant with the standards and guidelines such as the IFC and equator principles as summarised in Table 3-3 are overarching, as well as alignment with the relevant in-country legislation as highlighted in Table 12-1

In the case of its direct investments as the WKFSP (including project and corporate finance provided through financial intermediaries), the IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced.

12.4.2. Applicable Kenyan Legislation

The legislation pertinent to mine closure in Kenya is summarised in Table 12-1. The list is deemed sufficient for the development of the initial closure framework

Table 12-1: Applicable Closure Related Legislation

Legislation, Regulation, Guideline or By-Law	Details
The Constitution of Kenya, 2010	Article 42 of the Constitution states that everyone has the right to a clean and health environment, which includes the right – • To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and • To have obligations relating to the environment fulfilled under Article 70. Article 70 (2) of the Constitutions states that "Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources".
The Environmental Management and Co-Ordination Act, 1999 (Act No. 8 of 1999) (EMCA)	EMCA was enacted in line with Articles 42, 69 and 70 of the Constitution of the Republic of Kenya to provide the establishment of an appropriate legal and institutional framework for the management of the environment. EMCA sets out the Regulations for: • Environmental impact assessment, • Environmental audit and monitoring; and • Orders for environmental restoration and conservation. Section 58 of the Act makes it a mandatory requirement for an EIA to be carried out by proponents intending to implement projects specified in the second schedule of the Act. Such projects have the potential of causing significant impacts on the environment. Similarly, Section 68 of the same Act requires operators of existing projects or undertakings to carry out environmental audits to determine the level of conformance with statements made during the EIA.
National Guideline on Mine Site Decommissioning and Rehabilitation	The Guideline provides guidance on the decommissioning and rehabilitation of mine sites after the cessation of the mining operations, with the aim to ensure protection of the environment as well as public health and safety through elimination of adverse environmental effects resulting from the mining activities. The Guideline seeks to provide guidance on the preparation of mine site decommissioning and rehabilitation plans to meet regulatory requirements and best practices. Encourages mine to adopt best practices on mine site decommissioning and rehabilitation; and to promote effective engagement and inclusive participation of Project Affected Persons (PAPs) and communities in decision making processes relating to mine site decommissioning, rehabilitation and after use.
The Mining Act 2016 (Act No. 12 of 2016)	The Mining Act, 2016 sets out the requirements relating to the development of the nation's mineral resources. The Act differentiates between large scale mining operations, small scale mining operations, and artisanal mining operations. The mining Act, 2016 requires that mining license be granted to the applicant on condition of having obtained: • Environmental impact assessment license; • Approved social heritage assessments; • Approved environmental management plans; and • Site mitigation and rehabilitation or mine closure plans.
The Water Act, 2016 (Act No. 43 of 2016)	The Water Act, 2016 provides the legal framework for the management, conservation, use and control of water resources and for the acquisition and regulation of right to use water and sewage services in Kenya. The Act is founded on the principle that the National Government, (through Water Resources Authority) has overall responsibility in trust for the people of Kenya and authority over water resource management, including the allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under The Water Act. In general, the Act gives provisions regarding ownership of water, institutional framework, national water resources, management strategy, and requirement for permits, state schemes and community projects.
The Physical and Land Use Planning Act (Act No. 13 of 2019)	The Act provides provision for the planning, use, regulation and development of land and for connected purposes. The Act seeks to promote sustainable use of land, and integrated economic, social and environmental needs of present and future generations. The Acts requires land use planning to be comprehensive, sustainable and integrated at all levels of Government, and to consider long-term optimum utilization of land and conservation of scarce land resource. The Act mandates physical and land use planning to be inclusive and must take into consideration the culture and heritage of people concerned. The Act requires the physical and land use

Legislation, Regulation, Guideline or By-Law	Details
	planning to consider new approaches such as transit-oriented development, mixed land-uses, planning for public transport and non-motorized transport among others to achieve sustainable development and more efficient use of natural resources
Climate Change Act, 2016 (Act No. 11 of 2016)	The Climate Change Act of 2016 provides a regulatory framework for enhanced response to climate change, mechanism and measures to achieve low carbon climate development, and for connected purposes. The Act is applied for the development, management, implementation and regulation purposes. of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. The Act is applicable to all sectors of the economy.
Environmental Management and Coordination (Waste Management) Regulations, 2006	The waste Management Regulations are conferred through Sections 92 and 147 of the Environmental Management and Co-ordination Act No. 8, of 1999 (EMCA). The Regulations apply to all categories of wastes in Kenya. The Regulations sets general provisions for: • Responsibilities of waste generators • Segregation of waste materials, • Cleaner production principles, • Waste transportation requirements • General obligations to mitigate pollution • Waste treatment; and • Handling, storage, transportation and treatment of hazardous waste
The National Environment Policy, (Sessional paper No. 10 of 2014)	The Goal of the Policy is to better quality of life for present and future generations through sustainable management and use of the environment and natural resources. The Policy provides a framework for an integrated approach to planning and sustainable management of Kenya's environment and natural resources. The policy seeks to strengthen the legal and institutional framework for good governance, effective coordination and management of the environment and natural resources.

12.5. Physical Closure and Rehabilitation

Mine closure commences when the ore-extracting activities of a mine have ceased and includes the final decommissioning and mine reclamation. At closure, the following activities will be executed to minimise or mitigate closure risks to acceptable levels:

- Rehabilitation activities at the open pit (Construction of safety/security berm around the pit perimeter to ensure safety of humans and animals, construction/reinstatement of storm water management berms, landscape and re-vegetation);
- Transfer of selected mine infrastructure to third parties for ongoing re-use;
- Potential demolition and removal of mine infrastructure and disposal of inert building waste in the pit;
- Final rehabilitation of the TSF and WRD and
- Post-closure, monitoring and maintenance.

It is recognised that some infrastructure may have a beneficial use and could be transferred to third parties. For the purposes of this MCP, it is assumed that all infrastructure will be removed, in alignment with the requirements of International Financial Reporting Standards (IFRS). Closure must ensure that the site is stable and safe in the long-term. The activities that will need to be carried out for rehabilitation and closure of the proposed project are as follows:

- Comprehensive characterisation of soils, overburden and mineral processing wastes to determine their capacity to support plant growth and their potential to have adverse impacts on water quality:
- Characterisation of soils and overburden to start as early as the exploration phase and continue through the pre-feasibility, feasibility and operational phases as a basis for mine planning. The requirement for characterisation will continue during the operation of the mine, particularly where the ore grade and mine plan change in response to altered market conditions or for other reasons;
- Soils, overburden and waste classification provides the basis for rigorous segregation and selective placement of materials to achieve a sustainable vegetation cover and to prevent impacts to surface and groundwater resources, if managed appropriately;
- Establishment of sustainable ecosystems after the LoM generally requires the conservation and replacement of soil resources over the disturbed areas;
- Implementing rehabilitation measures during the construction and operational phases of the mine (wherever possible). As areas become available in their final closure form, they should be rehabilitated during the operational phase, rather than waiting for the decommissioning phase;

- Ensuring that rehabilitated areas are left free draining (as far as possible) and well vegetated (whether through re-vegetating with indigenous or natural plant colonisation) and the plant cover is self-sustaining;
- Ensuring that the TSF and WRD slopes are designed and rehabilitated to minimise future potential for erosion and contamination;
- Maintenance of all disturbed areas (i.e. pit, TSF and WRD) and re-vegetated areas until such areas have developed a sustainable and erosion-resistant cover; and
- Monitoring of key environmental variables (i.e. soils, erosion, vegetation, surface water and air quality) to demonstrate stability and sustainability of rehabilitated areas.

The MCP will be reviewed and updated in response to material changes in operating parameters. Wherever possible and practical, closure planning and closure risk assessments will continue to involve relevant internal and external stakeholders.

12.6. Final Land Use Plan

The final land use plan is the end land use to which the mine would like to return the land disturbed by mining activities. The closure objectives set as part of the mine closure planning process aims to support achievement and effective implementation of the final land use plan. The plan should ensure long-term sustainability and strive to promote post-closure land productivity for the potential offset of post-closure costs (i.e. monitoring and maintenance).

The closure objectives set as part of the mine closure planning process aims to ensure that the final land use plan is achieved and that:

- The area is sustainable in the long term from an environmental, legal and social perspective; and
- Aligned with the regional planning and compatible with surrounding land uses.

12.6.1. Current Land Use

The Project area and its direct surroundings is dominated by various land uses. The land use categories are divided into:

- Buit Area;
- Rangeland;
- Crops;
- Bare Ground; and
- Tree Plantations

The dominant land used include “Built Areas“ and “Crops”(Figure 12-3). The dominance of these land uses emphasises the likelihood of significant soil degradation in the form of compaction and over utilising of soil resources for subsistence crops. The dominance of crops emphasises the likelihood of soils having a high agricultural potential. The “Trees” land uses indicate forested areas, that are likely continuously utilised for wood. The “Bare Ground” areas indicate severe disturbances in the form of clearances and excavations, likely for building material.

12.6.2. Post Mining Land Use

An initial land use evaluation was undertaken for the Project area, which assessed the potential land use options. The land use options were evaluated based on the following criteria and are reflected in Table 12-2.

- **Likely end land uses:** Primary or anchoring end land uses, that are likely to be functionally self-sufficient over the long term;
- **Possible end land uses:** Secondary or supporting land uses, that are reliant on likely uses or other external factors to be sustainable; and
- **Unlikely end land uses:** Undesirable end land uses, or land uses that are unlikely to be sustainable or that would be contextually inappropriate.

Table 12-2: Evaluation of Post-Mining Land Use Options

Likely	Possible	Unlikely
• Grazing and /or a mix of traditional agricultural activities; • Wilderness (Ramula pit); and • Water treatment for use by intensive agricultural (if treatment is required).	• Agricultural processing; • Aquaculture; • Intensive agriculture (dependent on post mining land capability); • Forestry/ timber production; • Contractors’ accommodation / training facility (Accommodation camp); • Power generation for local communities through establishing solar panel fields on the TSF and/ or WRD; and • Water treatment for use by agricultural and other potential industries (if treatment is required).	• Nature conservation; • Dry-land agriculture (dependent on post mining land capability); • Large-scale commercial or urban development; and • Large-scale solar energy generation.

12.6.3. Preliminary Final Land Use Plan

The initial proposed post-mining land use is to restore a mix of land capabilities that include portions of agriculture, light grazing and wilderness aligned with the current land uses illustrated in Figure 12-3. A detailed end Land Use Plan (LUP) should be developed to ensure a coherent approach to rehabilitation and restoring land uses aligned and complementary to the surrounding land use mix.

Once complete, the final LUP should be shared with the relevant stakeholders to ensure their inputs are included in the plan where applicable, and to attain their buy-in which will avoid potential conflict/ misalignment with surrounding land users post-closure.

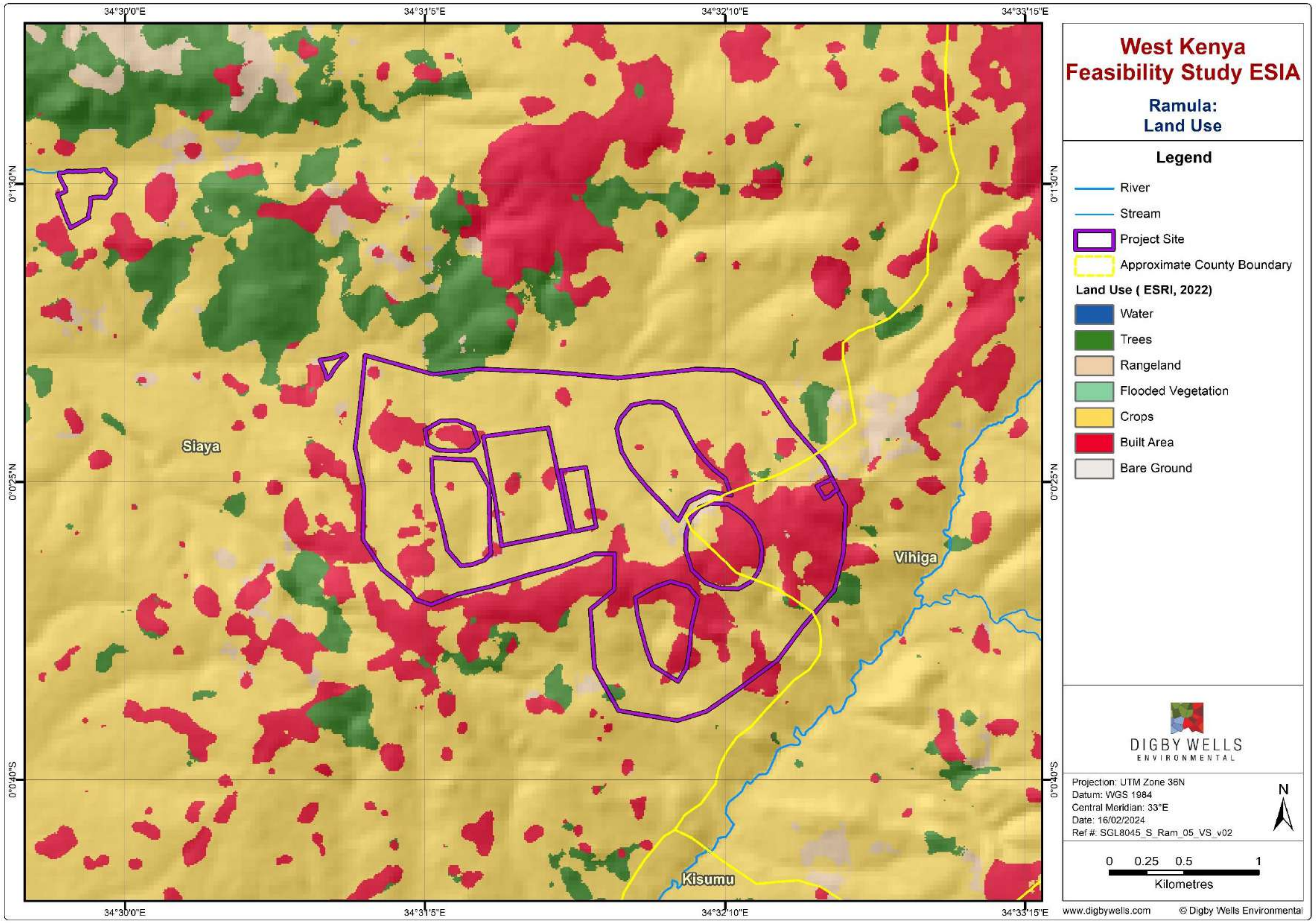

Figure 12-3: Land Use Map of the Project Area

12.7. Closure Scenario

The Project is currently in the planning and authorisation application phase. The MCP and CCA outlined in this report are based on the LoM closure scenario presented in Table 12-3. The overarching assumption is that the mine will be developed as planned, concurrent rehabilitation and removal of redundant infrastructure will be implemented during the operational phase and specific aspects will be addressed at planned closure.

12.8. Closure Environmental Management Plan

The main aim in developing the MCP is to minimise and mitigate the impacts caused by mining activities and to restore land back to a satisfactory standard. It is best practice to develop the MCP as early as possible to ensure the optimal management of rehabilitation and closure issues that may arise. It is critical that a MCP is defined and understood from before mining progresses and is complimentary to the objectives and goals set.

The table below sets out the rehabilitation and closure actions required at the various areas related to the mine. The closure measures are developed in support of achieving the final land use and mitigating post-closure contamination potential over the site. The closure measures should be refined once more detailed supporting information becomes available (i.e., engineered landform designs, end land use planning, land capability assessments, radiological, geochemical and geohydrological laboratory analysis of the waste streams, etc.).

Table 12-3: Life of Mine Closure Scenario

Closure Aspect	Operational Rehabilitation	LoM Rehabilitation
Ramula Open Pit	• The open pit will remain post closure, apart from the required operational stormwater management measures and construction of envirobunds to limit inadvertent access to the pit, no concurrent rehabilitation is foreseen.	• The open pit will remain post closure; • Construct a safety/security berm around the pit perimeter as a barrier to limit access; • Develop a dished depression on the outside of the barrier berm to reroute surface water runoff around the pit and into the natural catchment and to protect the berm against erosion; and • Surface water management measures should be implemented to manage surface run-off and to avoid erosion.
TSF	• Rehabilitate the embankment side slopes as the construction of each phase is competed.	• Dismantle and remove the TSF ring feed pipelines; • Dismantle and remove the return water pipeline; • Pump and treat the pond remaining on the upper surface prior to final rehabilitation; • Remove the floating barge and associated pipelines and powerlines; and • Shape the upper surface to be free draining and to receive the final cover placement.
WRD	• Rehabilitate the side slopes that become available for concurrent rehabilitation and will not be further disturbed by operations; and • Construct additional storm water management measures aligned with the final landform design.	• Remove WRD material required for pit backfilling purposes; • Shape the remaining WRD footprint in accordance with final landform design; and • Vegetate affected areas.

Closure Aspect	Operational Rehabilitation	LoM Rehabilitation
Accommodation camp	• N/A	• Dismantle and remove the infrastructure related to the mine accommodation camp at closure and rehabilitated all footprints, including access roads.
Plant infrastructure	• N/A	• All surface infrastructure related to the plant will be dismantled, decontaminated and removed prior to final rehabilitation of the disturbed footprint.
Surface water management dams	• N/A	• All unwanted surface water impoundments will be removed and rehabilitated at the end of the LoM.
Linear infrastructure	• N/A	• The overland conveyor, related access roads, pipelines, power lines and fencing will be dismantled, removed and all disturbed areas rehabilitated.

Table 12-4: Closure and Rehabilitation Measures

Mine Aspect	Closure Cost Ref No.	Plan ref No.	Rehabilitation Measures
Accommodation camp area	Accommodation camp infrastructure	Buildings C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15,C16,C17,C18,C19,C20,C21, C22,C23,C24,C25,C26,C27,C28,C29,C30, C31	<u>Infrastructure demolition (Accommodation camp):</u> • Demolish and remove all concrete structures to 1 m below ground level. • Demolish and remove prefabricated buildings; • Dispose of inert building rubble in mine open pit within a 3 km hauling distance; and • Remove all contractor containers from site prior to closure. <u>General rehabilitation (Accommodation camp):</u> • General levelling and Shaping of all areas where infrastructure is removed to align surface water runoff with the site wide drainage framework; • Replace 300 mm of topsoil (load and haul within 1km); • Rip area to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix. <u>General rehabilitation (Accommodation camp Access Roads)</u> • Grade footprint; • Replace 300 mm of topsoil across shaped footprint (load and haul within 1km); • Rip area to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Area 2:	Process plant	Primary Crushing – (PF6 PF7, PF8, PF94, PF95, PF129, PF130);	

Mine Aspect	Closure Cost Ref No.	Plan ref No.	Rehabilitation Measures
	• Primary crushing; • Secondary and tertiary crushing; • Electrical Rooms; • Screening Stations; • Horizontal Belt Filter; • Classified Ore Transfer Station; • Reclaim Hopper; • Fine Ore Bin; • 10.000T Stockpile Area; • Ball Mill; • Primary Cyclone Cluster; • Floatation Cells; • Cons Thickener; • Float Tails Thickener; • CIC; • Tail Leach Tanks; • Barren Solution Tank; • Process Water Tank; • CIP; • Cyanide Recovery Thickener; • DETOX; • Filtered Feed Thickener; • Filtered Feed Tank; • Tails Filter; and • ADR	• Secondary and Tertiary Crushing – (PF104, PF105, PF106, PF107, PF108, PF131); • Electrical Rooms – (PF96, PF97, PF132, PF4, PF2, PF103); • Screening Stations – (PF9, PF10, PF11, PF98, PF99, PF100, PF101, PF109, PF110, PF111, PF112, PF113, PF114, PF115, PF122); • Horizontal Belt Filter – (PF21) • Classified Ore Transfer Station – (PF126); • Reclaim Hopper – (PF119, PF93); • Fine Ore Bin – (PF121); • 10.000T Stockpile Area – (PF116); • Ball Mill – (PF3, PF86, PF87, PF88, PF89, PF90,PF91, PF92); • Primary Cyclone Cluster – (PF1); • Flotation Cells – (PF39, PF40, PF41, PF42, PF43, PF44, PF45); • Cons Thickener – (PF68, PF69, PF70, PF71, PF72, PF73, PF74, PF75, PF76); • Float Tails Thickener – (PF77, PF78, PF79, PF80, PF81, PF82, PF83, PF84, PF85); • CIC – (PF34, PF35, PF36, PF37, PF38); • Tail Leach Tanks – (PF27, PF28, PF29, PF30, PF31, PF14, PF15, PF16, PF17, PF18); • Barren Solution Tank – (PF19); • Process Water Tank – (PF20); • CIP – (PF22, PF23, PF24, PF25, PF26, PF32, PF33); • Cyanide Recovery Thickener – (PF48, PF49, PF50, PF51, PF62, PF63, PF64, PF65, PF66, PF67); • DETOX – (PF46, PF47); • Filtered Feed Thickener – (PF52, PF53, PF54, PF56, PF57, PF58, PF59, PF60, PF61); • Filtered Feed Tank – (PF55); • Tails Filter – (PF12); and • ADR – (PF13).	Infrastructure demolition: • Demolish and remove all concrete structures to 1 m below ground level • Demolish and remove prefabricated buildings; • Dismantle streel structures and store in designated salvage yard prior to removal/selling off; • Dispose of inert building rubble in mine pit within a 1 km hauling distance; • Decontaminate the plant; and other facilities on site; • Dispose contaminated building rubble at an approved landfill site; • Demolish and remove all concrete structures; and • Remove all contractor containers from site prior to closure. General rehabilitation: • Grade the mine service area footprint; • Level and shape the general process plant area; • Replace 300 mm of topsoil across shaped footprint; • Rip area to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
	Admin and support facilities	Mine services area buildings - (A1, A2, A3, A4, A5, A6)	
	Explosives compounds	Emulsion compound, emulsion storage, magazine compound and explosives storage) Emulsion Storage and Workshop Area - (E4, E5, E6, E7, E8, E9, E10);	
	Explosives magazine	Explosives magazine (M1)	
	Workshop Facilities	Workshops - (W1, W2, W3)	

Mine Aspect	Closure Cost Ref No.	Plan ref No.	Rehabilitation Measures
	Landfill site	L1	
	Water treatment plant	Mine water treatment plant	
Area 3: Linear Infrastructure	• Mine camp fence; • Admin and support facilities fences; • Emulsion storage & workshop area fences; • Workshop facilities fence; • Mine perimeter fence; • Plant area fence; • Conveyors belts; • Pipelines; and • Haul roads and access roads.	• Mine camp fence – (C32); • Admin and support facilities fences – (A6, A7), • Emulsion storage & workshop area fences – (E1, E2, E3); • Workshop facilities fence – (W4); • Mine perimeter fence (F1); • Plant area fence - (P4); • Conveyors – (PF5, PF117, PF118, PF120, PF123, PF124, PF125, PF127, PF128, PF133, PF134, PF102); • Pipelines – (PL1, PL2, PL3), and • Haul roads and access roads – (1,2,3).	Infrastructure demolitions : • Dismantle conveyor structures including concrete support structures; • Drain and dismantle pipelines; • Demolish paved surfaces; and • Demolish hauling and gravel roads. General rehabilitation: • General Levelling and Shaping to align surface water runoff with the site wide drainage framework; • Replace 300 mm of topsoil across shaped footprint; • Rip topsoil to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Area 4: ROM Pads	Offload pad; ROM pad	Offload pad – (P1), ROM pads - (P2)	Infrastructure demolition: • No actions required. General rehabilitation: • Remove veneer; • Rip area to alleviate compaction; • Place 300 mm of topsoil; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Area 5: Open Pits	Ramula open pit	Pit - (H1)	Infrastructure demolition: • No actions required. General rehabilitation (North-eastern pit and Danaya pit): • Construct a safety berm/ barrier around the 100% of pit perimeter including layer compaction and topsoil placement; • Develop a dished depression on the outside of the barrier berm to reroute surface water runoff around the low-lying portion of the pit into the natural catchment and to protect the berm against erosion (where necessary) • Establish suitable vegetation on the safety berm to act as a bio barrier, and • Establish vegetation in the dished depression including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix; and • Surface water management measures should be maintained to manage surface run-off and to avoid erosion.

Mine Aspect	Closure Cost Ref No.	Plan ref No.	Rehabilitation Measures
Area 6: Waste Rock Dump	WRD	WRD - (W1)	Infrastructure demolition: • No actions required. General rehabilitation: • Shape side slopes of the WRD; • Replace 300mm of topsoil; • Rip area to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Area 7: Tailings Storage Facility	TSF	TSF - (S1)	Infrastructure demolition (Tailings dam): • Dismantle and remove tailings pipelines and barge system. General rehabilitation (TSF 1 and TSF 2): • Shape and level to ensure free draining upper surface to receive a cover; • Place a layer of 200 mm fine crushed WRD material to act as a capillary breaker; • Import and replace 300 mm of topsoil; • Construct spillway to divert clean surface water runoff back into catchment; and • Establish vegetation (proposed local grasses and shallow rooted small shrubs), including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Area 8: Topsoil Storage Areas	Topsoil stockpile footprint rehabilitation (T1-T2), material will be reclaimed and used for rehabilitation purposes	Topsoil stockpile footprint rehabilitation (T1-T2),	Infrastructure demolition: • No actions required. General rehabilitation: • Rip area to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Monitoring and Maintenance			
• Implement vegetation monitoring and maintenance across rehabilitated areas for 5 years post closure; • Based on an assumed vegetation success rate of 75%, vegetation maintenance includes reseeding 25% of the rehabilitated areas; • Groundwater qualities and in borehole elevations will be monitored and reported on for five years post closure; and • Water chemistry will be monitored at existing surface water sampling sites for five years post closure.			

12.9. Preliminary Mine Closure Schedule

The mine closure schedule addresses the timing of rehabilitation and closure activities performed during the decommissioning and post-closure phases. The schedule presented is preliminary and identifies the key activities that the Ramula- Mwibona Project will conduct during the decommissioning and post-closure phases. The schedule should be refined as the operation gets closer to mine closure (Table 12-5).

It is expected that the decommissioning phase will last five years after which monitoring, and maintenance will continue for an estimated period of five years. Monitoring and maintenance will need to continue until the site relinquishment criteria are met. Any potential water treatment requirements will most likely affect the pre-site relinquishment phase

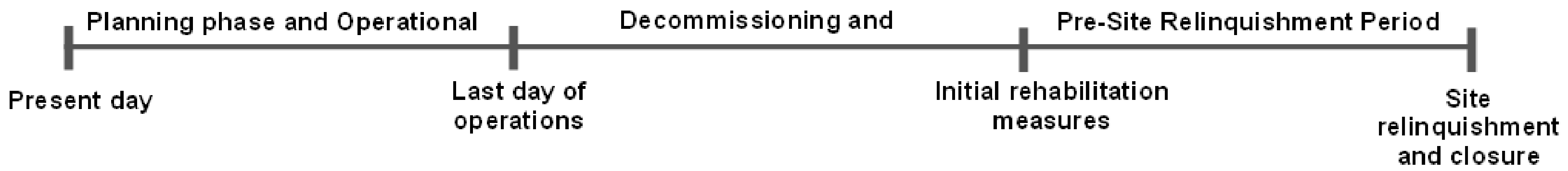

Table 12-5: Preliminary Mine Closure Schedule

Planning Phase and Operational Period	Decommissioning and Closure Period	Pre-site Relinquishment Period
Update the initial closure plan, rehabilitation plan, closure costing and environmental risk assessment annually.	Decontaminate the plant area and demolish surface infrastructure and ensure that access to the mining areas is prevented.	Undertake rehabilitation monitoring as per the post-closure monitoring programme to confirm success of rehabilitation measures, by assesing whether site relinquishment criteria are being achived.
Reduce the identified theats and uncertanties identified in the plan by closing the identified closure knowledge gaps, through undertaking the required additional studies and designing for closure.	Rehabilitate the disturbed footprints once infrastructure is removed.	Undertake care and maintenance (corrective action) where applicable. This will be informed by the rehabilitation monitoring.
Engage with the relevant stakeholders regarding the final land use plan.	Complete all outstanding rehabilitation on site, in line with the mine's closure objectives and final land use plan.	Continue surfce and groundwater monitoring until site relinquishment criteria are achieved.
Identify potential infrastructure for third-party transfer and ensure the required agreements/ contracts are in place.	Continue rehabilitation monitoring and undertake land capability assessments over rehabilitated areas (if not completed operationally).	Continue monitoring for the manifestation of residual risks (subsidence monitoring, decant monitoring) and continue mitigation of long-term closure risks (continued water treatment)

12.10. Monitoring Auditing and Reporting

Initial monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps are shown in Table 12-1.

The management measures for the post closure phase at specific areas on the mine are provided in Table 12-1 and primarily consist of environmental monitoring. Monitoring provides data to confirm whether the rehabilitation techniques implemented have been successful (i.e. whether site relinquishment criteria are being met). Monitoring should further provide an early indication of issues that may arise so that corrective action can be taken.

The post closure monitoring period will begin once the decommissioning phase and pre-site relinquishment phase are completed. Negative monitoring findings should be clearly linked to specific corrective actions.

The duration of post closure monitoring will be determined based on environmental performance and until it can be demonstrated that the rehabilitation work has achieved the agreed endpoints and is sustainable. However, at present, it has been assumed that post closure monitoring will not continue for more than 5 years. The purpose of monitoring is to ensure that the objectives of rehabilitation are met, and that the rehabilitation process is followed.

Table 12-1: Post Closure Monitoring, Auditing and Reporting Programme

Component / Aspect	Monitoring: Methodology	Monitoring: Frequency / duration	Performance / success criteria	Corrective action
Soil Management				
Erosion	• Conduct a visual assessment to determine areas of potential erosion; • Undertake field investigations, fixed point photography to document the significance of the erosion occurring on site; and • Undertake regular digital surveys of rehabilitated areas to confirm that final topography is aligned with landform designs.	• Bi-annually for at least 5 years after decommissioning or as deemed necessary.	• No evidence of significant erosion; and • 70% vegetation cover and species composition in line with best practice.	As required: • Re-shape areas to ensure that they are free-draining and aligned with the site wide surface drainage framework; • Establish vegetation on bare areas if practical; and • Reparation and stabilisation of erosion gullies and areas of sheet erosion.
Soil fertility	• Undertake a visual assessment and delineate areas where poor vegetation growth has occurred; and • Submit soil samples to an accredited soil laboratory to conduct soil fertility analysis.	• Annually until soil fertility supports the final land use or for at least 5 years after decommissioning or as deemed necessary.	• Soil analysis results comply with remediation targets at a 95-percentile level in line with best practice; and • Self-sustaining vegetation establishment.	• Apply amelioration measures where required as informed by sampling undertaken.
General site status	• Conduct a visual assessment with respect to compliance of the afore-mentioned closure measures and to ensure that the site is aesthetically neat and tidy, and that no health or safety risks exist on site.	• Once-off following implementation of rehabilitation measures.	• Waste/ rubble free sites.	As required: • Clear remnant rubble and dispose of at a registered landfill site.
Post-mining end land use	• Assess activities completed, as well as legal and related documentation completed and signed-off; and • Ensure rehabilitation measures are aligned to the LUP.	• Once off, at mine closure.	• Area has been rehabilitated to an aesthetic quality; • Transfer to third party operator has taken place once the area has been proven to be safe for redevelopment; • Legal and zoning issues have been addressed; and • Vegetation re-establishment, cover and composition are sustainable.	Refer to the end land use approach and refine measures to be implemented in achieving the desired final land use.
Topography	• Conduct a visual assessment to determine areas of potential erosion; and • Undertake regular digital surveys of rehabilitated areas to confirm that final topography is aligned with landform designs.	• During rehabilitation phase	• No evidence of significant erosion; • No evidence of water ponding on rehabilitated areas; and • The final profile achieved must be acceptable in terms of surface water drainage requirements and the end land use objectives.	As required: • Re-shape areas to ensure that they are free-draining and aligned with the site wide surface drainage framework; and • Refer to the end land use approach and refine measures to be implemented in achieving the desired final land use.
Terrestrial- and Aquatic Ecosystem Health Management				
Vegetation establishment	• Determine whether re-etsablishment of vegetation communities are on a course of achieving a stable self-sustaining community dominated by species typical of the climax-species present in the adjacent areas;	• Yearly for at least 5 years after decommissioning or as deemed necessary.	• Vegetation basal cover should be at least 15% at all times; • Limited to no erosion; and • Self-sustaining vegetation ecosystem.	As required: • Rip and prepare areas to promote re-growth of vegetation;

<table>
<tr><th rowspan="2">Component / Aspect</th><th colspan="2">Monitoring</th><th rowspan="2">Performance / success criteria</th><th rowspan="2">Corrective action</th></tr>
<tr><th>Methodology</th><th>Frequency / duration</th></tr>
<tr><td></td><td>• Inspect rehabilitated areas to assess vegetation re-establishment and provide for early detection of erosion in recently planted/ seeded areas;
• Undertake fixed point photography at specific points at the rehabilitated sites to obtain a long term directly comparable method of determining changes in the landscape;
• Conduct evaluation of rehabilitated areas by means of field inspections. During these assessments measurement of growth performance and species abundance will be carried out to determine: Plant basal cover and species abundance in the grassed areas. Estimates of vegetation canopy and ground cover as well as height;
• Distribution, growth and survival of woody species;
• Dominant plant species (woody and herbaceous);
• Presence of exotic invasive species, and degree of encroachment;
• Browsing or grazing intensity;
• Notes regarding erosion, such as, type, severity, degree of sediment build-up; and
• Species composition and richness.</td><td></td><td></td><td>• Re-vegetate poorly established rehabilitated areas where practical; and
• Apply additional fertiliser and/ or organic matter, depending on the condition of the vegetation and dedicated soil fertility sampling and analysis.</td></tr>
<tr><td>Invasive alien species</td><td>• Visually inspect areas where invasive species have been previously eradicated and areas prone to invasive species (e.g. eroded/ degraded areas, along drainage lines, etc.); and
• Undertake surveys on relevant sites where bush encroachment has previously been identified to determine the status quo of invasive vegetation.</td><td>• Yearly for at least 5 years after decommissioning or as deemed necessary.</td><td>• Limit and/ or prevent declared invader species;
• Minimise extended threats to ecosystems, habitats or other species;
• Increase the potential for natural systems to deliver goods and services; and
• Minimise economic or environmental harm or harm to human health.</td><td>• Saplings of alien trees establishing on rehabilitated areas should be removed before they reach 1 m in height;
• Revisit mitigation measures; and
• Continue control and management.</td></tr>
<tr><td>Wetlands bio-monitoring</td><td>• Undertake a wetland bio-monitoring programme.</td><td>• Annually for at least 5 years after decommissioning or as deemed necessary.</td><td>• In situ water quality within ranges of in-county standards;
• Free movement of wetland species, including migratory species; and
• Maintained levels of biodiversity.</td><td>• Refer to the objectives set out in the wetland management and rehabilitation plan; and
• Revisit mitigation measures.</td></tr>
</table>

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
Surface Water and Groundwater Management				
Surface water flow	• Determine whether the rehabilitated mine site is free draining and that unnecessary impoundment of surface water run-off is prevented; • Conduct a site inspection after the onset of the rainy period, after all closure related measures have been implemented; • Inspect all notable drainage lines on the rehabilitated mine site and establish whether these lines are free draining and have a limited potential for scouring; and • Check the catchments of the respective drainage lines for possible unnecessary impoundment of surface water run-off.	• Quarterly for 5 years after decommissioning or as deemed necessary.	• Free-draining landforms; and • Re-instated pre-mining surface water flow patterns maximising the clean surface water runoff into natural drainage lines.	As required: • In-fill erosion gullies; • Re-establish covers; • Ameliorate, cultivate and re-vegetate as required; • Re-instate surface drainage; and • Manage the spread of invasive plant species.
Surface water quality	• Visually assess the functionality of the surface water drainage systems feeding surface water runoff from rehabilitated areas; and • Monitor surface water quality in terms of the monitoring network that is aligned to the closure monitoring network.	• After major rains during the wet season and after major storms; and • Quarterly for at least a 5 year period after decommissioning or as deemed necessary.	• No evidence of significant erosion and water pooling on rehabilitated areas; • Acceptable threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the land use and downstream users; • No possible surface contaminant sources remaining on the rehabilitated mine site that could compromise the planned land use and/ or pose health and safety threats; and • Water quality results within ranges of in-country water qaulity standards.	As required: • Re-shape areas to ensure that they are free draining; • Undertake a source-pathway investigation; • Devise measures to clean-up sources of contamination; and • Refer to end land use approach and refine measures to be implemented in achieving the desired final land use.
Groundwater quality	• Monitor groundwater quality and levels in terms of the monitoring network that is aligned to the closure monitoring network.	• Quarterly for at least a 5 year period after decommissioning or as deemed necessary.	• Acceptable threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the land use; • The applicable thresholds do not pose a threat to surrounding land uses or land users; and • Water quality results within ranges of in-country water qaulity standards.	As required: • Increase monitoring frequency and detect point sources; • Optimise monitoring plan if needed; • Investigate the drilling and operation of scavenger boreholes; and • Confirm post closure management measures.
Groundwater quantity	• Sample and monitor groundwater levels in the vicinity of the mine.	• Quarterly for at least 5 years period after decommissioning or as deemed necessary.	• Water quality results within ranges of in-country water qaulity standards; and • No evidence of dewatering and lowering of water tables within the vicinity of the mine.	As required: • Develop and implement post closure management measures as required; • Increase monitoring frequency and detect point sources; and • Optimise the monitoring plan if needed.
Dust Management				

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
Dust	• Continuous PM_{10} and $PM_{2.5}$ monitoring by a designated air quality officer at sensitive receptor locations.	• Quarterly for at least a 3-year period after decommissioning or as deemed necessary.	• Acceptable threshold levels that meet the in-country Dust Control Regulations.	As required: • Undertake an investigation as to the source of the dust; and • Devise measures to reduce dust to acceptable levels.
General				
Audit Reports	• Auditing against the conditions outlined within the approved ESMP and ESHIA/ESMP Performance Assessment) or CP at time of mine closure; and • To determine compliance to ESMP or CP conditions.	• Annually and must be audited by an independent auditor.	• Annual Performance Assessment.	As required: • Environmental Officer/ Independent Third Party and updated annually.
General site status	• Conduct a visual assessment with respect to compliance of the afore-mentioned closure measures and to ensure that the site is aesthetically neat and tidy, and that no health or safety risks exist on site.	• Once-off following implementation of rehabilitation measures.	• Waste/ rubble free sites.	As required.

12.11. Preliminary Site Relinquishment Criteria

Site relinquishment requires formal acceptance from the regulatory authority to ensure that all obligations associated with closure are achieved, prior to a closure certificate being issued. To achieve site relinquishment, criteria need to be set, measured and met for all parties to understand what needs to be completed to obtain a closure certificate.

This provides all parties involved in the process a target that needs to be achieved and sets the standards that closure, and rehabilitation are measured against. Table 12-2 provides the preliminary site relinquishment criteria for the mine. These criteria will need to be updated once the final land use and post-closure water management requirements have been confirmed/ finalised.

Table 12-2: Site Relinquishment Criteria

Environmental Aspect	Closure criteria	Monitoring Requirement	Reporting Requirement
Biodiversity	Ensure establishment of vegetation has a basal cover of a reference site 5 years post-closure and that it is self-sustaining and can be measured over a 5-year period after mine closure, indicating that natural succession has occurred.	Bi-annual vegetation monitoring and rehabilitation monitoring for 5 years after mine closure.	Vegetation Monitoring Reports
Groundwater	Groundwater qualities after mine closure need to comply with the qualities stipulated in the groundwater report (Digby Wells, 2024). Geohydrological, geochemical and water and salt balance modelling must be confirmed against predictions.	Biannual groundwater monitoring for 5 years after mine closure. Updated modelling to confirm actual against predicted closure scenarios	Groundwater Monitoring Reports Specialist modelling reports
Surface Water	Surface water qualities after mine closure need to comply with the qualities stipulated in the surface water report (Digby Wells, 2024.	Biannual surface water monitoring for 5 years after mine closure.	Surface Water Monitoring Reports
Social	Engagement with stakeholders and employees regarding closure related aspects and formulisation of a retrenchment and downscaling policy. Therefore, demonstrating training initiatives and skills development assisting in employees being up skilled, which would help individuals to seek alternative employment at the time of closure.	Engagement, training and skills development policies during operational phase.	Records of correspondence, training matrices and records of training
Air Quality	Dust, PM_{10} and $PM_{2.5}$ must comply with the minimum standards and limits.	Monthly air quality monitoring during the decommissioning and rehabilitation phase.	Air Quality Monitoring Reports
Soil, Land Capability and Land Use	Post land use mining assessment to determine status of rehabilitated areas with respect to soil quality and that areas have been rehabilitated to an agreed upon land use. In addition to the above, inspections should be undertaken to identify areas of erosion and that erosion measures have been corrected.	Yearly soil chemistry and physical properties analysis during the rehabilitation phase. Daily soil erosion monitoring during the rehabilitation phase. Confirmed TSF cover functionality regarding recharge rates	Soil Quality and Erosion Monitoring Reports.
Erosion	Implementation or construction of erosion control measures.	Geotechnical and hydrological studies of existing structures. Evidence in rehabilitation report that appropriate risk assessment has been considered.	Erosion Monitoring Reports.
Safety	Ensure dangerous mining areas, such as the open pit area, have been appropriately backfilled and/ or bunded/ protected and appropriate signage erected.	Visual inspections and sign off report by a registered engineer.	Signed off report by a registered engineer.

12.12. Closure Cost Determination

The section details the approach and assumptions applied in the Closure Cost Assessment (CCA) undertaken in support of the financial provisioning requirements for mine closure. The CCA was undertaken using third party rates from Digby Wells' database.

12.12.1. Approach and Methodology

The following approach was followed in the estimation of the closure costs:

- Review supporting information supplied by SGKL;
- Collate infrastructure and mining aspect quantities using Geographic Information System (GIS) survey data, as per the current site layout plan supplied by the SGKL;
- Review infrastructure dataset provided by the mine. Identify and delineate infrastructure not captured to ensure completeness;
- Input infrastructure and mining aspect attributes into the Digby Wells closure cost model, and include all mine-related disturbances in the model;
- Compute the rehabilitation costs for each closure scenario, based on a set of costing assumptions;
- Summarise the CCA outcomes in this section of the MCP;
- Detail all assumptions applied to facilitate the CCA; and
- Compile a succinct closure costing report Memorandum describing the project outcomes.

12.12.2. Closure Costing Assumptions and Qualifications

The closure cost assumptions applied in the CCA are discussed below. These should be reviewed and updated in future iterations of the closure cost estimate to ensure they remain appropriate.

12.12.2.1. General

The general costing assumptions include the following:

- The CCA addresses decommissioning, demolition, surface rehabilitation, monitoring, and maintenance of the site. Other aspects that are not considered in the closure cost include staffing, separation packages, retraining or reskilling of employees, etc.;
- All areas where structures have been removed will be shaped and levelled to align the surface water runoff with the site wide drainage framework, top-soiled, ripped to alleviate compaction and vegetated;
- No legal due diligence was done as part of this closure cost assessment;

- Costs associated with the environmental authorisations and permitting for mine closure have been excluded from the closure costs;
- No landform modelling was done as part of this assessment;
- No materials balance was conducted for this assessment, it is assumed that there will be sufficient material on site for all the rehabilitation actions;
- Digby Wells' third-party contractor rates were applied. These rates were converted from South African Rands to United States Dollars using appropriate conversion factors and escalations; The Digby Wells internal rate database was formalised in 2016 to address typical closure aspects encountered across various mining and industrial sectors. The database is typically reviewed and updated annually and appropriately adjusted with inflation to match the date of the relevant CCA. The calculations are theoretical in nature and informed by typical methodologies and equipment mixes used by demolition and rehabilitation contractors. The composite rates are calculated using a combination of contractor quotations and rates from the Contractors Plant Hire Association (CPHA); and
- The financial provision estimate is based on the latest mine layout plans and information received from SGKL.

12.12.2.2. Infrastructure

The following assumptions are applicable to infrastructure aspects:

- As a general principle, handover of any infrastructure to third parties at mine closure is only considered in the closure costing if a formal agreement is in place with the relevant third party. Unless formal agreements with the next land users are in place, it is assumed that all infrastructure will be demolished and removed;
- All temporary structures will be removed from site, prior to closure and excluded from this estimate;
- Concrete bases associated with buildings (i.e. accommodation camp, steel structures, etc.) are assumed to be 200 mm thick;
- Concrete will only be demolished up to 1000mm below natural ground level;
- All movable assets such as containers, waste skip bins, JoJo tanks, etc., are assumed will be removed prior to closure and therefore, are not included in the cost;
- Full demolition of the accommodation camp infrastructure is included in the liability under the assumption that this will not remain for transfer to the third party post-closure;
- Provision has been made for rehabilitating gravel and haul roads for LoM closure scenario;
- All diesel tanks will be removed by the owner prior to closure and the related infrastructure will need to be demolished by the mine;

- The water transfer pipeline and associated infrastructure will not be dismantled and removed at LoM. It has been assumed that pipeline will be drained of excess water and exposed pipeline-ends on each side will be sealed at closure, if transfer has not yet happened to third parties;
- All inert waste (i.e. building rubble) will be disposed on site, to be disposed in the mine pit, or buried 1m underground during decommissioning;
- All areas where structures have been removed will be shaped, ripped, top soiled and vegetated;
- All shaping will be undertaken with the aim of aligning surface water runoff with the site wide drainage framework to ensure free draining landforms that limit the risk of erosion;
- Internal powerlines will be dismantled and removed, external powerlines will remain at closure and have been excluded from this CCA ;
- Revegetation activities include soil amelioration based on dedicated sampling and analysis, seed bed preparation and seeding with an appropriate seed mix; and
- All rehabilitated areas will be monitored and maintained for a period of 5 years or until the relinquishment criteria is achieved.

12.12.2.3. Ramula Open Pit

The Ramula open pit will remain at closure and the rehabilitation will be based on the following assumptions:

- Construct a safety/security berm/barrier around the pit perimeter including layer compaction and topsoil placement;
- Develop a dished depression on the outside of the barrier berm (where required) to reroute surface water runoff around the low-lying portion of the pit into the natural catchment and to protect the berm against erosion;
- Establish suitable vegetation on the berm and remainder of the pit perimeter to act as a bio barrier, and
- Establish vegetation in the dished depression including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.

12.12.2.4. Tailings Storage Facility

The following assumptions apply to the TSFs:

- The risk of dam break will be eliminated at closure, and no further activities will be required to support the TSF sides like buttressing;
- The embankments would have been rehabilitated to specification during the operations and no further measures are required at closure;

- Remove all infrastructure not needed for the support of post closure maintenance of the TSF at closure;
- Shape and level the upper surface of the TSF to provide a free draining landform to receive a cover;
- Replace 300 mm of topsoil over the remaining TSF surface areas, assuming that the concurrent rehabilitation will be implemented during the operational phase;
- Rip area to alleviate compaction; and
- Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.

12.12.2.5. Waste Rock Dump

The following assumptions apply to the WRD:

- Remove all infrastructure not needed for the support of post closure maintenance of the WRD at closure;
- Remove the WRD for backfilling of the Ramula Pit;
- Shape the remaining WRD footprint areas;
- Place 300 mm of topsoil on the entire remaining WRD;
- Rip area to alleviate compaction; and
- Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.

12.12.2.6. Topsoil Stockpiles

The following assumptions apply to topsoil stockpiles:

- Topsoil will be stripped prior to construction of surface infrastructure and mining areas. All the stockpiled topsoil will be used in the final rehabilitation;
- A load and haul distance of 1 km has been assumed for topsoil placement; and
- The footprint will be ripped to alleviate compaction; and vegetation established.

12.12.2.7. ROM Pads

The following assumptions are applicable:

- Allowance has been included to remove the veneer at closure for disposal on the WRD/ Ramula Pit prior to rehabilitation; and
- Place 300 mm of topsoil on the entire footprint, ripping and revegetation of the ROM pads footprint is accounted for.

12.12.2.8. Waste Management

The following assumptions are applicable:

- Allowance for the removal and/or implementation of bioremediation over contaminated areas (hydrocarbon and chemical) is not included in the closure cost until such areas of contamination have been delineated on site;
- Allowance for the appropriate disposal of hazardous waste is excluded from the closure liability until a closure waste management plan is available and provided; and
- Demolished waste will be stored or disposed on site. Costs to transport waste off-site have not been included.

12.12.2.9. Monitoring and Maintenance

The following assumptions apply to monitoring and maintenance:

- Water monitoring costs (surface water and groundwater) are included and assumed to take place bi-annually for a period of five years post closure;
- Ten (10) surface points and 10 groundwater points have been assumed for this CCA; and
- Vegetation monitoring and maintenance on rehabilitated areas is assumed to take place for five years after closure.

12.12.2.10. Additional Allowances

The following assumptions are applicable:

- It is assumed that third party contractors would be commissioned to establish on site (Preliminary and General Costs included) to implement the mass earthworks, demolition, site clean-up, related rehabilitation work and the post-rehabilitation monitoring and maintenance;
- A contingency of 10% has been allowed for in the financial provision. The contingency considers price fluctuations with regard to plant hire, fuel prices and possible omissions from the assessment;
- A 12% allowance has been included for Preliminary and General Costs (P&Gs); and
- The financial provision estimate does not include VAT.

12.12.2.11. Residual / Latent Closure Costs

At this stage in the Project life cycle, specific methodologies or alternatives for managing the residual/ latent risks identified have not been evaluated. This will only be possible once a closure-based geohydrological model and geochemical assessment has been developed for the mine. This geochemical and geohydrological modelling for closure will inform the expected volumes and qualities of mine water to be managed post-closure (if any).

A key management strategy to reduce the potential of this occurring is to develop, implement and continually improve a LoM water demand and conservation plan

12.12.3. Closure Cost Summary

A summary of the closure cost estimate for the planned closure scenario is reflected in. The total closure cost estimate amounts to to **USD 5,385,431**, for LoM closure scenario, respectively (excluding VAT and including P&Gs and Contingencies). The detailed costing is included in Mine Closure Plan and Costing Reports in the Appendix Y.

Table 1-3: Closure Cost Assessment Summary

DIGBY WELLS ENVIRONMENTAL	**Digby Wells Environmental** **Shanta Gold Kenya Limited, Ramula-Mwibona Gold Mining Project, SGL8045 Revision: 0**
Area and Description	**Life of Mine 2032**
Infrastructure demolition	
Area 1: Accommodation Camp	$-
Area 2: Mining, Admin & Plant Infrastructure	$812 808,44
Area 3: Linear Infrastructure	$75 505,61
Area 4: ROM Pads	$-
Area 5: Ramula Open Pit	$-
Area 6: Waste Rock Dump	$-
Area 7: Tailings Storage Facility	$-
Area 8: Topsoil Storage Areas	$-
Sub-total	**$888 314,06**
Rehabilitation	
Area 1: Accommodation Camp	$-
Area 2: Mining, Admin & Plant Infrastructure	$55 068,59
Area 3: Linear Infrastructure	$131 611,83
Area 4: ROM Pads	$12 230,45
Area 5: Ramula Open Pit	$69 522,60
Area 6: Waste Rock Dump	$1 556 176,13
Area 7: Tailings Storage Facility	$707 354,84
Area 8: Topsoil Storage Areas	$24 098,90
Sub-total	**$2 556 063,34**
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	$167 856,73
Monitoring Costs (Vegetation)	$1 351,18
Maintenance Costs (Vegetation)	$1 014 083,04

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental Shanta Gold Kenya Limited, Ramula-Mwibona Gold Mining Project, SGL8045 Revision: 0
Sub-total	**$1 183 290,95**
Preliminary and General (12%)	$413 325,29
Contingency (10%)	$344 437,74
GRAND TOTAL (Excl. VAT)	**$5 385 431**

12.12.3.1. Actions Required for Improvement of Closure Cost Accuracy

- Update the geohydrological and geochemical investigations and closure scenario modelling periodically, and develop a water and salt balance for the closure scenario to inform decision making regarding post closure water management requirements;
- The development of closure measures for the TSFs should be informed by designs and incorporated in subsequent CCA updates;
- The volume of demolition waste expected at closure should be determined by a quantity surveyor early in the Project life cycle, once this information is available the cost for disposal of demolition waste should be included in the CCA;
- Develop a site wide closure and rehabilitation materials balance to quantify rehabilitation requirements (topsoil volumes) versus available material onsite. Suitable sources of material will have to be identified to address any potential deficits (if any);
- A detailed closure cover design for the TSF should be undertaken early in the Project life cycle to ensure the required material is available on site and the cost estimation should be updated to accurately account for implementation of this cover;
- Develop a final landform design for the TSFs and WRD, and include potential material balances for closure, to ensure that the surface area is free draining;
- It is assumed that site relinquishment criteria for surface and groundwater will be achieved within five years post-closure, and that site relinquishment criteria over the rehabilitated areas will be achieved within five years. These post-closure monitoring periods should be reassessed and updated as/ if required;
- The percentage allocations applied for P&Gs, and Contingencies should be reassessed and updated to ensure these are in line with market rates; and
- Update the CCA periodically once more detailed infrastructure and mine plans are available and when mining commences, to ensure that all costs become more accurate over time and reflect current market conditions.

12.12.3.2. Recommendations

The following recommendations are made to improve the MCP in future updates:

- A detailed material balance should be undertaken to ensure the open pit is rehabilitated to be free draining, the TSF and WRD are adequately capped, as per a detailed closure capping design to be developed;
- Geohydrological and geochemical modelling for the closure period should be undertaken to inform the post-closure water treatment measures required, and to enable the required provisioning to be made for both the immediate and planned closure scenarios;
- Quarterly groundwater monitoring should take place during the operational phase, and at closure to determine possible changes in groundwater quantity and quality, which are to be used in updating the geohydrological model for the site;
- A post-mining land use plan should be developed early in the Project life cycle to inform the closure measures and site relinquishment criteria;
- There should be regular interaction and communication with local stakeholders, so that their requirements can be taken into consideration in the rehabilitation process, and particularly the post-mining land use plan development;
- Invasive alien plants should be removed on an on-going basis; and
- Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least five years post-closure and should also be implemented during the operational period. This enables corrective rehabilitation to be implemented during operations and reduces the residual risk associated with post-closure vegetation establishment failure.

13. Conclusion and Recommendations

This report constitutes the ESIA for the proposed Ramula Open Pit Mining Project for SGKL using conventional processes (truck and shovel), open pit. For SGKL to play a significant role in Kenyan's economy, further economically feasible reserves have been identified including the Miruka, Dhene, and Ochiegue. The Ramula- Mwibona deposits have proven to possess gold bearing zones that would be accessed and brought in production through open pit mining methods. The Ramula Mwibona deposits are among the identified reserves which will help the sustenance of SGKL for 8 years based on the Life of Mine (LoM).

The Environmental Permitting application process will be undertaken in accordance with the requirements of the EMCA and its subsequent regulations and guidelines. The ESIA Process will comply with the Good International Industry Practice (GIIP), such as the Equator Principles (EPs) of 2020 and the International Finance Corporation's Performance Standards on Environmental and Social Sustainability (IFC PSs).

The proposed Project is a new undertaking, as such, specialists' baseline studies were carried out in recognition of the existing baseline biophysical and socio-economic environment and the assessment of potential changes that may result from the proposed Project infrastructure and associated ancillary facilities. The mine already has established linkages with local communities and government in the area and will not be negatively affected by this Project. As shown in the report, these linkages and relationships will be further strengthened through the extension of mine life which in turn ensures continuation of the various development programmes that the surrounding communities enjoy.

The main impacts associated with the Project will be the change in land use from agricultural to mining, clearing of vegetation, loss of topsoil and destruction of habitat for terrestrial and aquatic faunal species. The land requirements for the Project will result in physical and economic displacement of households. Infrastructure placement and the construction of the associated facilities will have potential impacts on the surface and groundwater resources through the potential contamination within drainage lines, this impacts water being received downstream to the Yala River and aquatic habitat and assemblages.

As outlined in the ESMP presented in this report, the mine will work closely with the various government institutions and the county and sub-counties' administrations, to ensure that all the outlined mitigation measures are implemented, and the associated impacts controlled.

From the information gathered during the ESIA study, it can be concluded that the Project will have a significant long-term positive impact on the local and regional communities and ultimately contribute to the sustainable development of the nation. Generally, the communities are in support of the Project, as it is viewed as a major source of employment and income to the local people and will benefit several communities based on the CDA that will be signed between SGKL and affected communities as summarised in section 1.6.1.1. The Project is also expected to stimulate other infrastructure development programmes in the villages, wards and the affected counties as well. The identified potential impacts of the proposed Project will be mitigated in line with the proposed measures and the outlined management plans. The effectiveness of the proposed mitigation measures will be ensured and where necessary improved through the proposed monitoring plan.

Furthermore, for this Project to remain successful and sustainable, the following key recommendations are made:

- The prescribed ESMP must be implemented to avoid/ minimise negative impacts and enhance positive impacts. It is recommended that periodic auditing by an independent auditor be undertaken to ensure that Project activities are undertake in accordance with the objectives and commitments which have been set out in the ESMP;
- Ensure continuous monitoring (and where necessary corrective actions) of the following, as per the monitoring programme:
  - Water resources;
  - Ambient air quality;
  - Wetland Habitat;
  - Noise levels;
  - Nuisance impacts;
  - Terrestrial and aquatic biodiversity; and
  - Soil erosion and AIP infestation.
- As part of this ESIA, a conceptual rehabilitation and closure criteria was established for the Ramula- Mwibona Project. It is recommended that a detailed Rehabilitation and Closure Plan be updated throughout the Project's life. The detailed plan should consider social closure which will require ongoing consultation with relevant stakeholders on the desired post-mining land uses;
- A predictive hydrogeological numerical model was developed for purposes of the ESIA. This model should be updated periodically with the progression of mining and availability on longer term monitoring data to inform post closure management measures;
- Concurrent rehabilitation should be undertaken throughout the Project's life. This will reduce the liability at closure and aid in preventing long-term/ irreversible environmental degradation;
- Resettlement Policy Framework (RPF) has been developed as part of the proposed Project. This provides the resettlement and compensation processes associated with physical and economic displacement. Of key consideration is ensuring that adverse impacts to the livelihoods of persons to be displaced are minimised as far as possible;
- It is expected that population influx into the local area will occur due to the presence of the Project. To manage influx, it is recommended that an Influx Management Plan

(IMP) be developed and should consider appropriate objectives and interventions for influx management, including stakeholder engagement and monitoring methods;

- Maintain stormwater management structures and develop new structures where it is deemed necessary to ensure no significant impacts to the surrounding freshwater ecosystem are experienced;
- Continue training and environmental awareness of mine personnel, contractors and surrounding communities. All SGKL staff and subcontractors should be trained on the purpose, contents and implementation of the ESMP as well as engagement and interactions with the surrounding host communities to sustain a licence to operate; and
- Maintain relationships with stakeholders throughout the Project life

14. References

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