

BEA MOUNTAIN MINING CORPORATION

MATAMBO OPEN PIT MINE

ESIA Report

February 2024

ABS Africa
Sustainability Advisors

PETRA RESOURCES
- INCORPORATED -

TABLE OF CONTENTS

0 INTRODUCTION 0-2

0.1 PROJECT FRAMEWORK 0-2
0.2 BRIEF DESCRIPTION OF PROJECT 0-2
0.3 PROJECT DEVELOPER 0-3
0.4 BASELINE DESCRIPTION 0-5
0.4.1 Pre-Mining Biological and Physical Environment 0-5
0.4.2 Pre-Mining Social Environment 0-6
0.5 STAKEHOLDER ENGAGEMENT 0-7
0.6 ENVIRONMENTAL IMPACT ASSESSMENT 0-7
0.7 SOCIAL IMPACT ASSESSMENT 0-10
0.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 0-10
0.9 RECLAMATION AND MINE CLOSURE 0-11
0.10 MONITORING PLAN 0-11
0.11 CONCLUSION 0-12

1 INTRODUCTION 1-1

1.1 PROJECT FRAMEWORK 1-1
1.2 BRIEF DESCRIPTION OF PROJECT 1-3
1.3 PROJECT DEVELOPER 1-4
1.4 PROJECT AREA OF INFLUENCE 1-4
1.5 AUTHOR OF REPORT 1-8
1.6 STUDY STRATEGY 1-8
1.6.1 Report Format 1-8
1.6.2 ESIA Approach 1-8
1.6.3 Specialist Studies Associated With The ESIA 1-9

2 PROJECT MOTIVATION AND BENEFITS 2-1

2.1 THE NEED FOR GOLD AND THE GOLD MARKET 2-1
2.1.1 Uses of Gold 2-1
2.1.2 Gold Market 2-1
2.2 SOCIAL AND ECONOMIC BENEFITS OF GOLD MINING 2-1
2.3 SHAREHOLDER VALUE 2-4
2.4 MINING AND THE LIBERIA ECONOMY 2-4
2.5 QUANTITY AND VALUE OF PRODUCT 2-5
2.6 PROJECT BENEFITS TO LIBERIA 2-5
2.6.1 Mining and Minerals Law of 2000 and the Exploration Regulations 2-5
2.6.2 Direct Economic Benefits 2-5
2.6.3 Indirect Economic Benefits 2-6
2.7 REGIONAL AND COMMUNITY BENEFITS 2-6
2.7.1 BMMC Community development Plan 2-7
2.7.2 Local Job Creation 2-7
2.7.3 Training And Capacity Building 2-7
2.7.4 Local Business Development 2-7

3 ENVIRONMENTAL LEGISLATION AND PROJECT GOVERNANCE FRAMEWORK.....3-1

3.1 LEGISLATIVE REQUIREMENTS, INTERNATIONAL STANDARDS, AND INSTITUTIONAL FRAMEWORK.....3-1
3.1.1 National Liberian Legislation and Policies.....3-1
3.1.2 The Liberian Constitution (1986).....3-1
3.1.3 The Mineral Policy of Liberia (2010).....3-1
3.1.4 Ministry of Mines and Energy (MME).....3-1
3.1.5 Mineral Resources Department.....3-1
3.1.6 Minerals and Mining Law of 2000 (MML).....3-2
3.1.7 Minerals and Mining Act (ACT 703 OF 2006).....3-3
3.1.8 Liberia Extractive Industries Transparency Initiative Act (LEITI), (2009).....3-3
3.1.9 National Environmental Policy (2002).....3-4
3.1.10 The Environment Protection and Management Law (EPML) 2003.....3-4
3.1.11 Environmental Protection Agency Act (2003).....3-5
3.1.12 National Environmental Action Plan.....3-5
3.1.13 National Forest Policy (2006).....3-5
3.1.14 Forest Development Authority.....3-5
3.1.15 The National Forestry Reform Law Of 2006 (NFRL).....3-5
3.1.16 Liberia Land Commission Act (2009).....3-6
3.1.17 Revised Law and Administrative Regulations for Governing the Hinterland, 2001.....3-6
3.1.18 National Zoning Act of The City Of Monrovia Of 1957.....3-7
3.1.19 The Liberia Land Authority Act (LLA) Of 2016.....3-7
3.1.20 Land Rights Law 2018.....3-8
3.1.21 Biodiversity Legislation and Policy.....3-8
3.1.22 National Biodiversity Strategy and Action Plan (NBSAP).....3-8
3.1.23 Wildlife And National Parks Act (1988).....3-9
3.1.24 The Independent National Commission on Human Rights Act Of 2005.....3-9
3.2 MANAGEMENT AT A LOCAL LEVEL.....3-9
3.2.1 Statutory Management Practices.....3-9
3.2.2 Traditional Management Practices.....3-9
3.3 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS (IFC).....3-9
3.3.1 General Environmental, Health & Safety Guidelines.....3-10
3.3.2 IFC EHS Guidelines: Mining.....3-10
3.3.3 Mine Closure and Post-Closure.....3-15
3.3.4 Human Rights Considerations.....3-15
3.3.5 Corporate Policies.....3-16
3.3.6 Other Legislation and Policy.....3-16
3.3.7 First Amendment to the Restated and Amended Mineral Development Agreement by and between the Government of Liberia and Bea Mountain Mining Corporation (2023).....3-17
3.3.8 International Obligations, Commitments and Conventions.....3-17
3.4 INSTITUTIONAL FRAMEWORK.....3-18
3.4.1 Government Ministries.....3-18
3.5 STANDARDS AND GUIDELINES.....3-19
3.5.1 Legal Requirements and Noise Level Guidelines for the Republic of Liberia.....3-19
3.5.2 Water Quality Standards and Guidelines.....3-21

3.5.3 Air Quality *3-23*
3.6 MINE CLOSURE 3-27
3.6.1 Financial Feasibility *3-28*
4 PROJECT DESCRIPTION 4-3
4.1 SUMMARY 4-3
4.1.1 Temporary Construction Permits *4-5*
4.2 PROJECT LOCATION 4-5
4.3 MINE CONCESSION AREA 4-6
4.4 GEOLOGY AND MINERALIZATION 4-7
4.5 PLANNED STRUCTURES AND INFRASTRUCTURE ASSOCIATED WITH THE PROJECT 4-7
4.5.1 Matambo Open Pits and Supporting Infrastructure *4-7*
4.6 EXISTING STRUCTURES AND INFRASTRUCTURE TO BE USED AT NLGM FOR THE MATAMBO PROJECT 4-15
4.7 MINING METHODOLOGY 4-15
4.7.1 Open Pits *4-15*
4.7.2 Mining Fleet *4-15*
4.7.3 Recruitment *4-16*
4.7.4 Life Of Mine (LOM) *4-16*
4.8 MINE SUPPORT ACTIVITIES 4-16
4.8.1 Storm Water Management *4-16*
4.8.2 At-Source Waste Separation *4-17*
4.8.3 On-Site Waste Sorting *4-19*
4.8.4 Disposal and Recycling *4-19*
4.8.5 Waste Management Monitoring *4-19*
4.8.6 Wastewater/ Sewage/ Effluent Management *4-19*
4.8.7 Hazardous Waste Management *4-20*
4.9 RECOVERY METHOD AT NLGM 4-20
4.9.1 Gold Processing Plant *4-20*
4.9.2 Ore Receipt and Crushing *4-20*
4.9.3 Milling *4-20*
4.9.4 Intensive Leach Reactors *4-21*
4.9.5 Thickening and CIL *4-21*
4.9.6 Elution *4-21*
4.9.7 Gold Room *4-21*
4.9.8 INCO *4-21*
4.9.9 Tailings Storage Facility (TSF) *4-22*
4.9.10 Reagents *4-22*
5 PHYSICAL AND BIOLOGICAL BASELINE 5-5
5.1 GEOLOGY 5-5
5.2 GEOCHEMICAL ASSESSMENT 5-5
5.2.1 Geochemical Characterization- Composite Simples *5-5*
5.3 CLIMATE 5-10
5.3.1 Precipitation *5-10*
5.3.2 Evaporation *5-12*

5.3.3 Temperature *5-13*
5.3.4 Humidity *5-14*
5.3.5 Surface Wind Field *5-14*
5.4 DRAINAGE AND TOPOGRAPHY 5-15
5.4.1 Hydrological Characteristics *5-15*
5.4.2 Surface Water and Hydrogeology *5-16*
5.5 WATER QUALITY 5-28
5.5.1 Groundwater Quality *5-28*
5.5.2 Surface Water Quality Analysis *5-33*
5.6 SOILS AND LAND CAPABILITY 5-36
5.6.1 Soil Sampling Analysis *5-36*
5.6.2 Land Capability Classification and Rating *5-36*
5.6.3 Baseline Soils and Survey Results *5-36*
5.6.4 Land Use and Land Capability *5-41*
5.6.5 Site Sensitivity *5-43*
5.7 AIR QUALITY 5-45
5.7.1 Sensitive Receptors *5-45*
5.8 NOISE 5-49
5.8.1 Description Of Receiving Environment *5-49*
5.8.2 Noise Survey And Results *5-50*
5.9 ECOLOGICAL OVERVIEW 5-54
5.9.1 Global Perspective *5-54*
5.9.2 Regional Perspective *5-54*
5.9.3 Local Perspective *5-56*
5.9.4 General Results and Survey Coverage *5-56*
5.9.5 Habitat and Plant Species *5-56*
5.9.6 Avifauna *5-62*
5.9.7 Mammals *5-65*
5.9.8 Herpetofauna *5-66*

6 SOCIO-ECONOMIC BASELINE 6-1

6.1 GENERAL OVERVIEW 6-1
6.2 SOCIAL CONTEXT 6-1
6.2.1 Population and Demographics *6-1*
6.2.2 Gender Demographics *6-2*
6.2.3 Social Infrastructure *6-2*
6.2.4 Emergency Services and Safety *6-3*
6.3 ECONOMIC CONTEXT 6-3
6.3.1 Livelihood And Employment *6-3*

7 ENVIRONMENTAL IMPACT AND RISK ASSESSMENT METHODOLOGY 7-1

7.1 IDENTIFICATION AND DEFINITION OF IMPACTS 7-1
7.2 IMPACT SIGNIFICANCE RATING 7-1
7.3 ACTIVITIES THAT MAY IMPACT THE RECEIVING ENVIRONMENT 7-4
7.3.1 Construction Phase Activities *7-4*
7.3.2 Operational Phase Activities *7-4*

7.3.3 Closure And Decommissioning Phase Activities 7-4

8 PHYSICAL IMPACTS 8-3

8.1 SURFACE WATER QUANTITY 8-3
8.2 GEOHYDROLOGY 8-3
8.2.1 Construction Phase 8-3
8.2.2 Operational Phase 8-3
8.2.3 Long Term Post-Closure Phase 8-4
8.3 SOILS AND LAND CAPACITY 8-5
8.3.1 Construction Phase Impacts 8-7
8.3.2 Operational Phase Impacts 8-8
8.3.3 Decommissioning & Closure Phase Impacts 8-8
8.4 GREENHOUSE GAS EMISSIONS 8-9
8.4.1 Potential Effects of Climate Change on the Project and Community 8-9
8.5 NATIONAL GHG STRATEGY AND PLANS 8-10
8.5.1 Liberia's National GHG Strategy and Plans 8-10
8.5.2 Project GHG Emissions 8-10
8.6 AIR QUALITY 8-11
8.6.1 Impact Significance Rating 8-11
8.7 NOISE 8-12
8.7.1 Impacts 8-12
8.7.2 Impact Significance Rating 8-13
8.8 VIBRATION AND BLASTING 8-13
8.8.1 Impacts 8-14
8.9 PHYSICAL IMPACT MATRIX 8-17

9 BIOLOGICAL IMPACTS 9-1

9.1 TERRESTRIAL BIODIVERSITY 9-1
9.1.1 Key Potential Impacts 9-1
9.2 BIOLOGICAL IMPACT MATRIX 9-7

10 SOCIAL AND ECONOMIC IMPACT ASSESSMENT 10-1

10.1 PRE-CONSTRUCTION IMPACTS 10-1
10.2 CONSTRUCTION IMPACTS 10-1
10.2.1 Employment 10-1
10.2.2 Infrastructure, Transportation 10-1
10.2.3 Water Pollution 10-2
10.2.4 Education 10-2
10.2.5 Health 10-2
10.2.6 Socio-Economic Compensation 10-2
10.2.7 Air Pollution, Dust and Noise 10-3
10.3 CONSTRUCTION AND OPERATIONAL PHASES 10-3
10.4 CONCLUSION 10-3

11 ASSESSMENT OF CUMULATIVE IMPACTS 11-1

11.1 METHODOLOGY 11-1

11.2 EXISTING AND PLANNED DEVELOPMENTS 11-1
11.3 CUMULATIVE IMPACTS 11-2
11.3.1 Air Quality 11-2
11.3.2 Greenhouse Gas Emissions 11-2
11.3.3 Land Use 11-3
11.3.4 Surface Water Resources 11-3
11.3.5 Groundwater Resources 11-3
11.3.6 Clearing of Natural Vegetation 11-3
11.3.7 Traffic Volumes, Wear and Tear, Damage to Roads and Road Safety 11-3
11.3.8 Noise 11-3
11.3.9 Evaluation of Major Cumulative Impacts 11-3
11.3.10 Measures of Prevention and Attenuation and Compensation of Cumulative Impacts 11-4

12 EVALUATION OF PROJECT ALTERNATIVES 12-1

12.1 NO DEVELOPMENT OPTION (NO GO OPTION) 12-1
12.2 MINE DESIGN ALTERNATIVES 12-2
12.2.1 Pit Locations and Dimensions 12-3
12.2.2 Alternative Mining Methods 12-3
12.2.3 Alternative Mineral Processing Methods 12-3
12.2.4 Location, Number and Design of Mine Residue Facilities and Support Infrastructure 12-4
12.3 RAW WATER SUPPLY ALTERNATIVES 12-5
12.4 SOLID WASTE DISPOSAL ALTERNATIVES 12-5
12.5 MINE HAUL ROAD ALTERNATIVES 12-5
12.6 ENERGY SUPPLY OPTIONS 12-5

13 STAKEHOLDER ENGAGEMENT 13-2

13.1 PROJECT LOCATION 13-2
13.2 STAKEHOLDERS IDENTIFICATION 13-2
13.2.1 Consultation Strategy 13-2
13.3 GRIEVANCE MANAGEMENT SYSTEM 13-5
13.3.1 ESIA Process 13-5
13.3.2 Post-ESIA Process 13-5
13.3.3 Consultation Findings 13-5
13.3.4 Consultation and Participation During Project Implementation 13-7
13.3.5 Disclosure of ESIA 13-7

14 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 14-1

14.1 INTRODUCTION 14-1
14.2 IMPLEMENTATION OF THE ESMP 14-1
14.3 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM 14-2
14.3.1 Leadership 14-3
14.3.2 Environmental Policy 14-3
14.3.3 Roles and Responsibilities 14-3
14.3.4 Actions to Address Risks and Opportunities 14-3
14.4 ENVIRONMENTAL AND SOCIAL ACTION PLAN AND STUDIES 14-4
14.4.1 Environmental Objectives 14-5

14.4.2 Environmental Targets *14-5*
14.4.3 Planning Actions to Achieve Environmental Objectives *14-5*
14.4.4 Communication *14-6*
14.4.5 Documentation and Information *14-6*
14.4.6 Control of Documents *14-7*
14.4.7 Operation *14-7*
14.4.8 Performance Evaluation *14-7*
14.4.9 Management Review *14-8*
14.4.10 Improvement *14-9*
14.5 MITIGATION MEASURES 14-9
14.5.1 Project Development Area *14-9*
14.5.2 Open Pit Mining, and Waste Rock Dump *14-11*
14.5.3 Power Supply *14-14*
14.5.4 Roads and Transport *14-14*
14.6 ENVIRONMENTAL MANAGEMENT PLAN 14-16
14.7 SOCIAL MANAGEMENT PLAN 14-33
14.7.2 Environmental Management *14-34*
14.7.3 Grievance Management *14-34*
14.8 ENVIRONMENTAL MONITORING PLAN 14-34
14.8.1 Inspections *14-34*
14.8.2 Aftercare And Maintenance *14-34*
14.8.3 Post Closure Environmental Monitoring *14-34*
14.9 RECORD-KEEPING 14-34
14.9.1 Monitoring Plan *14-35*
14.10 EMERGENCY PREPAREDNESS AND RESPONSE PLAN 14-39
14.10.1 Objectives *14-39*
14.10.2 Scope *14-40*
14.10.3 Responsibility *14-40*
14.10.4 Management *14-40*
14.10.5 Aspects To Be Incorporated into the EPRP *14-40*

15 FRAMEWORK FOR REHABILITATION AND MINE CLOSURE PLAN 2

15.1 POLICY GUIDELINES AND LEGISLATIVE REQUIREMENTS 2
15.2 POST CLOSURE LAND USE OBJECTIVES 3
15.3 SOCIAL TRANSITION 3
15.4 RECLAMATION AND CLOSURE COMPLETION CRITERIA 4
15.5 CONCEPTUAL REHABILITATION AND CLOSURE PLAN 5
15.5.1 General Reclamation and Closure Activities *5*
15.5.2 Reclaim and Closure Activities Applicable to Specific Infrastructure Areas *6*

16 CONCLUSION 16-1

17 REFERENCES 17-2

TABLE OF FIGURES

FIGURE 0-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC CLASS A MINING LICENSE AREA 0-4
FIGURE 1-1: LOCALITY OF THE Matambo RESOURCE AREA IN RELATION TO THE BMMC CLASS A MINING LICENSE AREA 1-2
FIGURE 1-2: WATERSHED/CATCHMENT AREA OF INFLUENCE 1-6
FIGURE 1-3: ZONE OF INFLUENCE 1-7
FIGURE 2-1: PERCENTAGE IN-COUNTRY PAYMENTS BY GOLD MINING COMPANIES 2-2
FIGURE 2-2: AVERAGE PAYMENTS TO HOST COMMUNITIES 2-3
FIGURE 2-3: SUMMARY OF LOCAL COMMUNITY EMPLOYMENT BY GOLD MINING COMPANIES 2-4
FIGURE 4-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC-MDA 4-4
FIGURE 4-2: REGIONAL SETTING OF THE MATAMBO RESOURCE WITHIN THE BMMC MDA 4-6
FIGURE 4-3: PIT SHELLS 4-8
FIGURE 4-4: GENERAL LAYOUT FOR THE MATAMBO MINE PROJECT 4-9
FIGURE 4-5: CAMP DESIGN 4-13
FIGURE 4-6: PLANNED STORMWATER DIVERSIONS 4-17
FIGURE 4-7: DRAINAGE AREAS RELATED TO MATAMBO 4-18
FIGURE 4-8: MINE SITE LAYOUT AND SELECTED PHOTOS FROM JANUARY 2024 4-23
FIGURE 5-1: LOCATION OF DRILL CORES (MDD0134, MDD0087, MDD0298, MDD0198) AND MDD0563) AND CORE PROFILE SHOWING THE MINERALOGY OF THE SECTION OF THE CORE ANALYSED – SAMPLES MT_DE_00006, 00013, 00014, 00015, AND MT_DE_00034 5-7
FIGURE 5-2: MONTHLY PRECIPITATION RECORDED AT DARU WEATHER STATION FROM 1951 – 1997 5-11
FIGURE 5-3: MONTHLY PRECIPITATION RECORDED AT HARBEL WEATHER STATION FROM 1933-1993 5-11
FIGURE 5-4: ANNUAL PRECIPITATION CYCLES FOR DARU WEATHER STATION 5-12
FIGURE 5-5: ANNUAL PRECIPITATION CYCLES FOR HARBEL WEATHER STATION 5-12
FIGURE 5-6: REGIONAL MEAN ANNUAL POTENTIAL EVAPORATION MAP 5-13
FIGURE 5-7: DIURNAL TEMPERATURE PROFILE (MODELLED MM5 DATA, 2015 TO 2017) 5-14
FIGURE 5-8: PERIOD, DAY AND NIGHT-TIME WIND ROSES (MODELLED MM5 DAT, 2015 TO 2017) 5-15
FIGURE 5-9: MATAMBO PRE-DEVELOPMENT SUB-CATCHMENTS 5-16
FIGURE 5-10: ESTIMATED MEAN ANNUAL RUNOFF COEFFICIENTS FOR TROPICAL AFRICA 5-18
FIGURE 5-11: AFRICA'S MEAN ANNUAL RUNOFF COEFFICIENTS CONTOURS 5-19

FIGURE 5-12: LOCALITY MAP OF MINE HYDROGEOLOGICAL BOREHOLES AND COMMUNITY WELLS (GEOSTRATUM, 2024) 5-24
FIGURE 5-13: DOMINANT SOILS MAP 5-38
FIGURE 5-14: PRE-CONSTRUCTION LAND CAPABILITY 5-42
FIGURE 5-15: SITE SOIL SENSITIVITY MAP 5-44
FIGURE 5-16: AIR QUALITY SENSITIVE RECEPTOR LOCATIONS 5-45
FIGURE 5-17: PARTICULATE CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-47
FIGURE 5-18: CO_2 CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-48
Figure 5-19: HCHO CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-48
FIGURE 5-20: TVOC CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-49
FIGURE 5-21: NOISE SENSITIVE RECEPTOR LOCATIONS AND NOISE SAMPLING LOCATIONS 5-50
FIGURE 5-22: LOCATIONS OF PRELIMINARY SHORT-TERM NOISE SAMPLING 5-53
FIGURE 5-23: REMAINING UPPER GUINEA FOREST EXTENT 5-55
FIGURE 5-24: FROM LEFT TO RIGHT: THE SEASONAL PHENOLOGY OF FOREST TREES, THE MONTHLY BREEDING INTENSITY FOR FOREST BIRDS (NON-PASSERINE, PASSERINE AND RIVER BIRDS), AND SELECTED NON-PASSERINE BIRD FAMILIES (GATTER, 1997) 5-56
FIGURE 5-25: DISTRIBUTION OF HABITATS / VEGETATION COMMUNITIES WITHIN THE MATAMBO AREA 5-59
FIGURE 5-26: DRONE PHOTOS TAKEN IN 2021 OF SPECIFIC HABITATS IN THE EASTERN PORTION OF THE MATAMBO AREA 5-60
Figure 5-27: DRONE PHOTOS TAKEN IN 2023 OF THE MATAMBO AREA 5-61
FIGURE 5-28: A PHOTO OF *Didelotia idae* FOUND IN THE STUDY AREA 5-62
FIGURE 5-29: COLLAGE ILLUSTRATING (CLOCKWISE) 1: A STOCK PHOTOGRAPH OF IUCN VULNERABLE PICATHARTES. 2: A PICATHARTES RECORDED BY CAMERA TRAP WITHIN THE SPECIES' OPTIMAL ROCKY CAVE/ DRAINAGE LINE HABITAT ON THE INTERFACE BETWEEN WESTERN SILVER HILLS AND EASTERN MATAMBO 5-64
FIGURE 8-1: SOILS AND AGRICULTURE SENSITIVITY 8-6
FIGURE 8-2: FLY ROCK IMPACT ZONE POST MITIGATION 8-16
FIGURE 9-1: CRITICAL HABITAT 9-2
FIGURE 12-1: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION OPTION 1 12-1
FIGURE 12-2: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION OPTION 2 12-2
FIGURE 12-3: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION COMPARED TO MAJOR WATER COURSES OPTION 1 12-3
FIGURE 12-4: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION COMPARED TO MAJOR WATER COURSES OPTION 2 12-4
Figure 13-1: Timeline of Stakeholder Engagement 13-3

LIST OF TABLES

TABLE 1-1: DETAILS OF THE DEVELOPER 1-4
TABLE 1-2: PROJECT ZONE OF INFLUENCE ASSOCIATED WITH THE PROPOSED DEVELOPMENT 1-5
TABLE 2-1: PERCENTAGE OF GDP PER SECTOR 2-5
TABLE 3-1: TYPES OF MINING LICENCES 3-2
TABLE 3-2: INDICTIVE VALUES FOR TREATED SANITARY SEWAGE DISCHARGES 3-12
TABLE 3-3: EFFLUENT GUIDELINES 3-12
TABLE 3-4: MINIMUM AVERAGE ILLUMINATION FOR DESIGNATED MINE LOCATIONS AND ACTIVITIES 3-14
TABLE 3-5: INTERNATIONAL CONVENTIONS UNDER WHICH LIBERIA HAS OBLIGATIONS RELEVANT TO THE PROJECT 3-17
TABLE 3-6: MAXIMUM PERMISSIBLE NOISE LEVELS FOR GENERAL ENVIRONMENT 3-19
TABLE 3-7: MAXIMUM PERMISSIBLE NOISE LEVELS (CONTINUOUS OR INTERMITTENT) FROM A FACTORY OR WORKSHOP 3-20
TABLE 3-8: MAXIMUM PERMISSIBLE NOISE LEVELS FOR IMPACT OR IMPULSIVE NOISE 3-20
TABLE 3-9: MAXIMUM PERMISSIBLE NOISE LEVELS FOR CONSTRUCTION SITE 3-20
TABLE 3-10: MAXIMUM PERMISSIBLE NOISE LEVELS FOR ACCELERATING VEHICLES 3-20
TABLE 3-11: WATER QUALITY GUIDELINES 3-21
TABLE 3-12: WORLD HEALTH ORGANIZATION AMBIENT AIR QUALITY GUIDELINES (AS USED BY IFC) 3-24
TABLE 3-13: SANDCR ACCEPTABLE SETTLEABLE DUST RATES 3-25
TABLE 3-14: SMALL COMBUSTION FACILITIES EMISSIONS GUIDELINES (3MWTH – 50 MWTH) 3-25
TABLE 4-1: PROJECT ACTIVITIES ASSOCIATED WITH THE PROJECT 4-10
TABLE 4-2: APPROXIMATE DIMENSIONS OF WRDS AND STOCKPILES 4-11
TABLE 4-3: APPROXIMATE PIT DIMENSIONS 4-15
TABLE 4-4: REQUIRED MINING EQUIPMENT 4-16
TABLE 5-1: SUMMARY OF MAJOR AND TRACE ELEMENT COMPOSITION AS DETERMINED BY HANDHELD XRF. VALUES EXPRESSED AS MASS %. ND INDICATES CONCENTRATION IS BELOW THE DETECTION LIMIT. 5-8
TABLE 5-2: PARTIAL ACID BASE ACCOUNTING DATA FOR THE 11 SAMPLES TESTED. 5-9
TABLE 5-3: SUMMARY OF NAG DATA FOR THE 11 SAMPLES TESTED. TOTAL ACID GENERATION IS THE SUM OF THE NAG 4.5 AND NAG 7 VALUES 5-9
TABLE 5-4: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A NORMAL YEAR. 5-10
TABLE 5-5: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A DRY YEAR 5-10
TABLE 5-6: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A WET YEAR 5-11
TABLE 5-7: MEAN MONTHLY AND ANNUAL RAINFALL FOR A NORMAL YEAR 5-11

TABLE 5-8: MONROVIA MEAN ANNUAL AND MONTHLY POTENTIAL EVAPORATION...5-12
TABLE 5-9: RECOMMENDED MEAN ANNUAL AND MONTHLY EVAPORATION.....5-13
TABLE 5-10: MINIMUM, MAXIMUM AND AVERAGE HOURLY TEMPERATURES (MODELLED MM5 DATA, 2015 TO 2017) 5-13
TABLE 5-11: BASIC PHYSICAL CHARACTERISTICS OF THE CATCHMENTS.....5-15
TABLE 5-12: BASELINE FLOOD PEAKS AND VOLUMES (PRE-DEVELOPED) 5-17
TABLE 5-13: FLOOD PEAKS AND VOLUMES (POST-DEVELOPED) 5-17
TABLE 5-14: ESTIMATED MEAN ANNUAL RUNOFFS (PRE-DEVELOPED) 5-19
TABLE 5-15: ESTIMATED MEAN ANNUAL RUNOFFS (POST-DEVELOPED).....5-19
TABLE 5-16: RECOMMENDED MONTHLY DISTRIBUTION OF THE MEAN ANNUAL RUNOFF.....5-20
TABLE 5-17: HYDROGEOLOGICAL TEST AND MONITORING BOREHOLES 5-21
TABLE 5-18: HYDROCENSUS POINTS OF SURROUNDING COMMUNITY WELLS 5-22
TABLE 5-19: PUMPING TEST RESULTS 5-26
TABLE 5-20: GROUNDWATER QUALITY RESULTS – HYDROCENSUS POINTS.....5-30
TABLE 5-21: SURFACE WATER QUALITY RESULTS SAMPLED AT LOCATIONS AS SEEN IN MAP 5-2 5-34
TABLE 5-22: ANALYTICAL RESULTS 5-40
TABLE 5-23: BASELINE NOISE MEASUREMENT SURVEY RESULTS.....5-51
TABLE 5-24: BASELINE NOISE MEASUREMENT SURVEY DETAILS AND BROADBAND RESULTS 5-51
TABLE 5-25: PRELIMINARY SHORT-TERM NOISE SAMPLING RESULTS 5-52
TABLE 5-26: LAND COVER STATISTICS FOR LIBERIA 2014/2015.....5-54
TABLE 5-27: HABITAT TYPES OF THE MATAMBO AREA 5-57
TABLE 5-28: THREATENED AVIFAUNA SPECIES OBSERVED WITHIN THE MATAMBO AREA.....5-63
TABLE 5-29: THREATENED MAMMAL SPECIES OBSERVED/ REPORTED IN THE MATAMBO AREA.....5-65
TABLE 5-30: AMPHIBIAN SPECIES AND COUNTS OBSERVED DURING THE 2021 MATAMBO BASELINE SURVEYS. 5-66
TABLE 5-31: REPTILE SPECIES OBSERVED DURING THE MATAMBO AREA BASELINE SURVEYS 5-67
TABLE 6-1: COMMUNITY PROFILE WITHIN STUDY AREA 6-2
TABLE 7-1: CRITERIA FOR ASSESSING THE SIGNIFICANCE OF IMPACTS 7-2
TABLE 7-2: SIGNIFICANCE RATING MATRIX.....7-3
TABLE 7-3: POSITIVE/ NEGATIVE MITIGATION RATINGS 7-4
TABLE 8-1: GREENHOUSE GAS EMISSIONS INVENTORY 8-10
TABLE 8-2: LIST OF RECEPTORS FOR BLASTING IMPACT.....8-14
TABLE 9-1: IFC PS6 TRIGGERS AND RELEVANT HABITATS FOR ALL CONCESSIONS (ADAPTED FROM ENVIRO-INSIGHT 2021).....9-1
TABLE 12-1: SITE SELECTION CRITERIA – KEY ASPECTS AND CONSIDERATIONS 12-2

TABLE 13-1: SUMMARY OF VARIOUS LEVELS OF STAKEHOLDER ENGAGEMENT 13-4
TABLE 13-2: NON - LOCAL STAKEHOLDERS.....13-4
TABLE 13-3: SUMMARY OF COMMUNITY THEMATIC ISSUES / CONCERNS 13-5
TABLE 13-4: SUMMARY OF STUDY-AREA STAKEHOLDER CONCERNS AND CORRESPONDINGS.....13-6
TABLE 14-1: ENVIRONMENTAL MANAGEMENT PLAN FOR THE MATAMBO OPEN PIT PROJECT.....14-17
TABLE 14-2: MONITORING PLAN FOR KEY ENVIRONMENTAL PARAMETERS 14-36
TABLE 14-3: MATAMBO MONITORING POINTS.....14-37

LIST OF MAPS

MAP 1-1: LOCATION OF THE BMMC MDA LICENCE AREA 1-10
MAP 1-2: GENERAL SITE LAYOUT 1-11
MAP 5-1: TOPOGRAPHY 5-68
MAP 5-2: 2023 SAMPLING LOCATIONS 5-69
MAP 14-1: MONITORING POINTS AT MATAMBO 14-42

LIST OF APPENDICIES

APPENDIX 1-1: ACCEPTANCE LETTER AND PROJECT BRIEF FOR THE PROJECT 1-12
APPENDIX 1-2: TEMPORARY PERMITS GRANTED 1-13
APPENDIX 1-3: EPA ACCREDITATION CERTIFICATE 1-14
APPENDIX 5-1: PUMPING TEST GRAPHS (GEOSTRATUM, 2024) 5-70
APPENDIX 5-2: RAPID ECOLOGICAL BASELINE STATUS VERIFICATION REPORT 5-75
APPENDIX 5-3: AVIFAUNA SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS MATAMBO RESOURCE AREA 5-76
APPENDIX 5-4: MAMMAL SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS THE MATAMBO RESOURCE AREA 5-78
APPENDIX 5-5: AMPHIBIAN SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS THE MATAMBO RESOURCE AREA 5-80
APPENDIX 5-6: REPTILE SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS MATAMBO RESOURCE AREA 5-81
APPENDIX 6-1: SOCIAL ECONOMIC PROFILES (PETRA 2024) 6-0
APPENDIX 6-2: SOCIAL ECONOMIC BASELINE (PETRA 2021) 6-1
APPENDIX 6-3: SOCIAL ECONOMIC BASELINE (PETRA 2024) 6-2
APPENDIX 8-1: PHYSICAL IMPACT MATRIX 8-18
APPENDIX 9-1: BIOLOGICAL IMPACT MATRIX 9-8
APPENDIX 9-2: BIODIVERSITY IMPACT ASSESSMENT 9
APPENDIX 10-1: SOCIO-ECONOMIC IMPACT MATRIX 10-5
APPENDIX 10-2: SOCIAL IMPACT ASSESSMENT REPORT (PETRA, 2024) 10-6
APPENDIX 10-3: RELOCATION ASSISTANCE PLAN (PETRA, 2024) 10-7
APPENDIX 13-1: MATAMBO STAKEHOLDER ENGAGEMENT PLAN (PETRA, 2024) 13-9
APPENDIX 13-3: MATAMBO ESIA COMMUNITY CONCERNS_ROUND1 13-10

NON-TECHNICAL SUMMARY

TABLE OF CONTENTS

0 INTRODUCTION 0-2

0.1 PROJECT FRAMEWORK 0-2
0.2 BRIEF DESCRIPTION OF PROJECT 0-2
0.3 PROJECT DEVELOPER 0-3
0.4 BASELINE DESCRIPTION 0-5
0.4.1 Pre-Mining Biological and Physical Environment 0-5
0.4.2 Pre-Mining Social Environment 0-6
0.5 STAKEHOLDER ENGAGEMENT 0-7
0.6 ENVIRONMENTAL IMPACT ASSESSMENT 0-7
0.7 SOCIAL IMPACT ASSESSMENT 0-10
0.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 0-10
0.9 RECLAMATION AND MINE CLOSURE 0-11
0.10 MONITORING PLAN 0-11
0.11 CONCLUSION 0-12

LIST OF FIGURES

FIGURE 0-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC CLASS A MINING LICENSE AREA 0-4

0 INTRODUCTION

0.1 PROJECT FRAMEWORK

Bea Mountain Mining Company (BMMC) has a Mineral Development Agreement (MDA) and holds a class A mining license issued by the Liberian Ministry of Mines and Energy (MME).

Within its MDA concession area, BMMC has identified and is intending to mine the Matambo Resource. Prior to commencing with mining, BMMC is required to obtain environmental permission from the Environment Protection Agency. The application for the environmental permit must be informed by an Environmental and Social Impact Assessment (ESIA).

ABS Africa (Pty) Ltd. (ABS Africa) and Petra Resources Inc. (Petra) are Environment Protection Agency (EPA)-accredited independent environmental consultants.

BMMC appointed ABS Africa and Petra in 2023 to undertake the required ESIA and compile an Environmental and Social Management Plan (ESMP) for the Matambo Open Pit Project (the Project). The ESIA and ESMP is undertaken in conformance with the requirements of Liberia's environmental legislative framework.

Various baseline studies, including biodiversity, natural habitat assessment, air quality and noise, blasting and vibration, soils and land capability, hydrology and hydrogeology, preliminary geochemical investigations with social surveys were conducted to inform the ESIA.

0.2 BRIEF DESCRIPTION OF PROJECT

BMMC proposes developing the Matambo Resource Area by means of establishing three open pits and associated infrastructure. The Project is approximately 95 km northwest of Monrovia.

The Mafa River system is located to the West of the Matambo site, flowing Northeast to Southwest. Communities around the area include Bangorma, Gogoima, Brown, Saanor, Yattesville, God Blessing, Kumah Sorkporjah and Massakpa 1 and 2.

The proposed development is within the boundaries of the Class A mining license. The ore mined at the open pits will be processed at NLGM, making use of the existing mining support infrastructure including the processing plant, Tailings Storage Facility (TSF), and associated infrastructure, thus reducing the capital requirements as well as the environmental and social impacts associated with the proposed development. A newly constructed 10 km haul road connects the Matambo project area to NLGM, which is 12.4 km to the southeast of Matambo. Tailings from the processing will be managed at the existing TSF at NLGM. High-grade ore will be temporarily stockpiled in the Project area and transported to the processing plant at NLGM. Low-grade ore will be stockpiled for future processing at Matambo via heap leach technology, followed by transport to NLGM for further processing.

The proposed Matambo Open Pit Mine Project (the Project) will include the following activities and infrastructure:

- Construction phase;
  - Establishing a haul road and access roads;
  - Clearance and stripping of vegetation and topsoil for development and establishment of laydown areas;
  - Stripping saprolite material from the proposed open pit area (limited blasting if required);
  - Establishing saprolite & topsoil stockpiles;
  - Crops compensation of affected communities.
  - Power supply and associated infrastructure;
  - Water supply;
  - Establishing water and waste management infrastructure;
  - Establishing ancillary facilities and buildings, such as administrative offices, camp, workshop-service buildings, warehouse, hydrocarbon storage, explosives storage; and

- Drilling of monitoring boreholes.

➲ Operational Phase

- Establishing internal roads, offices and workshop facilities;
- Development of three pits (Matambo pit 1, 2 and 3), measuring approximately 176 ha in total;
- Open pit mining which includes blasting;
- Establishing low-grade ore stockpiles;
- Establishing a Run of Mine (ROM) stockpile;
- Establishing two Waste Rock Dump (WRD) facilities;
- Pit dewatering and associated infrastructure as well as general water management facilities;
- Crops compensation of affected communities.
- Ore to be transported via the 10 km haul road to NLGM; and
- Ore to be processed at the existing NLGM processing plant.

➲ Decommissioning and Closure Phase.

- Removal of certain infrastructure;
- Removal and rehabilitation of the storm water management infrastructure;
- Treatment/removal of any contaminated soil;
- Ripping of non-backfilled infrastructural footprint areas;
- Establishment of vegetation; and
- Environmental monitoring of decommissioning activities.

0.3 PROJECT DEVELOPER

Avesoro Resources Inc. (Avesoro) is a privately-owned gold production subsidiary of Avesoro Jersey Limited. Avesoro explores for, develops, and operates gold assets in West Africa. Bea Mountain Mining Company (BMMC) is a wholly owned in-country subsidiary of Avesoro.

The BMMC-MDA concession is situated 90 km northwest of the capital, Monrovia, in Grand Cape Mount County, in the north-western portion of the Republic of Liberia.

The MDA property covers an area of approximately 537 km^2 (FIGURE 0-1).

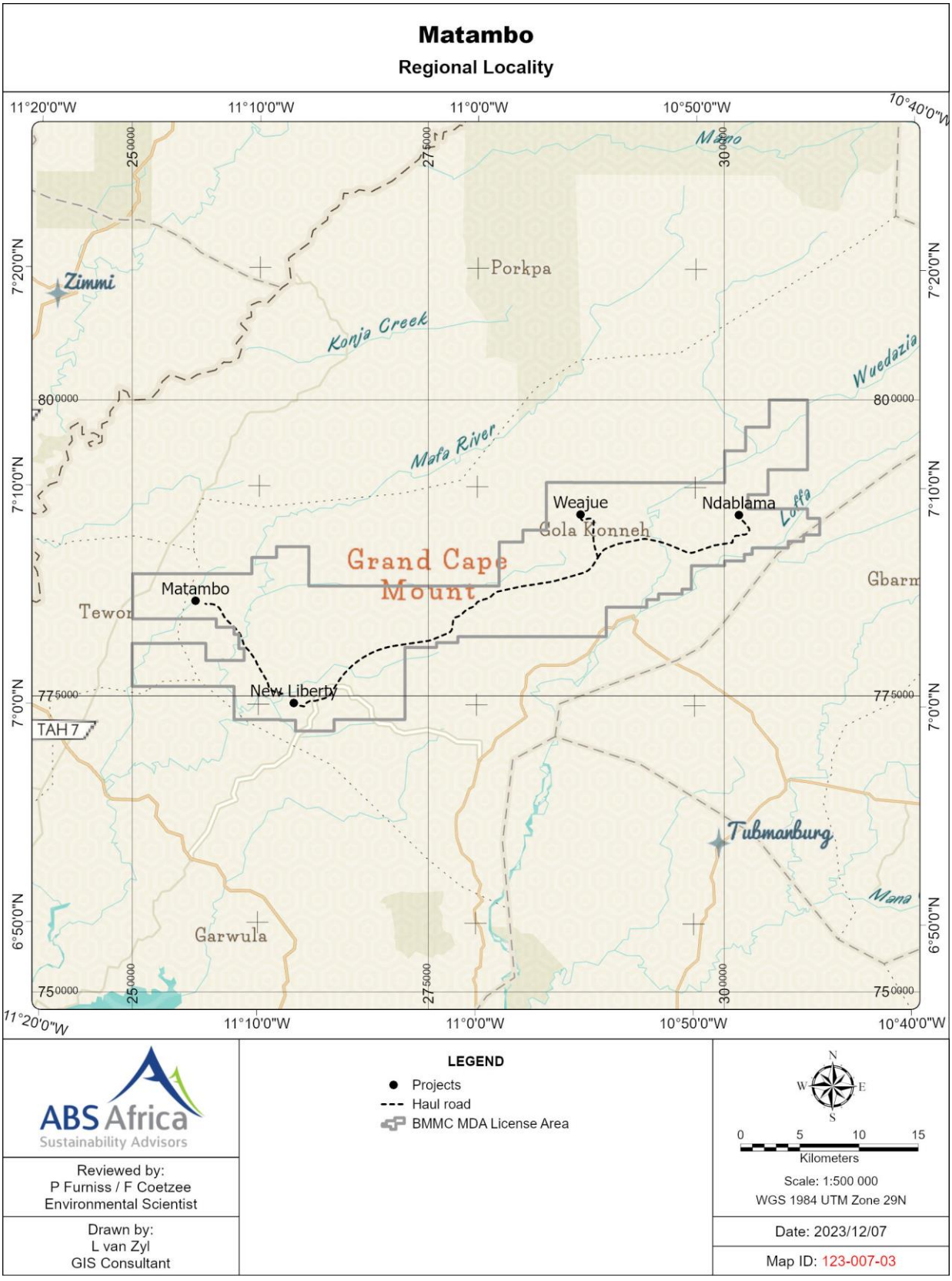


FIGURE 0-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC CLASS A MINING LICENSE AREA

0.4 BASELINE DESCRIPTION

0.4.1 PRE-MINING BIOLOGICAL AND PHYSICAL ENVIRONMENT

0.4.1.1 Pre-Mining Biological Environment

The Matambo Site forms part of the Upper Guinean forests which extend from Senegal to Togo and are regarded as one of the biodiversity hotspots of the world. Woodland savanna stretching from the Sahel to the Gulf of Guinea, known as the Dahomey gap, separates the Upper Guinean forests from the rest of the African forests and consequently, the Upper Guinean forests have a high degree of plant and animal endemism.

A comprehensive baseline assessment of biodiversity aspects was undertaken for the Matambo Exploration area in 2021. The information from 2021 was augmented for this ESIA through a biodiversity verification survey at the proposed Matambo Open Pit Mine Project area, undertaken in the last quarter of 2023.

Five main habitat types were delineated for the pre-developed Matambo development site:

- Hillslope Forest;
- Lowland Forest
- Secondary and Pioneer Forest / Thicket
- Azonal Riparian Forest; and
- Azonal Swamp Vegetation.

Where these habitat types remain intact and relatively untransformed, several plant and animal species are expected to occur.

Although not specifically observed within the Matambo Open Pit Mine Project area during the rapid verification survey, the following biodiversity summary is relevant to the broader area (Matambo Exploration Area):

- Approximately 254 bird species are expected to occur in the Broader Matambo Exploration Area. Of the 254 bird species expected to be present, 143 (56 %) are restricted (endemic) to the Guinea-Congolian forest block. In addition, 78 % of Guinea-Congolian forest endemics in Liberia (c. 184 species) could also be present in the Broader Matambo Exploration Area. Of these, 128 species were confirmed in the Broader Matambo Exploration Area during the surveys;
- Based on habitat suitability and the six years of previous records within the region, an estimated 142 mammal species may be expected to occur within the Matambo Exploration area (APPE). During the 2021 study, a total of 29 species were observed, representing 20% of the expected species respectively.
- A total of 34 amphibian species were observed across all baseline surveys in the Matambo Exploration Area. This represents remarkably high species richness, comprising 58% of the 59 species expected within the region attributed to the diversity of habitats and presence of pristine habitats in place within the Matambo Exploration Area.
- A total of 21 reptile species, comprising 10 snakes and 11 lizards, were observed across all baseline surveys in the Matambo Exploration Area. This represents a moderately high species richness and makes up 21% of the 100 species expected within the region.

0.4.1.2 Pre-Mining Physical Environment

Climate

The movement of the Inter Tropical Front (ITF) is largely responsible for the climate of West Africa, and therefore Liberia. The ITF is formed by the meeting of the hot, dry Tropical Continental Air Mass over the Sahara and the cool, moist Equatorial Maritime Air Mass over the equator. The interface plane between these two air masses is known as the frontal surface. During the Liberian dry season (October to March), a low-pressure belt builds up over Southern Africa and a high-pressure belt builds up over North Africa resulting in a north-eastern wind known as the Harmattan. The Harmattan is a dry, hot and often dust laden wind, which can be seen as the manifestation of the Tropical Continental Air Mass. Conversely, during the Liberian wet season (April to September), a low-pressure belt builds up over the Sahara and a high-pressure belt builds up over Southern Africa resulting in the south-west monsoon winds, which can be seen as the manifestation of the Equatorial Maritime Air Mass.

There is very little variation in the diurnal wind field. During both daytime and night-time conditions, the wind field is mostly from the southwestern sector with an average wind speed of 1.9 m/s and 25% calm conditions (wind speeds < 0.5m/s). During the day higher wind speeds were observed compared to during the night, but a higher frequency of calms also occurs during the day. Most high wind speed episodes (wind speeds >5 m/s) occurred during the day.

Geology

Geologically, the lithologies underlying Matambo consist of a sequence of highly deformed granitic gneisses into which sequences of ultramafic schists have been folded. Most of the felsic gneisses are strongly foliated and layered, and their structural relationship with intercalated iron-formations, quartzite, schist, and amphibolite is highly suggestive that the gneisses are metasedimentary. Granite dykes (aplitic to pegmatite) intrude the schist.

The baseline aquifer data were obtained from the MBH test boreholes at Matambo Project Area, as well as similar studies at the New Liberty Gold Mine (NLGM) property. The two hydrogeological units and aquifers features are weathered hydrogeological unit and fractured rock hydrogeological unit.

Soils and Land Capabilities

Four dominant soils were identified in the area, namely Leptosols, Cambisols, Ferralsols and Luvisols/Fluvisols. The land capability rating ranges from moderate to low palatable grazing lands on the lower lying gently undulating to hilly landforms Haplic Alisols and Cambisols, to rough grazing and/or wilderness land on all of the steeper and shallow rooting soils associated with the Lithic Leptosols and Regosols. In general, the soils associated with the more hilly terrain and metasediments are too shallow and the slopes overly steep for any form of arable cultivation other than possibly commercial forestry. Soils with greater than 400 mm of rooting depth are for the most part restrictive to cultivation due to soil water holding capability and effective rooting depth, while any slope over 12% is considered too steep for any form of cultivation.

Air Quality

There are limited local sources that are expected to contribute to pollutant concentrations in the region. Local sources of fugitive dust and gaseous emissions include chainsaw logging activities, bush clearing (burning), subsistence farming, charcoal making, small-scale livestock farming, wildfires, vehicle activity on unpaved roads and small-scale artisanal mining activities. Household fuel burning and possibly refuse burning also constitutes a significant local source of low-level emissions.

Noise

Day- and night-time baseline (pre-mining) noise measurements were conducted in August 2021 (Grobler, 2021) at four villages (Bangorma, Kumah Sorkporjah, Masakpa and Gogoima). The acoustic climate at NRs is currently affected by community activities, generators, vehicle traffic, domesticated animals as well as natural noises such as birds and insects. Recorded LAeq,d were below the Liberian noise limits at sites 1, 6 and 7, and slightly exceeded the 55 dBA level at site 4 (Korma Sorkpoja), mainly due to natural and community noise. Because of community and natural noise (such as birds and insects), night-time noise levels were significantly higher than the Liberian limit for residential locations (35 dBA), and slightly higher than the limit for mixed-use residential areas (45 dBA).

0.4.2 PRE-MINING SOCIAL ENVIRONMENT

Socio-economic baseline studies were conducted in the broader area by Petra Resources in 2021 with more focussed baseline surveys undertaken in 2023 and 2024 as part of this ESIA.

The broader Matambo area is densely inhabited with much of the cleared land currently used for mining activities. Recent years have witnessed an increase in the alluvial mining activities – especially with the use of earth moving equipment. This scale-up and use of equipment has further contributed to the surge of people moving into the area. Apart from the few subsistence farms identified and the widespread alluvial mining, no other major forms of livelihood have been identified.

The 2023 field assessment identified ten (10) communities in the surrounding area, namely:

- Bangorma Town;
- Brown Village;
- God Blessing Village;
- Gogoima Community;
- Kumah Sorkporjah
- Massakpa_01;
- Massakpa_02;
- Saanor Village;
- Yattesville Village; and
- Victoria Village.

According to the 2024 study, Victoria Village is an abandoned village. The average population of 9 communities combined are approximately 8 884. Bangorma was identified as the largest community with a population of about 4 300, comprising of mostly children. The second largest community identified was Kumah Sorkporjah, with a population of approximately 1 615 people, with most of the population identified as children. The smallest community is God Blessing Village with a population of 19, mostly comprising of men. Most communities in the area are old, established towns. These communities are all between 63 and 250 years old, with the exception of God Blessing Village, which was identified to be about 4 years old.

0.5 STAKEHOLDER ENGAGEMENT

As part of the consultation process conducted for the Project, stakeholder engagement was undertaken as part of the ESIA process. The consultation exercise was conducted to support the wider environmental and social impact assessment (ESIA) in keeping with national regulations. The Social Impact Assessment (SIA) and stakeholder engagement was undertaken by Petra in 2023 and 2024. Three rounds of stakeholder engagement were undertaken (30 November 2023, 25 January 2024 and 31 January 2024).

The Stakeholder's Engagement Plan (SEP) for the Project is aligned with the national statues and guidelines including the Revised 2022 Environmental and Social Impact Assessment Guidelines issued by the EPA.

The process was to ensure that as many as possible stakeholders across the project landscape could be engaged at multiple levels. Engaging stakeholders involved capturing their interests, concerns as well as support for the project implementation including managing expectations at all levels.

A total of 9 communities totalling 297 individuals participated in the engagements and discussions. During the engagements the project design, impacts from specialists' studies were presented to the participants.

0.6 ENVIRONMENTAL IMPACT ASSESSMENT

Groundwater Impact

During the risk assessment the risk to the groundwater levels and quality were evaluated.

- During the construction phase:
  - Potential groundwater impacts such as small-scale dewatering during overburden removal, would be minor with the correct water management measures. Potential risks are of low significance, and no environmental receptors or community water points are foreseen to be impacted on.
- During the Operational phase:
  - Groundwater drawdown cones would develop because of open pit dewatering. Based on the distance to village wells (except Bangorma) and the short duration of mining (3 years), it is unlikely that mine dewatering would have an impact on the community wells. The potential impact on community wells at Bangorma will be mitigated by the relocation process.

- Mine contact water could have elevated salt and metal concentrations compared to water use/discharge guidelines due to hydro-geochemical reactions and/or leaching of constituents from exposed rock material. With the correct management measures, the impact could be of ***Low*** to ***Low-Medium*** significance.
- Waste rock dumps and ore stockpiles could be long-term and short-term contaminant sources of groundwater respectively. Leachate from these material types could generate site specific groundwater contaminant plumes. The groundwater quality risk will be over a small area (site specific) and it is not expected that the contaminant plumes will reach community water supply points during the operational phase.

- Long term Post-Closure phase:
  - Pit-lakes will develop in all mined-out pits after cessation of dewatering activities. Surface decant or pit overflow could take place at the 3 Matambo pits, with water flowing into the Matambo River system. The exposed part of the flooded pit will contain saprolitic rock. This material does not normally pose a significant contaminant risk and with the high surface runoff it is not expected to have a material impact on stream water quality The impact on the Matambo River quality is likely to be acceptable in terms of international and local water quality standards.
  - Ongoing subsurface infiltration of leachate from the waste rock dumps could generate a long-term groundwater contaminant plume downgradient from these facilities. Rehabilitation of the waste rock dumps with a topsoil and saprolite cover is advisable to ensure noncontact surface runoff.
  - No community wells are likely to be impacted.

Surface Water Impact

Based on the proposed project activities, the following potential impacts to surface water were identified:

- Minor decrease is expected to site surface water quantity for both the SW-East and SW-West CMA's
- Minor reduction to flood peaks and volumes with an average of roughly 5% reduction,[1]
- Slightly reduced mean annual runoff (MAR).

Soils and Lang Capability Impact

The soils associated with the areas that are to be disturbed by the mining and its associated activities are rated as moderately sensitive to non-sensitive in nature and will be moderately easy to work on and with. Un-managed soil stockpiles and soil that is left uncovered/unprotected (cleared areas etc.) will be lost to wind and possibly water erosion, loss of nutrient store and inherent fertility, and exposure to compaction. The construction of the mining infrastructure and its support activities will, if un-managed and without mitigation have a variance of impacts based on the duration and spatial extent/scale of the disturbance planned. The impacts will include:

- A impact on the environment due to the loss of the soil area and the ecosystem services (use of soils for food production etc.) on the activities associated with the permanent infrastructure (WRD and Open Pit Mining);
- A definite medium negative impact on the environment due to the loss of the soils and ecosystem services on the activities associated with the support infrastructure as listed. These activities are considered medium or Low negative but reversable;
- A definite medium or high negative impact due to contamination (hydrocarbon and reagent chemical spills, raw materials and spillage of the raw product), compaction of working/laydown areas and storage facility footprint areas and the potential for erosion (wind and water – dust and suspended solids) over unprotected areas;
- The continuation of impacts throughout the construction phase and into the operational phase, and
- The impacts being confined to the site.

[1] Peens and Associates – Matambo Surface Water Quantity Assessment 2024

With the management procedures, the significance of the impacts will likely reduce to *Medium* or *Low* in the medium term for all areas other than the Open Pits and WRD. These features will remain at a *Medium* to *High* significance rating.

Air Quality Impact and Greenhouse Gas Emissions

A greenhouse gas emissions inventory was compiled for the proposed Matambo Project operations. The total annual average GHG emissions (tCO_2eq) is calculated to be 63 967 kg.

Dispersion modelling simulations indicate that simulated concentrations of all pollutants were well below the WHO Air Quality Guidelines at all sensitive receptor locations surrounding the mining operations at the Matambo 2 and Matambo 3 open pits. Simulated daily and annual average PM10, PM2.5 and NO_2 concentrations could exceed the WHO AQGs, as well as the WHO interim targets for these pollutants, at Bangorma when mining activities are undertaken at the Matambo 1 pit (if the residents of Bangorma are not relocated). It is recommended that no mining, stockpiling or hauling activities be undertaken within 250 m of residential locations to avoid exceedances of the WHO AQGs at such locations. Simulated concentrations of all pollutants were below the WHO AQGs at the proposed accommodation camp location and the proposed relocation site. Simulated dust fallout could exceed the chosen assessment level of 600 mg/m²/day at Bangorma when mining is undertaken at the Matambo 1 pit. Simulated SO_2 and CO concentrations are well below the WHO AQGs for the entire study area.

Noise Impact

The propagation of noise generated during the operational phase was calculated with CadnaA in accordance with ISO 9613. Meteorological and site-specific acoustic parameters along with source data were applied in the model.

Results for all the operations:

- The simulated equivalent continuous day-time rating level ($L_{Req,d}$) of 55 dBA (Liberian noise guideline level) extends for approximately 700 m around the perimeter of the mining areas, with possible exceedances of the 55 dBA level at the accommodation camp and the village of Bangorma (if the residents of Bangorma are not relocated).
- Measured baseline night-time noise levels already exceed 45 dBA (Liberian noise guideline level) at all four sampling locations, and mining activities will result in increased noise levels, with cumulative levels of 50 dBA simulated up to 1700 m from the operations and exceedances of 55 dBA during the night simulated at up to 1000 m from the operations.
- An increase of 3 dBA above the baseline up to approximately 1000 m from the mining operations during the day and 1700 m from the mining operations during the night is possible, which means that noise sources at the Matambo Project might be audible at Gogoima, Masakpolor, Korma Sorkpoja, Bangoma and the accommodation camp, but according to the SANS 10103 ratings, are only expected to be disturbing to the residents of Bangorma and the accommodation camp, and possibly to the residents of Masakpolor and Gogoima during the night.
- The accommodation camp is expected to be mostly vacant during times when the mine is operational during the day, but it is recommended that the residents of Bangorma be relocated prior to the commencement of mining operations at the Matambo 1 open pit.

The overall significance of construction and decommissioning phase noise impacts on nearby NSRs is considered *Very Low* negative if the residents of Bangorma are relocated and mining activities are limited to the daytime. No noise impacts are expected post-closure.

Blasting Impact

The impacts assessed are for the planned blasting activities during the operational phases of the Matambo Mine Project where blasting activity will be undertaken in three separate open pits. Possible impacts are assigned to Ground Vibration, Fly Rock and Air Blast:

- **Ground vibration** impact on local communities and artisanal workings within 250 m of the blast area. The communities of concern are well outside the limiting criteria of ground vibration induced damage to buildings (12.7 mm/s) and outside the limit of concern for people inside the buildings (5 mm/s).

- **Fly Rock**. The range is dependent on stemming length. There is a risk that fly rock could reach parts of Masakpa and the peripheries of Bangorma. Unmitigated blasting measures will pose a significant risk to people, buildings and structures within the development footprint. When mitigated, fly rock will be limited to within a few tens of metres from the blasts and will only impact the HME workshop, fuel farm and other mine structures that are closer than 500 m from blasting.
- **Air Blast**. The unmitigated zone of influence for air blast will affect most of the nearby communities. The range of influence will depend on the wind direction and velocity. As each blast will be small, the impact will be limited, and it will only occur over a brief time. Once blasting migrates deeper into the mine, the impacts on surface of air blast, dust and fumes will disappear to insignificant levels.

0.7 SOCIAL IMPACT ASSESSMENT

The findings of the SIA indicate that the construction and the operation of the proposed Matambo Open Pit Gold Mine have both positive and negative impacts. Positive impacts are mainly due to creation of employment opportunities, boosting of the local economy due to increased disposal income and contribution to the overall national revenue of Liberia which ultimately may lead to improved quality of life.

On the contrary, negative impacts may be experienced due to migration of job seekers into the Project area and surrounding towns and village; damage to property and infrastructure because of mining activities; decline in the quality of life due to air, noise, land and water pollution and increased traffic.

A significant proportion of the population of the Project area is resident in Bangorma Town which has a population of 4 300 residents.

The clinic in Bangorma Town operates in a catchment network, servicing nearly 12 communities within and around the Project area. Ensuring continual access to this social service is critical to improving the health access to residents in the Project area.

Given this backdrop, the mine offers an opportunity to contribute to the overall improvement of the socio-economic status of Matambo Corridor. Striking a balance between economic, social, and environmental conservation is often challenging considering the numerous stakeholders and differing motives. A healthy competitive environment needs to be established for the opposing land uses such as mining, agriculture, and human settlement.

To this BMMC is committed to a full-scale rehabilitation of the Project area; a detailed rehabilitation plan is presented in the overall Project closure management plan; these commitments as well as supporting the communities through direct Project initiatives are strong ethical foundations to which BMMC is committed to.

In addressing the negative impacts, the social impact study outlines the following solutions:

- Upgrading and maintenance of the public road network to pre – construction status or better.
- Increasing the level of higher skilled local employees.
- Expanding the domestic water point sources.
- Establishing mining supplier parks to enhance enterprise development in the Project communities.
- Resolving land claims to improve economic growth and improve living conditions.
- Providing comprehensive support to corporate social contributions initiatives so that Project communities can directly benefit from corridor development programs.

0.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

In response to issues and potential impacts identified in the impact assessment phase, BMMC has designed and will implement a variety of mitigation measures to reduce, minimise, or eliminate adverse effects that could result from development of the proposed Project. Mitigation measures that will be implemented during construction, operation and closure of the Project are described herein.

In general, the mitigation measures proposed in this report are designed to:

- Reduce or eliminate the adverse effect through life of mine (LOM) planning and engineering design wherever possible.
- Minimise adverse effects by limiting the degree or magnitude of the action and its resulting effects.
- Remedy the adverse effect by rehabilitating the affected environment.
- Develop and implement environmental and social management plans to manage, monitor and review adverse effects.
- Develop and implement social management plans to enhance positive social impacts (e.g., employment).
- Compensate for the adverse effect by replacing or providing substitute resources or environments.

Monitoring measures will be used to ensure that actions taken are effective in ameliorating both foreseen and unforeseen effects. In addition to describing specific actions to mitigate potential effects, the overall philosophy of BMMC is described herein with respect to its obligations to minimise and mitigate adverse effects on the environment within the Project area.

Mitigation actions presented in the ESIA Report represent BMMC obligations to be a good steward of the environment and a good neighbour in the communities in which it operates. Methods of measuring the degree of success that BMMC achieves in meeting these responsibilities are described in subsequent sections of this ESIA.

The ESMP for the Project has been compiled in line with the requirements of the relevant legislation of Liberia.

0.9 RECLAMATION AND MINE CLOSURE

BMMC objective for the rehabilitation and closure of the mine is to ensure that the site is left in a condition that is safe and stable where long-term environmental impacts are minimized and any future liability to the community and future land use restrictions are minimized. The final post-mining land use will be determined in consultation with the local communities, Ministry of Mines and Energy as well as other departments responsible for environmental and social aspects. The likely land uses to be identified during this process are expected to include:

- Areas for agriculture;
- Areas livestock grazing; and
- Wildlife habitat.

For health and safety reasons as well as the protection of specific rehabilitations works, specific areas within the mine lease may be designated as exclusion zones. Natural soil covers and vegetation will as far as possible be re-established over these areas but access by humans and / or livestock will be prohibited.

0.10 MONITORING PLAN

Environmental and social monitoring will be used to determine the impact and change of the environment as a result of site activities. A budget will be provided for monitoring and maintenance of vegetation establishment as well as for wastewater treatment and environmental monitoring after closure of the site.

Environmental monitoring data (surface and groundwater, air quality, noise, soils, etc.) will be collected and analysed, and monitoring reports will be compiled for a period of 3 years covering:

- the phase of dismantling and reclamation of the Project; and
- the completion of the decommissioning and
- closure phase.

The following registers will be maintained:

- Project permits and licenses;
- EIA and ESMP;
- All matters related to compliance monitoring, environmental performance and ESMP implementation;

- HSE attendance records and HSE training material;
- A list of all persons receiving job-related training;
- Environmental monitoring and verification data / reports and results of inspections performed;
- Copies of all written ESMP instructions / approvals / exemptions issued to contractors;
- The approved method statements and codes of practice for specific activities and facilities;
- Waste management files;
- Maintenance records of vehicles and equipment;
- Maintenance and inspection of all safety equipment, e.g. fire extinguishers;
- Photographic documents of the development and restoration of the site;
- A properly completed and signed environmental incident / non-compliance report for each incident or environmental non-compliance reported;
- An up-to-date register of external communications;
- Completed and updated form and register of complaints and external grievances for each external complaint received;
- A register of contacts in case of emergency; and
- A register of dangerous substances and the associated Material Safety Data Sheets.

0.11 CONCLUSION

The Matambo Project ESIA has considered the proposed development of the Project infrastructure components against the relevant biophysical, social and economic aspects, as well as the relevant Liberian legislative requirements.

None of the impacts identified in the ESIA are considered to be fatal flaws. Establishment of site procedures and the implementation of the mitigation measures described in the Environmental and Social Management Plan, including a commitment to the regular updating and review of the risks and impacts which the development poses to the receiving environment, will be important to ensure the environmental performance of the Matambo Project. In conclusion, from an environmental and social perspective it is considered that the proposed development can proceed, provided that the relevant environmental and social mitigation and management measures are implemented.

CHAPTER 1
INTRODUCTION AND BACKGROUND

TABLE OF CONTENTS

1 INTRODUCTION 1-1

1.1 PROJECT FRAMEWORK 1-1
1.2 BRIEF DESCRIPTION OF PROJECT 1-3
1.3 PROJECT DEVELOPER 1-4
1.4 PROJECT AREA OF INFLUENCE 1-4
1.5 AUTHOR OF REPORT 1-8
1.6 STUDY STRATEGY 1-8
1.6.1 Report Format 1-8
1.6.2 ESIA Approach 1-8
1.6.3 Specialist Studies Associated With The ESIA 1-9

LIST OF FIGURES

FIGURE 1-1: LOCALITY OF THE Matambo RESOURCE AREA IN RELATION TO THE BMMC CLASS A MINING LICENSE AREA 1-2
FIGURE 1-2: WATERSHED/CATCHMENT AREA OF INFLUENCE 1-6
FIGURE 1-3: ZONE OF INFLUENCE 1-7

LIST OF TABLES

TABLE 1-1: DETAILS OF THE DEVELOPER 1-4
TABLE 1-2: PROJECT ZONE OF INFLUENCE ASSOCIATED WITH THE PROPOSED DEVELOPMENT 1-5

LIST OF MAPS

MAP 1-1: LOCATION OF THE BMMC MDA LICENCE AREA 1-10
MAP 1-2: GENERAL SITE LAYOUT 1-11

LIST OF APPENDICES

APPENDIX 1-1: ACCEPTANCE LETTER AND PROJECT BRIEF FOR THE PROJECT 1-12
APPENDIX 1-2: TEMPORARY PERMITS GRANTED 1-13
APPENDIX 1-3: EPA ACCREDITATION CERTIFICATE 1-14

1 INTRODUCTION

ABS Africa (Pty) Ltd. (ABS Africa) and Petra Resources Inc. (Petra) were appointed in 2023 to undertake an Environmental and Social Impact Assessment (ESIA) and an Environmental and Social Management Plan (ESMP) for the Matambo Open Pit Project (the Project). ABS Africa received EPA accreditation (APPENDIX 1-3) for this project in November 2023 (EPA/AC-007/1123)

This document describes the project and the Environmental and Social Impacts associated with the project, as well as the Environmental and Social Management Measures that must be implemented to mitigate the impacts associated with the project.

1.1 PROJECT FRAMEWORK

Avesoro Resources Inc. (Avesoro) is a privately-owned gold company subsidiary of Avesoro Jersey Limited. Avesoro explores for, develops, and operates gold assets in West Africa. The company primarily owns interests in the New Liberty Gold Mine (NLGM) located in Liberia.

Bea Mountain Mining Company (BMMC) is a wholly owned in-country subsidiary of Avesoro. BMMC signed a Mineral Development Agreement (MDA) with the Government of the Republic of Liberia on 28 November 2001 to conduct exploration for gold within the MDA area boundary for a period of 25 years, with an option to extend this term for additional terms of 25 years. The parties entered the Restated and Amended Mineral Development Agreement on 7 September 2013 and the first amendment to the Restated and Amended Mineral Development Agreement was approved by the President of the Republic of Liberia on 14 September 2023 for 25 years commencing from the first Amendment Effective Date. BMMC hold a class A mining license for the MDA area, which was issued by the Liberian Ministry of Mines and Energy (MME) on 29 July 2009 and amended on October 23, 2023. The entire MDA property covers an area of 537 km^2. (FIGURE 1-1).

The proposed project requires environmental authorisation in terms of the Environmental Protection and Management Law (EPML). A permit process for a private haul road required for the transport of the ore to NLGM was already completed and the environmental permit was issued on 6th of March 2022 valid 2 years (permit number: EPA/EP/PB/001-0322) (APPENDIX 1-2). A project brief for the proposed project have been submitted on 15 November 2023. A Notice of Intent (NOI) for the project was undertaken and submitted to the EPA on 15 November 2023 in line with the EPA 2021 ESIA regulations.

Since the submission of the November project brief, exploration drilling led to the addition of another small pit (to the far west) and support infrastructure to the proposed layout, therefore an updated project brief was submitted to the Environmental Protection Agency (EPA) on 12 December 2023.

The EPA granted the following temporary environmental permits (APPENDIX 1-2) for:

- Preparatory Works for the Construction of Housing Units and Fabricated Buildings & Mine Camps & an Explosive Magazine (EPA/TSR/TEMP.EP/001-1023);
- Saprolite Removal to Access Base Rock Ores and Stockpiling of Topsoil and Saprolite (EPA/TSR/TEMP.EP/002-1023).

On the basis of the abovementioned permits issued, BMMC proceeded with the development and construction of the housing units, fabricated buildings and mine camps, establishing access roads, the removal of saprolite and stockpiling of topsoil.

A letter from the Republic of Liberia, EPA accepting the NOI for the Project of the Bea Mountain Mining Corporation and acknowledging the development of the full ESIA can be found in APPENDIX 1-1. The full ESIA as well as the EMP is undertaken by ABS Africa and Petra. It is aligned with the requirements of Liberia's environmental legislative framework.

Various baseline studies, including biodiversity, critical habitat assessment, preliminary geochemical investigations, air quality and noise, blasting and vibration, soils and land capability, hydrology and hydrogeology, with separate social surveys were conducted in 2020 and updated in 2023. These studies will be used to inform the ESIA.

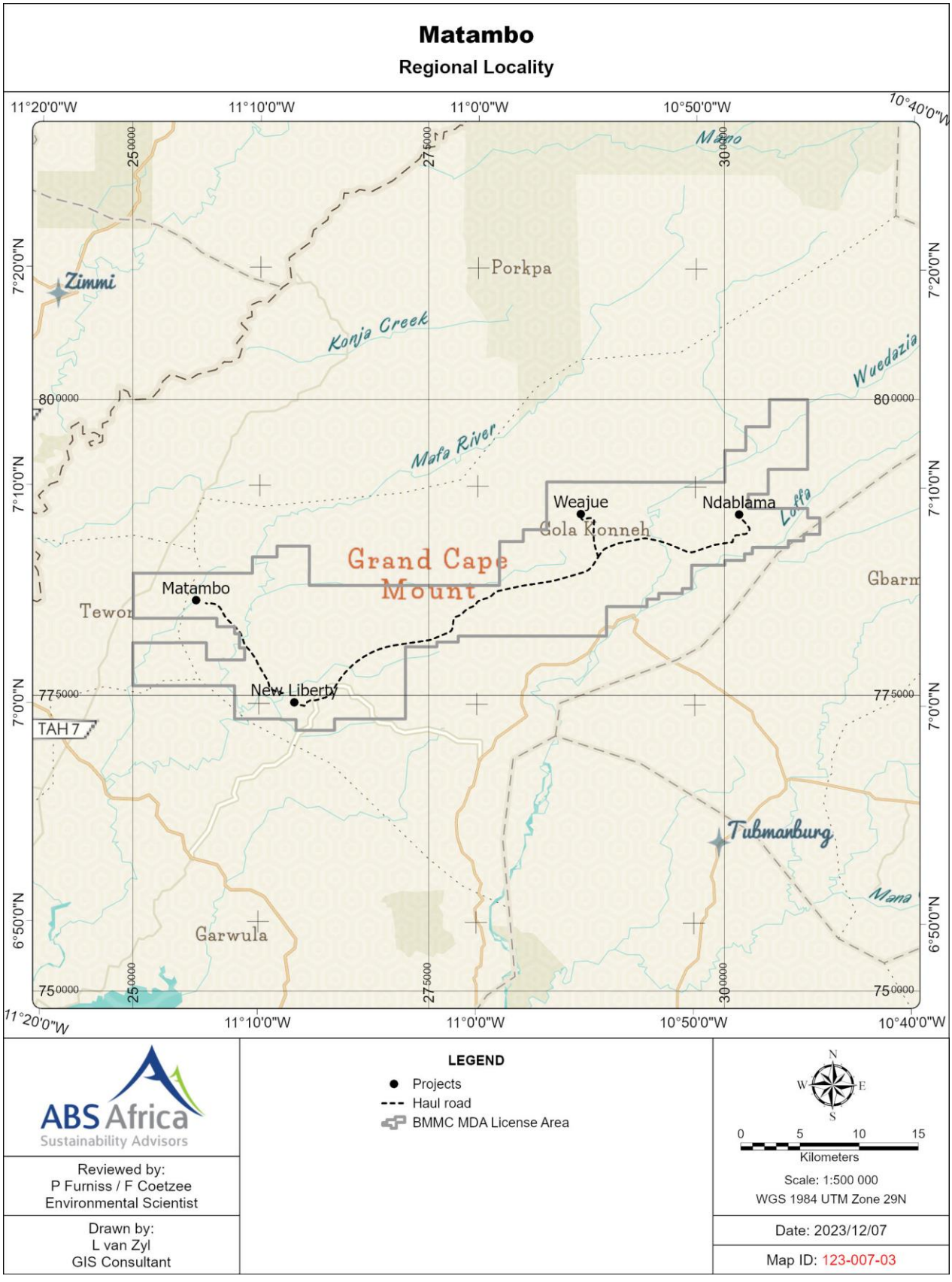


FIGURE 1-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC CLASS A MINING LICENSE AREA

1.2 BRIEF DESCRIPTION OF PROJECT

The Project is located within the Grand Cape Mount County of Liberia, situated within the greater Bea Mountain Mining Corporation Mineral Development Agreement (BMMC-MDA) property/concession area. A small portion of the greater Bea Mountain Mineral Development Agreement intersects the Gbarpolu County, but no infrastructure is planned in the Gbarpolu County for this Project. The Project is approximately 95 km northwest as the crow flies from the capital, Monrovia. The Mafa River system is located to the West of the Matambo site, flowing Northeast to Southwest.

The proposed development is within the boundaries of the Class A mining license. The ore mined at the open pits will be processed at NLGM, making use of the existing mining support infrastructure including the processing plant, Tailings Storage Facility (TSF), and associated infrastructure, thus reducing the capital requirements as well as the environmental and social impacts associated with the proposed development. A newly constructed 10 km haul road connects the Matambo resource area to NLGM, which is 12.4 km to the southeast of Matambo. Tailings from the processing will be managed at the existing TSF at NLGM. High-grade ore will be temporarily stockpiled in the Project area and transported to the processing plant at NLGM. Low-grade ore will be stockpiled for future processing at Matambo via heap leach technology, followed by transport to NLGM for further processing.

The key phases associated with the proposed Project will include:

- Construction phase;
  - Establishing a haul road and access roads;
  - Clearance and stripping of vegetation and topsoil for development and establishment of laydown areas;
  - Stripping saprolite material from the proposed open pit area (limited blasting if required);
  - Establishing topsoil stockpiles;
  - Power supply and associated infrastructure;
  - Water supply;
  - Establishing water and waste management infrastructure;
  - Establishing ancillary facilities and buildings, such as administrative offices, camp, workshop-service buildings, warehouse, hydrocarbon storage, explosives storage; and
  - Drilling of monitoring boreholes.
- Operational Phase; and
  - Establishing internal roads, offices and workshop facilities;
  - Development of three pits (Matambo pit 1, 2 and 3), measuring approximately 176 ha in total;
  - Open pit mining which includes blasting;
  - Establishing low-grade ore stockpiles;
  - Establishing a Run of Mine (ROM) stockpile;
  - Establishing two Waste Rock Dump (WRD) facilities;
  - Pit dewatering and associated infrastructure as well as general water management facilities;
  - Crops compensation of affected communities.
  - Ore to be transported via the 10 km haul road to NLGM; and
  - Ore to be processed at the existing NLGM processing plant.
- Decommissioning and Closure Phase.
  - Removal of certain infrastructure;
  - Removal and rehabilitation of the storm water management infrastructure;

- Treatment/removal of any contaminated soil;
- Ripping of non-backfilled infrastructural footprint areas;
- Establishment of vegetation; and
- Environmental monitoring of decommissioning activities

Mining will be undertaken by conventional drilling, blasting, excavating, and road haulage. After selective blasting within the planned open pits, the blasted ore and waste rock will be loaded onto trucks using excavators. Blasting operations are planned to commence at Matambo pit 3 and Matambo pit 2 first before continuing to Matambo Pit 1 after May 2024. The high-grade ore will be stockpiled temporarily and then transported to the existing NLGM processing plant (MAP 1-2).

Low-grade ore will be stockpiled separately for further processing at Matambo via a cyanidation and activated carbon Heap Leach Process at a later stage. The absorbed gold from this process will then be transported to NLGM for further processing. The pits will be mined in approximately 3 years.

1.3 PROJECT DEVELOPER

Avesoro explores for, develops, and operates gold assets in West Africa. The company primarily owns interest in the New Liberty Gold Mine, Ndablama Gold Mine and Weajue Underground Mine located in Liberia. Avesoro is a subsidiary of Avesoro Jersey Limited.

BMMC is a wholly owned subsidiary of Avesoro and is operating the NLGM in Kinjor, Grand Cape Mount County, which is approximately 90 km west of Monrovia, the Capital of Liberia. BMMC acquired a Mineral Development Agreement (MDA) in 2001, and this agreement was renewed in 2013 and then amended in 2023. The MDA property covers an area of approximately 537 km^2.

The details of the developer are provided in TABLE 1-1.

TABLE 1-1: DETAILS OF THE DEVELOPER

COMPANY NAME	Bea Mountain Mining Corporation
PHONE NUMBER	+231 886 533 039
ADDRESS	1st Floor Suites 101 & 105, Rose Garden Plaza, Crown Hill, Broad Street, Monrovia, Liberia
REPRESENTATIVE	Debar Allen
E-MAIL	Debar.allen@avesoro.com

1.4 PROJECT AREA OF INFLUENCE

The proposed development associated with the study include the following key development aspects that formed part of the Environmental and Social Impact Assessment:

- The area of influence is defined as the area likely to be affected by:
  - the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;
  - impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or
  - impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

The area of influence associated with the project ESIA is presented TABLE 1-2, FIGURE 1-2 and FIGURE 1-3.

TABLE 1-2: PROJECT ZONE OF INFLUENCE ASSOCIATED WITH THE PROPOSED DEVELOPMENT

ASPECT	DESCRIPTION
PROJECT SITE (DIRECT)	The Project site is limited to the proposed development footprint that includes all the aspects associated with the project. The Project sites mostly refer to the main mining area (Open Pits, WRDs and Stockpiles).
BLASTING (DIRECT)	The blasting influence zone is comprised of the proposed pit development footprint as well as the surrounding sensitive community receptors withing various blasting zones: Vibration zone- 12.7mm/s using 102 mm holes, Vibration zone - 12.7 mm/s using 115 mm holes. Fly rock zone, at 500 m.
AIRSHED (INDIRECT)	The airshed zone takes into consideration the proposed development footprint as well as the surrounding sensitive community receptors that may potentially be affected by the various emissions associated with the proposed development. These include NO_2, SO_2, dust fall, PM10, PM2.5 etc. The area of influence is limited to the project site and immediately surrounding areas (FIGURE 1-3).
NOISE (INDIRECT)	The noise influence zone is comprised of the proposed development footprint as well as the surrounding sensitive community receptors likely to be affected by the resulting noise produce from the development. The maximum permissible noise and vibration levels for the general environment includes a day-time limit of 70 dBA and a night-time limit of 60 dBA.
HAUL ROAD (DIRECT & INDIRECT)	The Haul Road influence zone is comprised of the surrounding sensitive community receptors likely to be affected by the road usage and indirect emissions associated with noise emissions, air emissions and social impacts, respectively.
WATERSHED (INDIRECT)	The area of influence associated with the proposed development is comprised of the catchment from the mine sites and haul road to the Matambo, Mafa and local rivers (FIGURE 1-2).
SOCIO-ECONOMIC AREA OF INFLUENCE (INDIRECT)	The socio-economic area of influence associated with the proposed development include 9 communities with in the direct and/or indirect impact vicinity of the project footprint: ➲ Bangoma Town; ➲ Brown Village; ➲ Yattesville Village; ➲ Saanor Village; ➲ Gogoima Town; ➲ Gbassa Korma; ➲ Korma Sorkporjah; ➲ Massakpa (1 and 2); and ➲ God Blessing Village.
TERRESTRIAL, AQUATIC ECOLOGY AND ECOSYSTEM SERVICES (INDIRECT)	The area of influence is limited to the immediate project footprint as well as the Mafa River and tributaries and associated the wetlands as well as related sensitive ecological and ecosystem services.

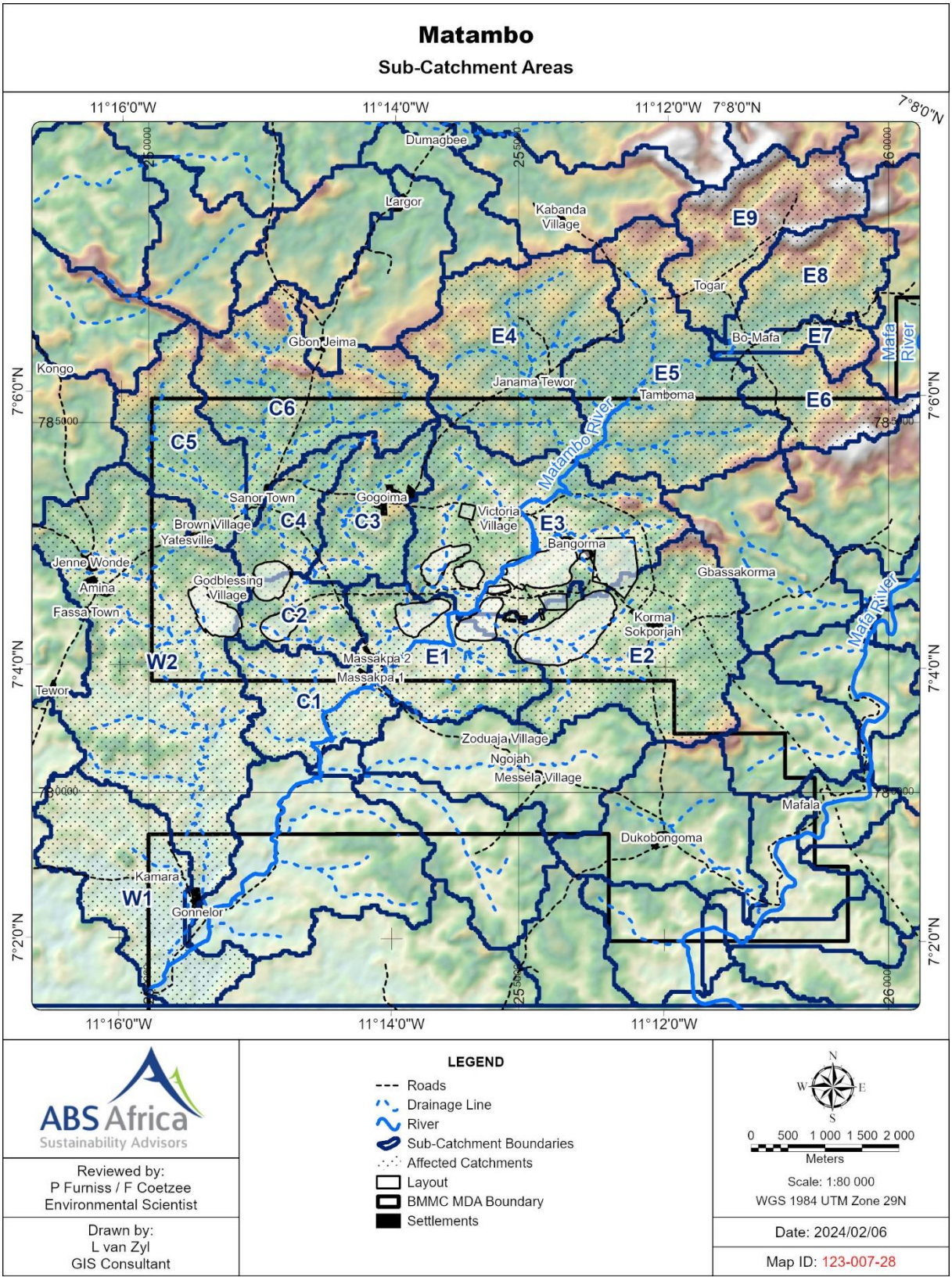


FIGURE 1-2: WATERSHED/CATCHMENT AREA OF INFLUENCE

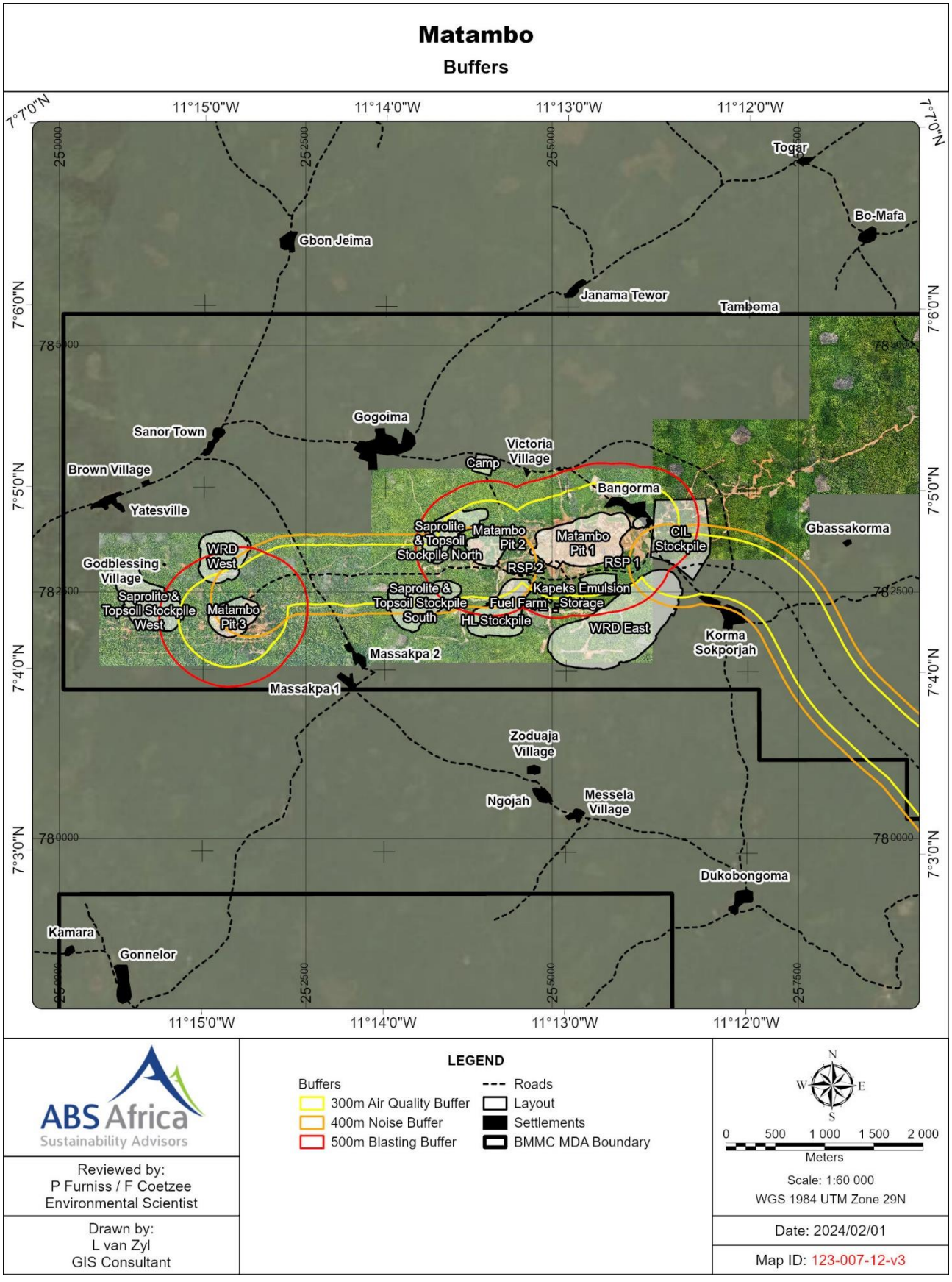


FIGURE 1-3: ZONE OF INFLUENCE

1.5 AUTHOR OF REPORT

The ESIA has been compiled by ABS Africa, together with Petra.

Petra is a Liberian consulting firm that provides specialized services covering all the social aspects.

ABS Africa is a South African company active in the mining industry, with a specialized focus on providing a complete range of sustainability services to our clients in Europe, Canada, Australia, and Africa.

SOCIO-ECONOMIC CONSULTANT	
Company Name	Petra Resources
Phone Number	+231 881 616 555
Address	Ocean Ambassador Compound Adjacent Old Budget Bureau, Redemption Road, Capitol Hill, Monrovia, Liberia
Representative	Monique Cooper Liverpool
e-mail	info@petraliberia.com
ENVIRONMENTAL CONSULTANTS	
Company Name	ABS Africa (Pty) Ltd
Phone Number	+27 11 805 0061
Address	Suite 2, Block C, Carlswald Close, c/o New and Seventh Roads, Carlswald, South Africa, 1685
Representative	Paul (PJ) Furniss
e-mail	paul@abs-africa.com
EPA Accreditation: Certificate No.	EPA/AC-007/1123

1.6 STUDY STRATEGY

1.6.1 REPORT FORMAT

This ESIA Report is a component of the Project's overall environmental and social impact assessment process. This document consists of following main sections:

- Non-technical summary;
- Main ESIA report, including
  - Baseline Description
  - Impact Assessment
  - Environmental and Social Management Plan
  - Monitoring Plan
  - Framework for Rehabilitation and Closure

1.6.2 ESIA APPROACH

The objectives of the ESIA are to:

- Provide a description of the proposed Project;
- Identify key environmental and social impacts related to the construction, operation and closure phases of Project;
- Describe how BMMC will plan and operate the mine to prevent and mitigate negative impacts on the receiving environment as well as enhance the positive impacts associated with the proposed development;

- Describe how BMMC will mitigate as well as monitor its impact on the receiving environment; and
- Assess the significant residual impacts associated with the proposed Project in Liberia.

1.6.3 SPECIALIST STUDIES ASSOCIATED WITH THE ESIA

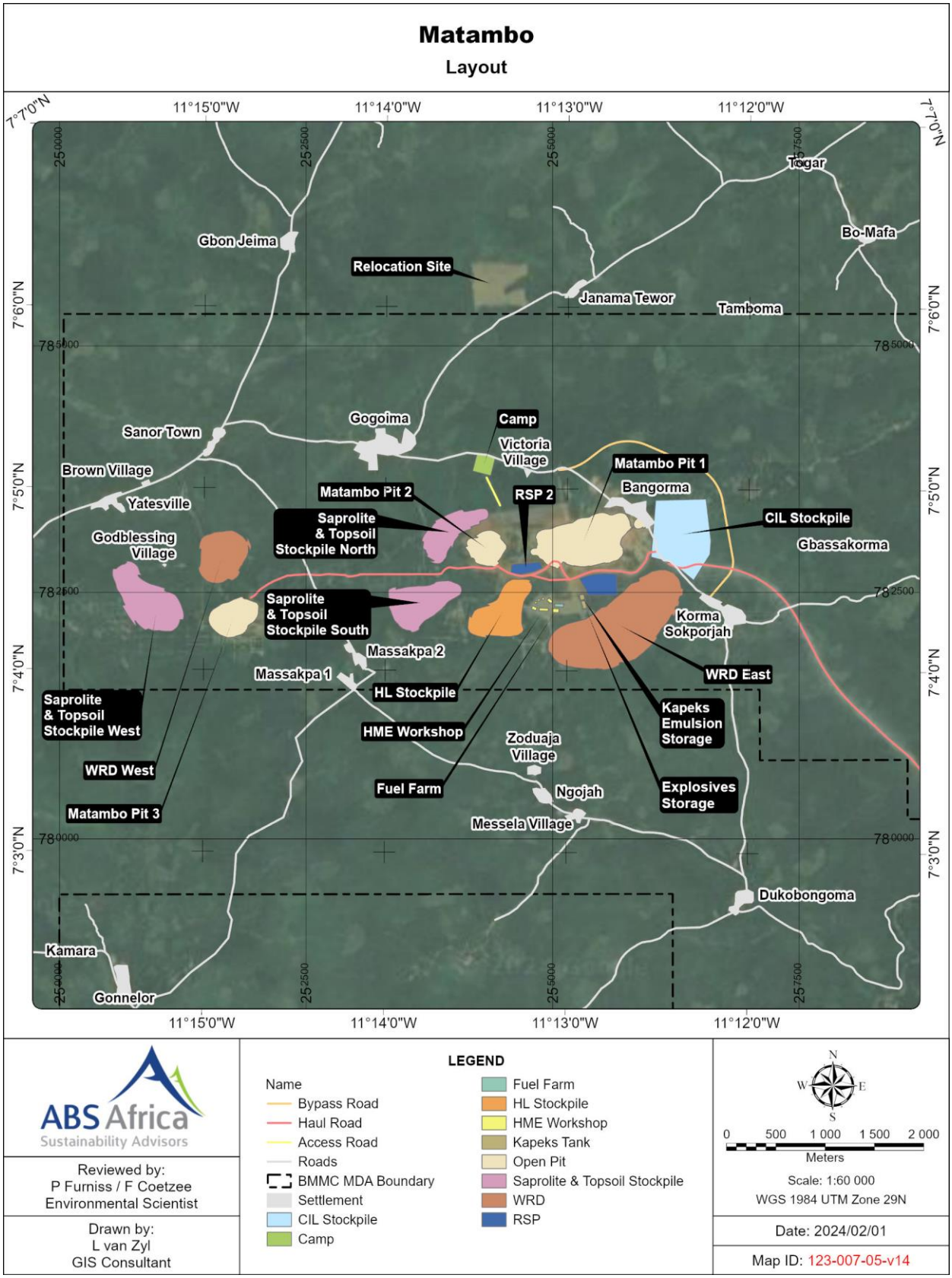
The following specialist studies were undertaken as part of the Matambo Open Pit Project ESIA:

- Air Quality Impact Assessment;
- Noise Impact Assessment;
- Biodiversity Assessment, including terrestrial and aquatic environments;
- Socio-Economic Assessment;
- Geohydrological Assessment;
- Soils, Land Capability and Land Use Assessment;
- Hydrogeological Assessment;
- Surface Water Quantity Assessment;
- Blasting Impact Assessment; and
- Decommissioning and Closure Plan.

MAP 1-1: LOCATION OF THE BMMC MDA LICENCE AREA



MAP 1-2: GENERAL SITE LAYOUT



APPENDIX 1-1: ACCEPTANCE LETTER AND PROJECT BRIEF FOR THE PROJECT

REPUBLIC OF LIBERIA
ENVIRONMENTAL PROTECTION AGENCY
P.O. Box 4024
4th Street Sinkor, Tubman Boulevard,
1000 Monrovia, 10 Liberia

Office of the Executive Director

ED/EPA/01/02864/23/RL

August 14, 2023

Mr. Debar Allen
Country Manager
Bea Mountain Mining Corporation
18th Street and Payne Intersection, Sinkor
Monrovia, Liberia

Dear Mr. Allen:

I present my compliments and acknowledge receipt of your application dated **July 31, 2023,** applying for an environmental permit for the operation of an open pit gold mine project located in Matambo, Grand Cape Mount County, Liberia.

In keeping with the standards and regulations of the Agency, this undertaking requires an Environmental and Social Impact Assessment (ESIA), beginning with an **ESIA Report,** and you are required to prepare the report through an EPA-certified independent environmental evaluator.

I am attaching for easy reference, a package containing:

- A list of EPA-certified local independent environmental evaluators
- *Note: all POCs for the said project and accredited laboratories must be considered by the consultant(s) for this undertaking*

The evaluators herein listed are the only certified Independent Environmental Evaluators accredited by the Agency to conduct environmental and social impact assessments, prepare environmental management plans, and other relevant environmental studies.

In response to your communication, the permit processing fees for this undertaking will be communicated to you upon submission of the **ESIA Report**.

This communication does not amount to the commencement of any work or operation until further official notice by the Agency is issued to commence work, or a conditional permit is issued.

Please accept the assurance of my highest esteem and consideration as we strive for environmental sustainability for now and for successive generations.

Kind regards,

Prof. Wilson K. Tarpeh
EXECUTIVE DIRECTOR/CEO

Website: http://www.epa.gov.lr *Mobile: +231886454493/+231776454493* *Email: dngeorge@epa.gov.lr*





LIST OF ACCREDITED ENVIRONMENTAL CONSULTANT FIRMS FOR CALENDER YEAR; 15 April 2022 TO 14 April 2023

*For inquires, kindly contact: **Prof. Wilson K. Tarpeh,** (Executive Director), Mobile:0888111777/0777169121, Email:* wtarpeh@epa.gov.lr, *Mr. **John K. Jalla** Jr (Manager, C&E), Mobile: 0888121715/0777797160, Email: jjallah@epa.gov.lr; Mr. **Daoda Socrates Carlon,** (Asst. Manager ESIA), Mobile: 0886036695 (WhatsApp)/0779086741, Email: dcarlon@epa.gov.lr*

NO.	INSTITUTION/COMPANY	EMAIL/PHONE NUMBER	CONTACT PERSON	PHYSICAL ADDRESS
1.	GreenCons, Inc.	info@greenconsliberia.com +231777001933/+231886844536, +231 776623483	Solomon P. Wright	Gurley and Broad Street, Abi Joudi building Apt. #3, downtown Monrovia
2.	Earth Environmental Consultancy, Inc.	michael.suah@yahoo.com +231770101027/+231886576335	Sumo S. Momolu	Benson Street, Adjacent Inter Digital Computer School, Monrovia, Liberia
3.	Petra Resources, Inc.	monique@petraliberia.com 0888555009/0776555140	Monique Cooper-Liverpool	Ocean View Ambassador Compound Redemption Road capitol Hill
4.	Earthtime, Inc.	whamdan@earthtimegroup.com /info@earthtimegroup.com 0886700060	Wassim Hamdan	Earthtime Building UN Drive, Clara Town, Bushrod Island, Monrovia, Liberia
5.	Eco Green Inc.	ecogreenlib1847@gmail.com 0888392829/0777864850	Boimah P. Massaley	Mulbah Willie Building, ELWA Junction Opposite Exclusive Supermarket
6.	Afric Consult Incorporated	0775219546/0886971782 info@africonsult.com	Prosper Inekhomon	BJK Anderson Building 2nd Floor Carey & Lunch Street Monrovia
7.	Forest & Environmental Research Institute (FERI)	forestenvironment@gmail.com /forestcryliberia04@yahoo.com 0886593292/ 0770215789	Dickson J. Chowolo	Kaly's Building, RLJ Hotel Junction, Paynesville
8.	Liberia Engineering & Geo-Tech Consultants	legconsultantsfirm@gmail.com +231886318407/+231776781916	Trokon Y. Brown, Administrator	Congo Town Backroad Adjacent Defense Minister House
9.	Ansumana Environmental	chadag1980@yahoo.com	Charles S. Dagoseh Sr.	72nd Boulevard, Paynesville

	Consultancy, Inc.	0886552963		
10.	MAC-Africa Consultant, Inc.	Mac-africa@gmail.com 0880880701	Hon. Walter McCarthy	Adjacent the Agro, Inc. Building, 1st Street, SinkorAdjacent Monrovia City Hall P.O. Box 10-1748
11.	Partners for Nature and Development (PaND)	0776194210/0886798425	Darlington Tuaben	Oldest Congo Town, Monrovia, Liberia
12.	Natural Resources Development Corporation (NRDC)	08886510482/0777893122	John C. Nylander	Off VP Road Togba Camp Area Old Road, Monrovia
13..	Environmental Consultancy Incorporated (ENCO)	jbkonuwa2005@yahoo.com environmentalconsultancy471@gmail.com 0886511477/0770537626	James B. Konuwa Sr.	Corner of Broad & Johnson Streets, Above Harvest Pharmacy, Monrovia
14.	Center for Environment and Development in Africa(CEDA) Liberia	cedailiberia@gmail.com 0777037265/0880767181	Prof. Samuel W.D. Wesley, Sr.	Waterside Community, New Georgia, Caldwell, Monrovia Liberia
15.	Bezelee+Turnkey Contractors	Patrick.usar@gmail.com bezalib@yahoo.com +231886659644/+231776594870	Patrick Usar, Administrator	77 2nd Floor Carey Street; Monrovia, Liberia
16.	General Consultancy, Inc.	gcilibinc@gmail.com +231777075166/+231880489841	John Zawu	Broad Street Opposite B.W. Harris, Gibson Building Apt#:2 last floor
17.	Royal Environmental Group (RE-GROUP LIBERIA, INC.)	regroupliberia@gmail.com cebuibo@gmail.com 0777917398/0886468072	Clarence E. Buigbo	icampus, Carey Street Sniper Hill Monrovia,Liberia
18	Earthlife Environmental Consultancy, Inc.	earthlifeeilib@gmail.com/+231886612613/+231777439171	Wannie Blamo	Weaver's Street, Paynesville, Liberia
19	Liberia Environmental Services	Dwehboley@yahoo.com +231776643788/ 0886434788 (WhatsApp)	Dweh S. Boley	14th Street Sinkor, Beach Side, Buld.No. 3

The environmental consultancy firms herein listed have completed the training course for Environmental Evaluators from February 21, 2022 – March 04, 2022 the conduct of Environmental and Social Impact Assessment/Strategic Environmental Assessment (ESIA/SEA) and Environmental Management System (E Liberia and have satisfactorily met all the professional requirements as established by the Environmental Protection Agency of Liberia to serve as EPA-certi party environmental Consultancy firms in Liberia for the period 15 April 2022-14 April 2023.

Signed & Sealed:

Prof. Wilson K. Tarpeh, **EXECUTIVE DIRECTOR/CEO**

APPENDIX 1-2: TEMPORARY PERMITS GRANTED

REPUBLIC OF LIBERIA

ENVIRONMENT PROTECTION AGENCY

P.O. Box 4024
4th Street Sinkor, Tubman Boulevard,
1000 Monrovia, 10 Liberia

Office of the Executive Director

ED/EPA/01/030703/23/RL

October 20, 2023

Mr. Debar Allen
General Manager
Bea Mountain Mining Corporation
18th Street and Payne Ave, Sinkor
Monrovia, Liberia

Dear Mr. Allen:

I present my compliments and acknowledge receipt of your communication, dated **October 20, 2023,** submitting a **Technical Summary Report** to facilitate the issuance of temporary permits for preparatory works at your proposed gold mine project in Matambo, Grand Cape County, Liberia.

The report was received, but the review of the said submission is contingent upon receipt of the payment of the temporary permit fees, while an ESIA site verification visit will be made to the proposed project's site to determine the validity of the report before complete acceptance by the Agency.

The "non-refundable" temporary permit processing fees for the below undertakings are as follows:

No	Undertaking	Permit Fees (USD)
i.	Saprolite removal to access ore	$15,050.00
ii.	Construction of infrastructure (offices, camps, Mechanical workshops, warehouse and explosive magazine)	$10,550.00
iii.	Stockpiles of base rock ores or topsoil areas	$10,050.00
Total		**$ 35,150.00**

Payment of the above fees can be made at the: **EcoBank: Account Number: 6100064132 (USD) Account Title: National Environmental Commission** or at the **Central Bank of Liberia** Account Number**: 00100116010050 (LRD)** Account Title**: Environmental Protection Agency.** *This amount should be paid within* ***two (02) days****, upon receipt of this communication.*
This communication does not amount to the commencement of any work, operation until further official notice by the Agency is issued to commence work, or a conditional permit is issued.

Please accept the assurance of my highest esteem and consideration as we strive for environmental sustainability for now and successive generations

Kind regards,

Prof. Wilson D. Tarpeh
EXECUTIVE DIRECTOR/CEO

Website: http://www.epa.gov.lr Mobile: +231886454493/+231776454495 Email: dngeorge@epa.gov.lr

APPENDIX 1-3: EPA ACCREDITATION CERTIFICATE

REPUBLIC OF LIBERIA

ENVIRONMENTAL PROTECTION AGENCY

4TH STREET SINKOR, TUBAMAN BOULEVARD
P.O. BOX 4024
1000 MONROVIA, 10 LIBERIA

Certificate No. EPA/AC-007/1123

CERTIFICATE OF ACCREDITATION

This certifies that

ADVISORY ON BUSINESS AND SUSTAINABILITY AFRICA (PTY) LTD

Is duly certified and recognized by the Environmental Protection Agency to conduct Environmental & Social Impact Studies within Liberia for the proposed **Matambo Open Pit Gold Mine Project** in Collaboration with its local partner, Petra Resources Incorporated.

Validity: *one year commencing 21st November 2023 to 20th November 2024 renewable under new terms and conditions.*

Issued this 21st day of November 2023 A.D. in the City of Monrovia, Montserrado County, Republic of Liberia

Prof. Wilson K. Tarpeh
EXECUTIVE DIRECTOR/CEO

CHAPTER 2
PROJECT MOTIVATION AND BENEFITS

TABLE OF CONTENTS

2 PROJECT MOTIVATION AND BENEFITS 2-1

2.1 THE NEED FOR GOLD AND THE GOLD MARKET 2-1
2.1.1 Uses of Gold 2-1
2.1.2 Gold Market 2-1
2.2 SOCIAL AND ECONOMIC BENEFITS OF GOLD MINING 2-1
2.3 SHAREHOLDER VALUE 2-4
2.4 MINING AND THE LIBERIA ECONOMY 2-4
2.5 QUANTITY AND VALUE OF PRODUCT 2-5
2.6 PROJECT BENEFITS TO LIBERIA 2-5
2.6.1 Mining and Minerals Law of 2000 and the Exploration Regulations 2-5
2.6.2 Direct Economic Benefits 2-5
2.6.3 Indirect Economic Benefits 2-6
2.7 REGIONAL AND COMMUNITY BENEFITS 2-6
2.7.1 BMMC Community development Plan 2-7
2.7.2 Local Job Creation 2-7
2.7.3 Training And Capacity Building 2-7
2.7.4 Local Business Development 2-7

LIST OF FIGURES

FIGURE 2-1: PERCENTAGE IN-COUNTRY PAYMENTS BY GOLD MINING COMPANIES 2-2
FIGURE 2-2: AVERAGE PAYMENTS TO HOST COMMUNITIES 2-3
FIGURE 2-3: SUMMARY OF LOCAL COMMUNITY EMPLOYMENT BY GOLD MINING COMPANIES 2-4

LIST OF TABLES

TABLE 2-1: PERCENTAGE OF GDP PER SECTOR 2-5

2 PROJECT MOTIVATION AND BENEFITS

This chapter provides a description of the overall need and purpose of the project, specifically in terms of the socio-economic benefits to the local, regional, and national economy of Liberia.

2.1 THE NEED FOR GOLD AND THE GOLD MARKET[1]

2.1.1 Uses of Gold

Gold is a precious metal. Beyond its traditional use in jewellery, it's several unique properties including its reflectivity, conductivity, malleability, and ductility make it useful in a variety of applications. Approximately 50% of the global gold supply is still used in the manufacture of jewellery, followed by investment demand, central bank demand and technology uses.

Investors in gold typically purchase the metal as a means of hedging against inflation and protecting future earnings. Similarly, central banks purchase gold as part of their investment portfolio aimed at stabilizing a country's financial system.

Technology and industrial applications include the following:

- A wide variety of electrical products contain gold. These vary from phones to home appliances;
- Due to the high reflectivity of gold, it is used in the manufacturing of spacecrafts and satellites;
- Gold is also used as a lubricant between mechanical parts, due to its malleability;
- The metal is used as a drug to treat a small number of medical conditions such as rheumatoid arthritis; and
- It is also used as a chemical catalyst for pollution control applications and fuel cells.

2.1.2 Gold Market

Gold mining is a global business with operations on every continent, except Antarctica, and gold is extracted from mines of widely varying types and scales.

Annual global gold production is estimated to be between 2500 and 3000 tonnes. Gold recycled from jewellery and electronic goods accounts for about one-third of annual gold supply volumes. The remaining two-thirds is provided through mining.

At a country level, China was the largest producer in the world in 2018 and accounted for around 12 per cent of the total global production. A breakdown of the top gold producing countries in the world, shows the geographical dispersion of gold mining operations and the gold supply.

The gold price has been subject to short-term volatility over recent years, primarily due to geopolitical risks and the weaker global economy. Looking forward, it is expected that demand for gold will remain high and may be increased if market conditions in Asia improve.

2.2 SOCIAL AND ECONOMIC BENEFITS OF GOLD MINING

Gold mining is a major economic driver for many countries across the world. Well-managed, transparent and accountable resource extraction can be a major contributor to economic growth due to the creation of employment and business opportunities for local people. Apart from direct and indirect jobs and employment, gold mining also brings foreign direct investment, foreign exchange and tax revenues to countries.

[1] Adapted from World Gold Council. https://www.gold.org/. Accessed on 19 January 2024

Often operating in remote locations, gold mining companies invest in infrastructure and utilities. In addition to supporting the needs of a gold mine, improvements to roads, water and electricity supplies are a long-term benefit to businesses and communities across the area, that outlives the production years of a gold mine.

Although not specific to Liberia, research undertaken by the World Gold Council (2020)[2] identified a range of benefits of the gold mining industry to socio-economic and human development, including the following:

- In 2021, World Gold Council (WGC) member companies directly contributed a total of US$57.1bn to host economies;
- This comprised US$35.4bn of payments to in country suppliers, US$11.7bn in employee wages and US$10.0bn in payments to governments (FIGURE 2-1);
- Additionally, in 2021 contributions of over US$450m were made to local communities and Indigenous groups in the 37 countries of operations (FIGURE 2-2);
- In 2021, WGC member companies directly employed close to 250,000 people and over 140,000 contractors (FIGURE 2-3);
- Every job in the gold mining industry also supports six more indirect jobs in the supply chain or almost ten more if induced jobs are included;
- Recent company efforts to train and develop local skills, as opposed to bringing in expatriates, has led to 95% of employees coming from the host country of operation.

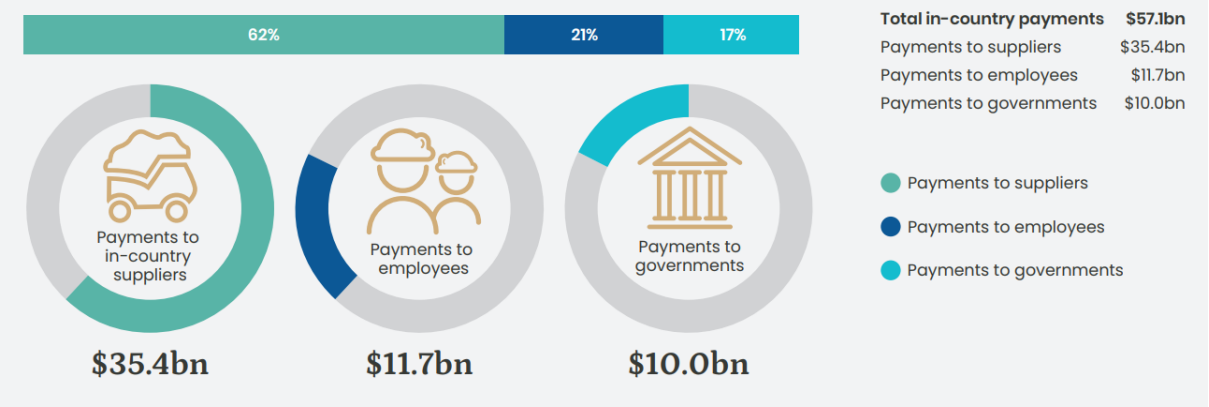


FIGURE 2-1: PERCENTAGE IN-COUNTRY PAYMENTS BY GOLD MINING COMPANIES[3]

[2] World Gold Council, 2022. The social and economic contribution of gold mining. https://www.gold.org/esg/the-social-and-economic-contribution-of-gold-mining. Accessed on 17 May 2023

[3] https://www.gold.org/esg/gold-and-society/gold-minings-contribution-to-the-un-sustainable-development-goals

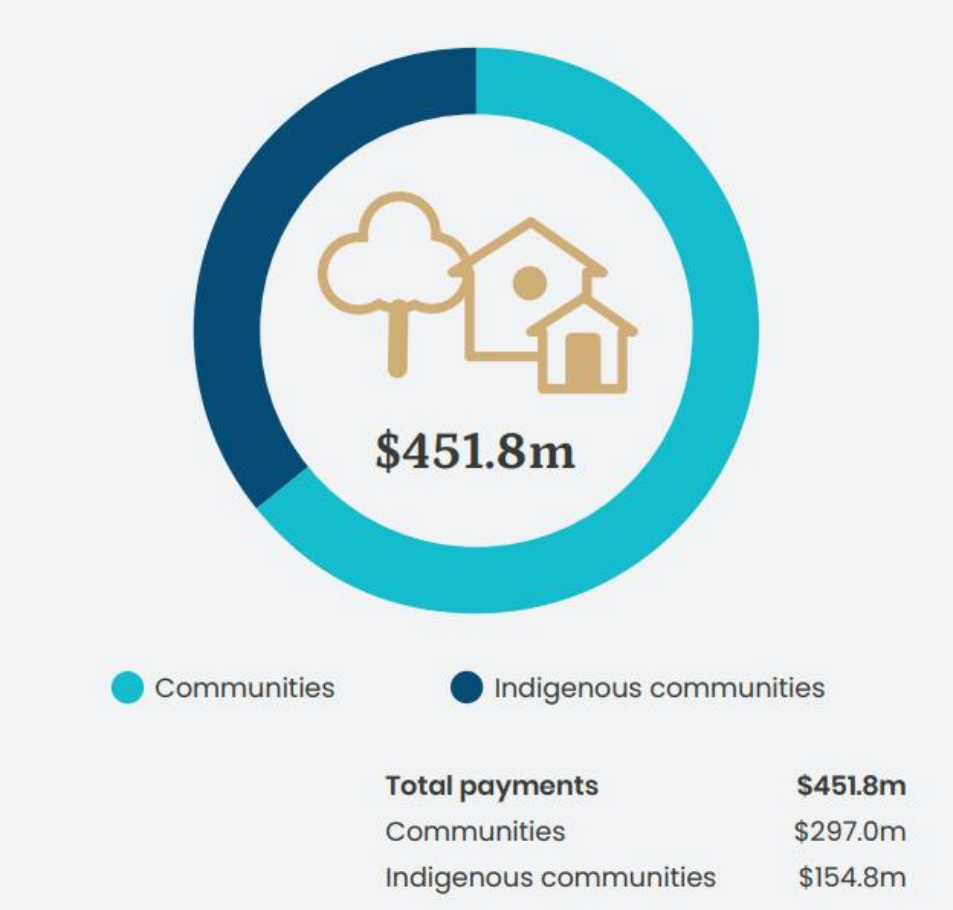


FIGURE 2-2: AVERAGE PAYMENTS TO HOST COMMUNITIES[4]

[4] https://www.gold.org/esg/gold-and-society/gold-minings-contribution-to-the-un-sustainable-development-goals

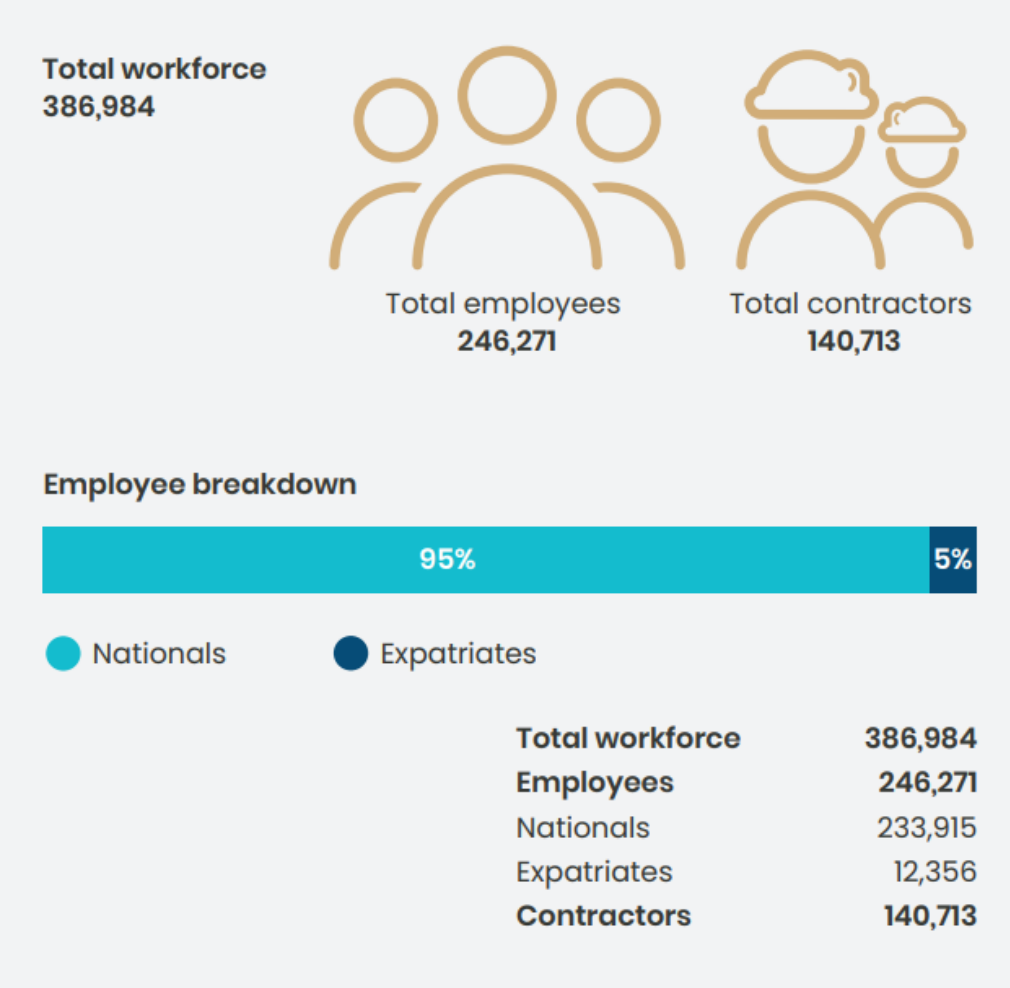


FIGURE 2-3: SUMMARY OF LOCAL COMMUNITY EMPLOYMENT BY GOLD MINING COMPANIES

2.3 SHAREHOLDER VALUE

The primary business interest of Bea Mountain Mining Corporation (BMMC) is to produce quality gold ingots for sale on the international gold market. In doing this, BMMC intend to derive optimal value by operating the mine in a manner that is profitable, benefits the people of Liberia, including local communities, and minimizes the impact to the environment.

2.4 MINING AND THE LIBERIA ECONOMY

Liberia has rich mineral deposits and historically, mineral extraction – particularly of iron ore, gold and diamonds – has been one of the leading export sectors for the country (U.S. Geological Survey, 2022)[5].

Liberia's Gross Domestic Product (GDP) was worth $3.51 billion in 2021, according to official data from the World Bank.[6] The GDP therefore improved in 2022 by 2.1% compared that of 2021.

[5] U.S. Geological Survey, 2022. 2019 Minerals Yearbook: U.S. Geological Survey https://www.usgs.gov/centers/national-minerals-information-center/africa-and-middle-east#li . Accessed on 20 May 2023

[6] Trading Economics,2023. Liberia GDP. https://tradingeconomics.com/liberia/gdp Accessed on 28 June 2023

Liberia's economy expanded by 4.8 % in 2022, which was mostly driven by mining and agriculture. Industrial output grew by 10.4% in 2022 largely driven by increased gold production.[7] Preliminary mineral export earnings were reported as $702 million in 2021 compared with $496 million in 2020. Of this amount, $347 million was generated by exports of iron ore and $356 million was generated by exports of diamond and gold compared with $289 million and $207 million, respectively, in 2020. Gold made up about 48% of export receipts in 2021[8].

TABLE 2-1: PERCENTAGE OF GDP PER SECTOR[9]

SECTOR	2019	2020	2021	2022
Agriculture and Fisheries	902.0	959.3	997.7	1 034.6
Forestry	272.9	285.3	285.2	296.6
Mining and Panning	454.7	463.7	545.3	587.7
Manufacturing	186.1	186.1	194.8	202.6
Services	1 366.3	1 193.3	1 194.9	1 242.7
Real GDP	3 182.1	3 087.7	3 217.9	3 364.1

-All figures are expressed in millions of U.S. dollars. * (Projection + Revised)/Actual

2.5 QUANTITY AND VALUE OF PRODUCT

Based on the Mineral Resource Estimation (MRE) study conducted by AMC Consultant (November 2023), it is indicated that the Matambo Mine will produce approximately 14.7 Mt Ore.

2.6 PROJECT BENEFITS TO LIBERIA

2.6.1 Mining and Minerals Law of 2000 and the Exploration Regulations[10]

The ministry of Mines and Energy (MME) is the government agency responsible for the administration in the mining and mineral sectors. This responsibility also includes the granting of licenses and its legislative oversight of the subsequent energy, minerals, land and water sectors of these applications. The minerals and mining sectors are regulated by the Mining and Minerals law of 2000 and the Exploration Regulations. The mineral policy of Liberia was created in March 2010 to complement the Mining and Mineral Law which outlines the governments expectations with regards to the contribution of all stakeholders towards the sustainable development of Liberia's mineral resources.

In addition to the mining licenses, there is a Mineral Development agreement (MDA) which sets out the bases of acquiring a Class A mining license (Wilson et al, 2017). The MDA document outlines the details in the operational and fiscal terms for both exploration and mining and to ensure a straight-forward transition from exploration to the mining phase of the operation provided that the operator has complied with the general provisions of the law (Wilson et al, 2017).

2.6.2 Direct Economic Benefits[11]

Direct economic benefits from the Matambo Open Pit Project will accrue to the Government of Libera from the payment of various taxes including that from local purchases from Liberian suppliers and salaries paid to the Liberian employees.

[7] https://www.worldbank.org/en/country/liberia/overview
[8] https://www.trade.gov/country-commercial-guides/liberia-mining-and-minerals
[9] Central Bank of Liberia: Annual report, 2021.
[10] The mining sector of Liberia: current practices and environmental challenges. (Wilson et al, 2017). Environ Sci Pollut Res.
[11] Mineral Development Agreement between the Government of Liberia and BMMC

2.6.2.1 Taxes and dividends

The various taxes as per the Revenue Code outlined in the MDA between the Government of Liberia and BMMC is as follows:

- BMMC shall be liable to taxation under provisions of the Revenue Code on its net taxable income, which shall include capital gain, as well as;
- BMMC shall be taxed on its net taxable income pursuant to Law; provided however that during the term of this Agreement such rate shall not exceed twenty five percent (25%). For dividend payment, tax shall be withheld at the rate of five percent (5%). Payments made by BMMC or any person acting on behalf of BMMC for activities directly related to the operations:
  - Tax shall be withheld at the rate of five percent (5%) of those payments, provided that payments made for resource modelling, project consulting, feasibility study, maintenance and engineering services which are directly related to the Operations of the Company, no withholding tax shall be applicable.
- Charitable contributions, not exceeding 20% of the Company's gross income (Section 21.2(e)) made to approved educational, religious, medical, and/or other social services shall be deemed to be tax deductible.
- BMMC shall pay to the government of Liberia in dollars a royalty at the percentage rate specified below on the proceeds paid to BMMC from the sale of minerals recovered from the production area and sold by BMMC;
  - Gold and silver at three percent (3%)
  - All other minerals to be agreed on but not exceed five percent (5%)
- BMMC shall pay to the Government, during each Contract year, a surface rental equal to Four Dollars ($4.00) per acre for the production Area. The Affected Communities shall be entitled to receive fifty percent (50%) of the Surface Rental payment in Section 23.1(a) above The Affected Communities portion of the Surface Rental payment shall be deposited by the Company in the Community Development Fund Account established under Section (15.3.a) and such deposit shall be appropriately identified as "surface rental". The Company shall maintain records of all surface rental payment made to the Community Development Fund.
- In respect of Operations and activities, BMMC and associates shall pay to the government of Liberia:
  - Import duty and excise tax, pursuant to the Revenue Code, on fuel at the rate of fifty percent (50%); and
  - Ten percent (10%) of the import duty and excise tax under Laws on consumables (other than fuels and oils).

2.6.3 Indirect Economic Benefits

There are several indirect economic benefits associated with the Project. These include local economic development through procurement of local goods and services and the creation of secondary businesses in support of the mine activities, infrastructure development and wealth creation. Further revenue for the Government of Liberia will also accrue through the various taxes payable by these companies and individual employees.

2.7 REGIONAL AND COMMUNITY BENEFITS

The project socio-economic benefits at the regional and local level are summarized as follows:

2.7.1 BMMC Community development Plan

BMMC has a community development plan (CDP) in place for the existing projects, such as NLGM, Ndablama and Weajue. The CDP will be updated to include the proposed Matambo open pit project. BMMC has initiatives such as assisting the surrounding communities with:

- Food Security;
- Livelihood development;
- Health & Education; and
- Local employment.

2.7.2 Local Job Creation

The most tangible economic benefit of the project is through employment. In addition to direct job creation, the project will indirectly generate other jobs through service providers offering services in support of the mining activities.

Specialised skills are required for some of the construction and operational phase mining activities and these skills will need to be brought in from outside if not available from the local community.

The Project will result employment opportunities at the Matambo during the construction and operational phases of the project. Approximately 500 people will work at the mine during the peak development, preparation, and production stages of the project. Additionally, the proposed development will ensure that current employment at the NLGM plant will continue due to the use of the plant.

2.7.3 Training And Capacity Building

BMMC developed a capacity building program that provides on continues training for its Liberian staff and qualified Liberians to train them for financial, accounting, supervisory, managerial, executive and other skilled positions within the company.

BMMC has also developed a vocational training facility, provided on-the-job training and utilized whatever other measures which are reasonable and necessary in supporting capacity building and the transfer of knowledge and skills to Liberian employees.

2.7.4 Local Business Development

Local projects spend on sourcing local goods and services is likely to be significant, through the implementation of BMMC plan of procurement of local goods and services. These would include construction materials, fuel, food, and other consumables.

The injection of cash income into the area is also likely to lead to the establishment of a range of other businesses to provide goods and services to Project employees.

CHAPTER 3
ENVIRONMENTAL LEGISLATION AND PROJECT GOVERNANCE FRAMEWORK

TABLE OF CONTENTS

3 ENVIRONMENTAL LEGISLATION AND PROJECT GOVERNANCE FRAMEWORK 3-1

3.1 LEGISLATIVE REQUIREMENTS, INTERNATIONAL STANDARDS, AND INSTITUTIONAL FRAMEWORK 3-1

3.1.1 National Liberian Legislation and Policies 3-1
3.1.2 The Liberian Constitution (1986) 3-1
3.1.3 The Mineral Policy of Liberia (2010) 3-1
3.1.4 Ministry of Mines and Energy (MME) 3-1
3.1.5 Mineral Resources Department 3-1
3.1.6 Minerals and Mining Law of 2000 (MML) 3-2
3.1.7 Minerals and Mining Act (ACT 703 OF 2006) 3-3
3.1.8 Liberia Extractive Industries Transparency Initiative Act (LEITI), (2009) 3-3
3.1.9 National Environmental Policy (2002) 3-4
3.1.10 The Environment Protection and Management Law (EPML) 2003 3-4
3.1.11 Environmental Protection Agency Act (2003) 3-5
3.1.12 National Environmental Action Plan 3-5
3.1.13 National Forest Policy (2006) 3-5
3.1.14 Forest Development Authority 3-5
3.1.15 The National Forestry Reform Law Of 2006 (NFRL) 3-5
3.1.16 Liberia Land Commission Act (2009) 3-6
3.1.17 Revised Law and Administrative Regulations for Governing the Hinterland, 2001 3-6
3.1.18 National Zoning Act of The City Of Monrovia Of 1957 3-7
3.1.19 The Liberia Land Authority Act (LLA) Of 2016 3-7
3.1.20 Land Rights Law 2018 3-8
3.1.21 Biodiversity Legislation and Policy 3-8
3.1.22 National Biodiversity Strategy and Action Plan (NBSAP) 3-8
3.1.23 Wildlife And National Parks Act (1988) 3-9
3.1.24 The Independent National Commission on Human Rights Act Of 2005 3-9

3.2 MANAGEMENT AT A LOCAL LEVEL 3-9

3.2.1 Statutory Management Practices 3-9
3.2.2 Traditional Management Practices 3-9

3.3 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS (IFC) 3-9

3.3.1 General Environmental, Health & Safety Guidelines 3-10
3.3.2 IFC EHS Guidelines: Mining 3-10
3.3.3 Mine Closure and Post-Closure 3-15
3.3.4 Human Rights Considerations 3-15
3.3.5 Corporate Policies 3-16
3.3.6 Other Legislation and Policy 3-16
3.3.7 First Amendment to the Restated and Amended Mineral Development Agreement by and between the Government of Liberia and Bea Mountain Mining Corporation (2023) 3-17
3.3.8 International Obligations, Commitments and Conventions 3-17

3.4 INSTITUTIONAL FRAMEWORK 3-18
3.4.1 Government Ministries *3-18*
3.5 STANDARDS AND GUIDELINES 3-19
3.5.1 Legal Requirements and Noise Level Guidelines for the Republic of Liberia *3-19*
3.5.2 Water Quality Standards and Guidelines *3-21*
3.5.3 Air Quality *3-23*
3.6 MINE CLOSURE 3-27
3.6.1 Financial Feasibility *3-28*

LIST OF TABLES

TABLE 3-1: TYPES OF MINING LICENCES 3-2
TABLE 3-2: INDICTIVE VALUES FOR TREATED SANITARY SEWAGE DISCHARGES 3-12
TABLE 3-3: EFFLUENT GUIDELINES 3-12
TABLE 3-4: MINIMUM AVERAGE ILLUMINATION FOR DESIGNATED MINE LOCATIONS AND ACTIVITIES 3-14
TABLE 3-5: INTERNATIONAL CONVENTIONS UNDER WHICH LIBERIA HAS OBLIGATIONS RELEVANT TO THE PROJECT 3-17
TABLE 3-6: MAXIMUM PERMISSIBLE NOISE LEVELS FOR GENERAL ENVIRONMENT 3-19
TABLE 3-7: MAXIMUM PERMISSIBLE NOISE LEVELS (CONTINUOUS OR INTERMITTENT) FROM A FACTORY OR WORKSHOP 3-20
TABLE 3-8: MAXIMUM PERMISSIBLE NOISE LEVELS FOR IMPACT OR IMPULSIVE NOISE 3-20
TABLE 3-9: MAXIMUM PERMISSIBLE NOISE LEVELS FOR CONSTRUCTION SITE 3-20
TABLE 3-10: MAXIMUM PERMISSIBLE NOISE LEVELS FOR ACCELERATING VEHICLES 3-20
TABLE 3-11: WATER QUALITY GUIDELINES 3-21
TABLE 3-12: WORLD HEALTH ORGANIZATION AMBIENT AIR QUALITY GUIDELINES (AS USED BY IFC) 3-24
TABLE 3-13: SANDCR ACCEPTABLE SETTLEABLE DUST RATES 3-25
TABLE 3-14: SMALL COMBUSTION FACILITIES EMISSIONS GUIDELINES (3MWTH – 50 MWTH) 3-25

3 ENVIRONMENTAL LEGISLATION AND PROJECT GOVERNANCE FRAMEWORK

Environmental governance responsibilities in Liberia are shared by a number of entities, organisations, and agencies. Each one has an area of responsibility in various sectors including study and planning, prevention and forecasting, regulatory controls, training, and communication as well as various cross-functional responsibilities. Relevant institutional structures with respective departments and environment-related responsibilities are discussed below.

3.1 LEGISLATIVE REQUIREMENTS, INTERNATIONAL STANDARDS, AND INSTITUTIONAL FRAMEWORK

3.1.1 National Liberian Legislation and Policies

This section provides a summary of relevant information in legislation, policies and plans that have bearing on the Project.

3.1.2 The Liberian Constitution (1986)

Article 7 of Chapter II of the New Liberian Constitution of 1986 provides for full public participation of all citizens in the protection and management of the environment, as well as consultations with, and the involvement of, a cross-section of stakeholders.

The Liberian Constitution and several statutes have been enacted to govern the rights of individuals to land and properties. Article 22 (a) and (b) of the Constitution gives right to all individuals to own property, either on individual basis or in conjunction with other individuals, as long as they are Liberian citizens. However, the right to property ownership does not extend to mineral resources on, or beneath, the land.

The Liberian Constitution states that expropriation may be authorized for public purposes. When the property taken for public use ceases to be used for that purpose, the former owner shall be given the right of first refusal to re-acquire the property. Article 20 of the Constitution provides for prompt payment of fair and adequate compensation in the case of compulsory acquisition of property. However, it does not clearly define how an individual or group shall be compensated or resettled.

Article 26 of the Constitution provides that where the rights of a person or association have been unconstitutionally contravened, that person or association may invoke the privilege and benefit of the judiciary, including a judgment of unconstitutionality. Anyone injured by an act of Government, or any person acting under its authority, whether in property or otherwise, shall have the right to bring suit for appropriate redress.

3.1.3 The Mineral Policy of Liberia (2010)

The Mineral Policy of Liberia, introduced in 2010, is intended to provide adequate indications to the investment community (both national and foreign) of a competitive mineral regime in Liberia that is informed by international trends, adheres to international norms, is grounded in local conditions and is accountable to national common interests. The Mineral Policy was created to complement the Mining and Minerals Law.

3.1.4 Ministry of Mines and Energy (MME)

The Ministry of Mines and Energy ensure the sustainable management and judicious utilisation of the country's Mines & Energy resources. There are two main departments: Mineral Resources and Energy.

The MME is the Government Agency responsible for the administration of the mineral and mining sector, including granting mining licenses, and it has statutory oversight of the energy, minerals, and water sectors.

The minerals and mining sector is regulated by the Mining and Minerals Law of 2000 and Exploration Regulations

3.1.5 Mineral Resources Department

The Mineral Resources Department acts as both the National Geological Survey and Mines Department of the Republic of Liberia, with the mandate to look after the Mining. Its two major operating areas are mines administration and geological and mineral investigations.

3.1.6 Minerals and Mining Law of 2000 (MML)

The Minerals and Mining Law (MML) contains specific environmental conditions for undertaking mining activities on forested lands, including the requirement to restore the mining site on completion of mining activities and to reforest the surface area of the mine, if the mining activities have caused the large-scale felling of trees.

There are five types of mining licences:

TABLE 3-1: TYPES OF MINING LICENCES

LICENSE	DESCRIPTION	VALIDITY PERIOD
PROSPECTING LICENSE	Granted when an area has not already been subject to a valid mineral right granted to another person; the area granted shall not exceed 100 acres. The Holder to file and submits a proposed work plan to the Minister of Land, Mines, and Energy. The prospecting right does not give the right to conduct commercial mining.	6 months, renewable once for a further 6 months provided that the holder meets his obligations under the law.
EXPLORATION LICENCE (SEE THE REGULATIONS GOVERNING EXPLORATION UNDER A MINERAL EXPLORATION LICENCE (2010).	Granted when the area has not already been subject to a valid mineral right granted to another person; the exploration area shall be contiguous and shall not exceed 1,000 square kilometres. The Holder is to submit a proposed exploration program to the Minister of Land, Mines, and Energy within 90 days after the issuance of the exploration licence and shall commence exploration within 180 days after the issuance of an exploration licence unless the Minister agrees to a longer period.	Not more than 3 years and it may be extended for a single 2-year term upon written application of a holder.
CLASS C MINING LICENCE	The production area **not** more than 25 acres. One person may hold up to 4 Class C mining licences at the same time. Holders of Class C licence shall conduct mining predominantly as a small-scale operation.	1 year, renewable for further terms of 1 year each, if the holder has met all his legal obligations.
CLASS B MINING LICENCE	Can conduct mining of industrial operations. Production area is 25 acres.	5 years, renewable for not more than 5 years.
CLASS A MINING LICENCE	Granted during or at the end of the exploration period of a discovery or exploitable deposits and is materially in compliance with a Mineral Development Agreement (MDA), which has become effective, permitting mining in the proposed production area.	Not be more than 25 years, may be extended for consecutive additional terms not exceeding 25 years each.

- In addition, there is a Mineral Development Agreement (MDA) which sets out the basis to acquire a class A mining license.
- The MDA sets out in detail the operational and fiscal terms for both exploration and mining and to ensure a straightforward transition from exploration to the mining phase of the operation provided that the operator has complied with the general provisions of the law.
- In negotiating an MDA, the Minerals Technical Committee has discretionary authority regarding those matters, which are subject to the regulations, which together with the law specify principal terms and conditions.
- The MML allows miners to cut timber when necessary to clear land for mining activities and gives authority to the Minister responsible for Mines to authorize the clearing of trees and shrubs "necessary for the mineral rights holder's activities outside the boundaries of his license or licenses".
- In addition, the Minister responsible for mining may also provide authorisation to a mineral rights holder to "develop roads, canals, pipelines, and channels, etc. for the purpose of transporting products…", which may be on forested land.

- Mining companies may also have the right to clear timber for their own operational use (not for commercialisation), based on the terms of their concession agreement.
- A concession is considered a special legislation under Liberian law because its approval by the legislature and subsequent approval by the President puts it on par with other general legislation and it cannot be amended unless by consent of the law makers and the President.

3.1.7 Minerals and Mining Act (ACT 703 OF 2006)

This Act revises and/or consolidates the laws pertaining to minerals and mining in Liberia. It states that all minerals in their natural state in/upon the land is the property of the Republic of Liberia and is vested in the President in trust for the people.

Land in the country (see below) may be made the subject of an application for a mineral license in respect of a mineral specified in the application. Section 72 (3) further states that the lawful occupier of land which is subject to a mineral right, shall retain the right to graze livestock and cultivation as far as these activities do not interfere with the mineral operations in the area. The owner or lawful occupier shall not erect buildings or structures without the consent of the mineral right owner.

Section 72 (5) states that the owner of the mineral lease shall, in the presence of the owner or lawful occupier, and an officer of the government agency accountable for land valuation, carry out a survey of the crops on the land and shall produce a crop identification map in the event that mining activities are extended to these areas.

Section 73 of the Act provides that the owner/lawful occupier of land under a mineral right is entitled to, and may claim from the mineral right holder, compensation for the disturbance of existing rights. The amount of compensation payable shall be determined by agreement between the parties concerned. Where agreement cannot be reached, the matter shall be referred to the responsible government agency who will then determine the compensation payable by the mineral right holder.

The Minister concerned shall ensure that the inhabitants, who prefer to be compensated by way of resettlement, are settled on suitable alternate land with due regard to their economic well-being and social and cultural values. Resettlement shall be carried out in accordance with the relevant town planning laws. The cost of resettlement shall be borne by the mineral right holder as agreed by the owner/occupant or by separate agreement with the Minister.

Section 74 of the Act sets out the compensation principles. Compensation may include:

- Deprivation of the use of the land;
- Loss of, or damage to, immovable properties;
- Loss of earnings or sustenance suffered by the owner/lawful occupier for land under cultivation; and
- Loss of expected income depending on the nature of the crops on the land and their life expectancy.

The compensation agreement shall take account of the payments and the value of benefits the mineral right holder already made or undertakes to make to the owner, including the cost of resettlement, the annual ground rent, and work the holder has carried out or undertakes to carry out to make good damage to the land and improvements.

3.1.8 Liberia Extractive Industries Transparency Initiative Act (LEITI), (2009)

This Act requires that companies involved in extracting natural resources must publish what they pay, and Government must report on what they collect from the companies.

To conduct, as frequently as may be necessary and through independent firms:

- Appropriate audits and/or investigations of the process by which each material concession, contract, license, and other right is awarded by the Government in respect of mining, agriculture and other designated resource sectors of Liberia in order to determine that each concession, contract, license, and similar right was awarded in compliance with applicable Liberian laws;
- To serve as one of the national depositories of all concessions, contracts, and licenses and similar agreements and rights granted by the Government of Liberia to individuals and companies in respect of

the mining and other designated sectors; and to grant members of the public access to such concessions and agreements in keeping with their status as public documents;

- The sectors of extractive and other natural resources covered by and within the scope of the LEITI are: (1) The Mining Sector; (2) the Oil and Natural Gas Sector; (3) the Agriculture and Forestry Sectors; and (4) such other sectors as the MSG may subsequently determine with the consent of the Government.

3.1.9 National Environmental Policy (2002)

The Liberian government has a National Environmental Policy that was approved in November 2002. This policy seeks to ensure the improvement of the physical environment, quality of life and co-ordination between economic development, growth, and sustainable management of national resources. The following sections are relevant to the ESIA:

- Section 4.8, which states that the "EIA process must document, evaluate, store, disseminate and utilize local and traditional knowledge and practices with regard to environment and natural resource management"
- Section 5.9-4, which states that "mining activities should take into consideration the socio, cultural and economic impact of the area"; and
- Section 6, which states that "stakeholder participation should be encouraged to involve everyone in decision-making, planning and implementation".

3.1.10 The Environment Protection and Management Law (EPML) 2003

According to the 2021 Revised Environmental and Social Impact Assessment/Strategic Environmental Assessment (ESIA/SEA) Procedural Guidelines (Republic of Liberia Environment Protection Agency, 2022), the principal agency for the management of the environment in Liberia is the Environmental Protection Agency (EPA). The Environmental Protection Agency Act of Liberia (EPA, 2003) mandates the EPA to coordinate, monitor, and supervise all activities in the field of the environment. The EPA makes it mandatory to file an Environmental and Social Impacts Assessment (ESIA) and Environmental Impacts Statement (EIS) to obtain government approval prior to initiating activities (Part III Section 10, EPML, 2003).

The guidelines highlight the stages of the ESIA processes.

The ESIA processes has two main parts with nine component phases, namely:

- Part 1:
  - Application package, in a form of a formal letter addressed to the Executive Director of the Agency;
  - Environmental Project Brief: following a response from the EPA
- Part 2 (Section 21 of the Environmental Protection and Management Law, 2003):
  - project screening;
  - scoping;
  - assessment process, which includes the environmental baseline; investigation of potential environmental and social impacts of the proposed project;
  - review by the agency;
  - public hearing;
  - decision making; and
  - Follow-up that ensures that proponents adhere to the terms and conditions enshrined in their permits.

This ESIA process is similar to other EIA processes worldwide in that the ESIA is a process that analyses and evaluates the impacts that human activities can have on the environment. Also, its purpose is to guarantee a sustainable development that is in harmony with human welfare and the conservation of ecosystems; thus, proven itself to be an effective tool in environmental planning and management.

Section 8 states:

- An environmental impact assessment (EIA) license or permit need to have been approved before the commencement of any large-scale mining concession and "selective removal of single commercial tree species".
- The EIA must include the location of the project and the projected areas of land, air and water that may be affected, among other information.
- The EIA process provides an opportunity for the Environmental Protection Agency (EPA) to determine whether a concession should be approved in its proposed location or whether it will have too significant of an impact, including on forests.

Section 21 states:

- If the impact on the environment is deemed significant or irreversible, the EPA can reject the EIA license, thereby effectively halting the conversion project.

Section 74 states:

The Agency may by published notice, prescribe general or specific guidelines or standards for the management of rivers, lakes, and wetlands which shall include the following:

- The control measures to be taken in the harvesting of minerals including strategies for the restoration of mining sites;

3.1.11 Environmental Protection Agency Act (2003)

To ensure the effectiveness of the National Environmental Policy, the establishment of a functional, independent, and authoritative institutional body for the management of the environment was required. Thus, the Environmental Protection Agency (EPA) of Liberia was established in 2002. The Agency coordinates, monitors, supervise and consult with relevant stakeholders on all activities in the protection of the environment and sustainable use of natural resources.

3.1.12 National Environmental Action Plan

The National Environmental Action Plan, prepared every five years, provides general guidelines for the management and protection of the environment and natural resources of Liberia, well as the strategies for preventing, controlling, or mitigating any negative effects. The Plan is linked with County Environment Action Plans and forms the basis of national environmental planning and implementation of development programmes.

3.1.13 National Forest Policy (2006)

The National Forest Policy was published in 2006. The aim of the forestry policy of Liberia is to conserve and sustainably manage all forest areas, so that they will continue to produce a complete range of goods and services for the benefit of all Liberians and contribute to poverty alleviation in the nation, while maintaining environmental stability and fulfilling Liberia's commitments under international agreements and conventions.

3.1.14 Forest Development Authority

The Forest Development Authority (FDA) was established in 1976. The FDA oversees the sustainable management of the forest and associated resources, including forest lands and wildlife. It provides medium- and long-term planning within the forest sector, the preparation and promulgation of forest policy, law and administration, the release of forest concession agreements, monitoring activities of timber companies and managing protected area programs and wildlife and national parks.

Other FDA activities include forest conservation, educational awareness, agro-forestry programs, environmental awareness-raising in communities surrounding protected areas, and discussion of trans-border issues (such as hunting in restricted areas, which tend to extend into neighbouring countries).

3.1.15 The National Forestry Reform Law Of 2006 (NFRL)

The NFRL of 2006 amends parts of both the National Forestry Law of 2000 and the Act Creating the Forestry Development Authority.

The National Forestry Reform Law of 2006 aims at assuring the sustainable management, conservation, protection and sustainable development of Liberia forest land. It provides for rules on the ownership and use of forest resources, policy and planning in relation to forests, the commercial and other use of forest resources, contractual aspects of forest resources licenses, relations between neighbouring forest areas, environmental protection, protected areas network and wildlife conservation, community rights and forests management, rights of land owners and occupants, public use of holder infrastructure, trade in forest resources, fiscal provisions, measures for the promotion of forestry and wildlife activities, dispute resolution, miscellaneous, offenses and penalties, regional and international forestry initiatives and conventions.

- Section 8(1)(c) states that no person shall conduct activities on public private Forest Land in violation of the Forest Management Guidelines or the Code of Forest Harvesting Practices
- Section 8(1)(d) states that no person shall waste Forest Resources, expose natural resources to damage, destroy the long-term productivity of Forest Land, or significantly harm the forest Environment, unless:

  The action has been approved under the environmental impact assessment laws of the Republic
- Section 8(2)(c): The Government shall not grant Class B or Class C Mineral Rights in Protected Areas or Proposed Protected Areas.
- Section 8(2)(d): The Government shall not grant Class A Mineral Rights in National Forests or Proposed Protected Areas unless:
  - The Authority has concurred with the grant;

(ii) The Authority has written appropriate guidelines for maximum protection of the Environment and sustainable management of the forest during exercise of the grant; and

(iii) Compliance with the guidelines is a condition of the grant.

- Section 9.10(v): No Person shall In a National Forest, prospect for minerals or undertake Class B or C mining.
- Community forests may not be used for conversion to agriculture or mining.
- Protected Forest Areas[1] would generally be ineligible for conversion. However, certain mining activities[2] could still be undertaken in a National Forest (one type of Protected Forest Area) once the FDA approves the grant of a mineral right and provides written guidelines for maximum protection of the environment and sustainable forest management during the mining.
- Section 8.2: It should be noted that the Lake Piso Basin Multiple Sustainable Use Reserve, Sapo National Park and East Nimba Nature Reserve have been granted protected forest area status through legislation: An Act for the Establishment of The East Nimba Nature Reserve, An Act for the Extension of the Sapo National Park and An Act to Establish Lake Piso Basin Multiple Sustainable Use Reserve. The Government gazetted and endorsed three Protected Forest Areas and identified eleven additional areas as proposed Protected Forest Areas.

3.1.16 Liberia Land Commission Act (2009)

The objective of the Act is to propose, advocate and coordinate reforms of land policy, laws, and programs in Liberia. It does not have adjuratory or implementation role. The goal of the commission is to develop a comprehensive national land tenure and land use system that will provide equitable access to land and security of tenure so as to facilitate inclusive sustained growth and development, ensure peace and security and provide sustainable management of the environment.

3.1.17 Revised Law and Administrative Regulations for Governing the Hinterland, 2001

Article 66 of the Revised Law and Administrative Regulations for Governing the Hinterland of 2001 states that title to the territory of the Republic of Liberia is vested in the state. The right and title of a tribe to an adequate

[1] Protect Forest Areas include: National Park, Nature Reserve, Strict Nature Reserve, Game Reserve, communal forest, and cultural sites.

[2] Class A Mineral Rights are a mining license for a proposed production area, valid for no more than 25 years: New Minerals and Mining Law, 2000, section 6.5.

land area for farming and other enterprises essential to the necessities of the tribe/clan are reserved, whether or not they have procured deeds from the Government.

Article 66 of the Act further states that when the tribe should 'advance', they should petition the Government for the division of the land into family holdings and the Government should grant deeds to each family in fee simple, which is the highest form of ownership.

Article 67 of the Act provides that an individual who is not a member of a tribe may enter a tribal land for the purpose of using a portion of the land after obtaining permission from the Tribal Authority concerned prior to commencing activities and upon payment of some token in the nature of rent.

3.1.18 National Zoning Act of The City Of Monrovia Of 1957

The National Zoning Act of the City of Monrovia is currently under review with the aim of re-enactment so that its mandates cover the entire country as well as incorporate contemporary realities. The Act prescribes that anyone seeking to construct, or alter a structure in Liberia, must first apply for a Zoning or Occupancy Permits at the Ministry of Public Works through its National Zoning Office. Upon review and subsequent inspection of the permit request, the Ministry will issue a final certificate of occupancy or construction. Under the Zoning Act, all applicants need a zoning permit prior to construction.

3.1.19 The Liberia Land Authority Act (LLA) Of 2016

The Liberia Land Authority is an autonomous agency of the Government established by an Act of National Legislature. The LLA is a product of the policy, legal and institutional reform of the land sector of Liberia led by the Erstwhile Land Commission. Their functions include the developing of policies in support of land governance, including land administration, use and management.

Governance functions include the control and management of land in the interest of equitable development, access to and use of Public Land and Government Land, except for Reserves, Protected Areas, Proposed Protected Areas. Land use and management functions include to promote, support and ensure the development of land use management plans and zoning schemes and their implementation through counties, districts and other local government structures.

The LLA serves as a central act governed by a Board of Commission. There are four mandate areas organized under four departments each headed by a commissioner:

1. Land Policy and Planning

2. Land Administration

3. Land Use and Management; and

4. Administration and Customer Services

Before committing an area identified in the National Forestry Management System to a proposed land use, the Authority shall validate the suitability of the area for the proposed land use in cooperation with the Liberia land Authority Act of 2016.

There are four categories of land ownership in Liberia, namely:

- Public Land;
- Government Land;
- Customary Land;
- Private Land.

LLA amends the Environmental Protection Agency of Liberia:

- Section 6(1)(a) "Propose environmental policies and strategies to the Policy Council and ensure the integration of environmental concerns in overall national planning in cooperation with the LLA.

3.1.20 Land Rights Law 2018

The Land Rights Law outlines the procedures for obtaining rights to any piece of land in Liberia through purchase, donation, intestacy, gift, will or Adverse Possession; provided that in all cases a valid acquisition of Private Land may be only by persons qualified to hold Private Land in keeping with Article 15:

- Natural persons who are citizens of Liberia;
- Sole proprietorships and partnerships owned entirely by Liberian citizens;
- Corporations owned entirely by Liberian citizens; and
- Missionary, educational or other benevolent institutions.

It distinguishes land ownership in Liberia into four categories: Public Land, Government Land, Customary Land and Private Land, which can be acquired by any of the following means:

- By treaty;
- By prior or pre-existing possession and usage;
- By donation;
- By purchase;
- By abandonment;
- By reversion;
- By escheat;
- By confiscation; and
- By Eminent Domain.

3.1.21 Biodiversity Legislation and Policy

Liberia ratified the Convention on Biological Diversity (CBD) on 8 November 2000; this acts as the over-arching framework for all Government legislation and policy concerning the conservation and sustainable use of biodiversity and the equitable sharing of its benefits.

3.1.22 National Biodiversity Strategy and Action Plan (NBSAP)

This is the key government policy regarding biodiversity at a national level. The goals and objectives are developed in consonance with the guiding principles. Those relevant to the current project are:

- Liberia's economic development must be based on sustainable use and sound management of renewable and non-renewable resources;
- Ecosystem approach should be seen as critical to comprehensive and effective conservation and sustainable use of biological diversity;"
- The NBSAP has an overall goal in very general terms, and six specific goals, only the first of which has direct relevance to the Project, which is:

"*To take appropriate measures to protect critical ecosystems against harmful effects or destructive practices for conservation of biological diversity*" and to meet this, 16 objectives are elaborated, those most relevant to the project being:

- Manage, conserve, protect and maintain game species and agricultural biodiversity as well as representative samples of forest ecosystems, inland water ecosystems, coastal and marine ecosystems, wetlands, and natural heritage sites;
- Develop EIA criteria for all programs and projects that are likely to have significant impacts on biological diversity;
- Leave enclaves of natural forests on higher elevations and along waterways; and
- Regulate the introduction of alien species.

3.1.23 Wildlife And National Parks Act (1988)

This Act covers the policies and objectives, the administration, and the establishment of protected areas, as well as their management including plans, and prohibited acts; controls on hunting; and the establishment of protected species.

3.1.24 The Independent National Commission on Human Rights Act Of 2005

The above Act establishes the framework upon which a complaint regarding the violation of a person's human rights can be received and investigated. The Commission is authorised to review national legislation and recommend provisions to ensure that laws are harmonised with international human rights standards and instruments. The Commission is authorised to draw to national attention, the violation of human rights of persons in any part of the country.

3.2 MANAGEMENT AT A LOCAL LEVEL

3.2.1 Statutory Management Practices

In support of the establishment of the EPA, County and District environmental committees have been established, which are responsible for the local delivery of national environmental policy and priorities. In a move towards a more bottom-up approach, a key function of the committees is to articulate local level environmental issues to the EPA who in turn are charged with formulating and passing on a relevant response for local level implementation.

In addition, the EPA is mandated to appoint environmental inspectors within districts to monitor the implementation of environmental standards. The power of these inspectors is wide ranging and includes the provision to close "any manufacturing plant, establishment or other activity which pollutes or is likely to pollute the environment, contrary to the provisions of the Act".

3.2.2 Traditional Management Practices

Local level resource management is implemented through traditional systems and practices. At the lowest level of local administration, power and decision-making is in the hands of traditional tribal authorities. The highest rank is that of Paramount Chief who is responsible for the actions of a number of Clan Chiefs. The Paramount Chief is elected by the chiefs and elders but serves at the discretion of the President, who may veto the election. The Paramount Chief has responsibility for enforcement of tribal customs, aspects of law and order, collection of taxes by lower rank chiefs, and promotion of agriculture, industries, trade, and welfare.

Chiefs are not government employees but retain a portion of taxes for their services and for local projects. Traditionally, their power is largely determined by their control (not ownership) of land. The interactions between the State and its institutions with the traditional tribal institutions and practices are regulated by the Hinterland Laws 1949.

3.3 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS (IFC)

The Matambo Open Pit Project ESIA has considered the applicable laws, guidelines and standards in Liberia. In the absence of local legislation, guidelines or standards concerning a specific environmental aspect (e.g. environmental noise), the ESIA has considered relevant international guidelines and standards such as those published by the IFC.

The IFC, a member of the World Bank Group, has adopted a suite of performance standards on social and environmental sustainability. These performance standards provide guidance on the management of projects related to social and environmental risks and impacts, as well as to enhance development opportunities in its private sector financing. The IFC performance standards are widely regarded as international best practice about the management of impacts associated with large project developments.

The technical reference documents of Good International Industry Practice ('GIIP') is used as guidance on the practices to be implemented on the existing Ndablama mine and will continue to be implemented on the Ndablama Underground project (IFC, 2007).

The IFC's updated Sustainability Framework came into effect on 1 January 2012 and reflects the evolution in good practice for sustainability, risk mitigation, and transparency. This process resulted in the publication of an update of the 2006 Performance Standards. Key changes were made in the following areas: climate change,

business and human rights, free, prior, and informed consent for indigenous people, project categorization, financial intermediaries, supply chains, and the Access to Information Policy.

The Sustainability Framework consists of:

- The Policy on Environmental and Social Sustainability, which defines IFC's commitments to environmental and social sustainability;
- The Performance Standards, which define clients' responsibilities for managing their environmental and social risks; and
- The Access to Information Policy, which articulates IFC's commitment to transparency;

3.3.1 General Environmental, Health & Safety Guidelines

The IFC's Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice ('GIIP'). These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines (such as for mining). The general EHS guidelines for environment cover:

- Air Emissions and Ambient Air Quality.
- Energy Conservation.
- Wastewater and Ambient Water Quality.
- Water Conservation.
- Hazardous Materials Management.
- Waste Management.
- Noise and
- Contaminated Land.

The remaining general EHS Guidelines (IFC, 1998) address occupational health and safety and community health and safety. The sector specific EHS guidelines for mining address mining specific environmental, occupational and community health and safety, closure and post closure impacts and management. Specific performance indicators and monitoring guidelines are given for emissions and effluent, environmental monitoring and occupational health and safety.

3.3.2 IFC EHS Guidelines: Mining

These guidelines provide information specific to the environmental health and safety concerns that would arise during various phases of mining relating to the environment and the mine workers.

3.3.2.1 Environmental impacts and management

WATER MANAGEMENT

The management of water availability, use and water quality in and around mine sites is a concern for both local communities and authorities regulating environmental health. Mining activities often result in long-term environmental degradation in groundwater and surface water bodies due to discharge, pollution, and seepage through tailings. The EHS Guideline for Mining provides effective management practises to eliminate, or reduce the impacts caused by the mismanagement of water. The recommended practices for managing water use and quality entail: a Sustainable Water Supply Management Plan, reuse, recycling, and treatment of water, establishing a water balance and assessing the impact of dewatering to the water balance, minimizing make-up water, monitoring the water quality at discharge points, and treating effluent discharge.

The management of stormwater is categorized according to the phases of the operation although these can span over various mine phases. Some practises recommended to manage the stormwater flow in mining areas is to reduce the exposure of sediment-generating materials to wind and water. Diverting runoff from undisturbed areas around disturbed areas is another practise to implement. Furthermore, constructing haul roads to a gradient and to maintain and prevent storm water channels from erosion will manage stormwater.

In addition to the prevention and control of stormwater and water quality and use, effluents, wastes, and potential releases of hazardous materials should also be managed. Additional recommendations for the management of potential sources of groundwater contamination, primarily associated with leaching and solution mining activities as well as tailings management and Acid Mine Drainage (AMD) is discussed as part of the EHS for Mining (2007).

WASTE

Mines generate large volumes of waste throughout their life cycle. Waste dumps, tailing dams and containment facilities are designed to appropriately manage and assess the risk posed by waste. Solid wastes may be generated in any phase of the mine cycle. The most significant waste generating mining activities will likely occur during the operational phases. Other types of solid wastes may include leach pad waste, Acid Rock Drainage, metal leaching, workshop scrap, household and non-process-related industrial waste, as well as waste oils, chemicals, and other hazardous wastes (EHS, 2007).

Recommended management of waste rock dumps include the management of Potential Acid Generating (PAG) wastes, considering potential change of geotechnical properties and appropriate planning of terraces and lift. Tailing management strategies should consider how they are handled and disposed of during operation, as well as permanent storage after decommissioning. Factors to also consider are topography, downstream receptors and the physical nature of the tailings. Tailings and leach-pad waste management are often site-specific considering metal leaching capability, seepage and planning the design and lining accordingly. Hazardous and non-hazardous waste is discussed in detail in the EHS Mining Guidelines. These guidelines entail separating hazardous, non-hazardous and rock waste and the treatment or recycling of waste.

WASTEWATER AND AMBIENT WATER QUALITY

TABLE 3-2 indicates the sanitary wastewater from industrial facilities may include effluents from domestic sewage, food service, and laundry facilities serving site employees. Miscellaneous wastewater from laboratories, medical infirmaries, water softening etc. may also be discharged to the sanitary wastewater treatment system (EHS, 2007).

TABLE 3-2: INDICTIVE VALUES FOR TREATED SANITARY SEWAGE DISCHARGES

POLLUTANTS UNITS GUIDELINE VALUE	POLLUTANTS UNITS GUIDELINE VALUE	POLLUTANTS UNITS GUIDELINE VALUE
pH	pH	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPN[a] / 100ml	400[b]
Notes: [a] Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation. [b] MPN = Most Probable Number		

EMISSIONS AND EFFLUENT

Effluent is the outflowing of contaminated water or gas to a natural waterbody. Leaks, spills or accidental releases of hazardous materials (such as cyanide) into surface water, soils and groundwater resources are all sources of effluent. Secondary containment can restrict movement of hazardous material into water bodies through walled sections in pipelines and shutoff valves to minimize spill volumes. Cyanide use should be consistent with the principles and standards of practice of the International Cyanide Management Code.

TABLE 3-3 presents effluent guideline values for environmental monitoring. Guideline values for process effluents in this sector are indicative of good international industry practice as reflected in relevant standards of countries with recognized regulatory frameworks.

TABLE 3-3: EFFLUENT GUIDELINES

POLLUTANTS	UNITS	GUIDELINE VALUE
Total Suspended Solids	mg/L	50
pH	S.U	6-9
COD	mg/L	150
BOD_5	mg/L	50
Oil and Grease	mg/L	10
Arsenic	mg/L	0.1
Cadmium	mg/L	0.05
Chromium (VI)	mg/L	0.1
Copper	mg/L	0.3
Cyanide	mg/L	1
Cyanide free	mg/L	0.1
Cyanide WAD	mg/L	0.5
Iron (total)	mg/L	2.0
Lead	mg/L	0.2
Mercury	mg/L	0.002
Nickel	mg/L	0.5

POLLUTANTS	UNITS	GUIDELINE VALUE
Phenols	mg/L	0.5
Zinc	mg/L	0.5
Temperature	°C	<3-degree differential
Note: Metal concentrations represent total metals		

The IFC encourage emissions management as part of their guidelines. Mining activities jeopardise ambient air quality by dust emissions, gases from fuel combustion, fugitive dust from blasting, haul roads and construction. Practices should be in place to prevent, eliminate or reduce emissions through dust suppression techniques, vegetation, enclosed chambers for dusty equipment and materials and by minimizing fall height of material.

OTHER ENVIRONMENTAL FACTORS

- Terrestrial habitats changes and land use changes influenced by mining is one of the most significant potential threats to biodiversity. Habitat alteration may occur during any stage of the mine cycle with the greatest potential for temporary or permanent alteration occurring during construction and operational activities, but can include exploration phase construction.
- Noise and vibrations should be minimized and should meet the noise guideline as presented in the General EHS Guidelines
- Recommended practices for the conservation of energy are to correctly size motors, use renewable energy where possible and to use non-invasive technology for exploration purposes.

3.3.2.2 Occupational health and safety

Mining activities should seek to provide an operation where people are able to work without being injured and where the health of the workforce is promoted. Practices should be based on job safety analysis or comprehensive hazard or risk assessment using established methodologies such as a hazard identification study (HAZID), hazard and operability study (HAZOP), or a quantitative risk assessment (QRA). Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, chemical, biological, and radiological health and safety hazards described in the General EHS Guidelines. In addition, underground mines should have a tagging system to account for all persons traveling underground.

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH), 21 the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),22 Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),23 Indicative Occupational Exposure Limit Values published by European Union member states, 24 or other similar sources.

AIR QUALITY

Ventilation, dust control measures and air-cooling systems are essential in maintaining a safe and clean source of air and maintaining visual clarity in underground mines. Operators and maintenance personnel should undergo training concerning problems resulting from explosive atmospheres, products of combustion, dust, and diesel fumes. Thermal conditions should be monitored to identify adverse effects that cause heat and cold stress and protective measures should be implemented to promote worker health. Underground mines should in particular control operating procedures associated with blasting, drilling, and material transport and dumping. Recommended management strategies are further outlined in the EHS Mining Guideline.

FIRE AND EXPLOSIONS

Underground mines should prepare and implement plans to prevent, detect and combat outbreaks and spread of fires. Some measures include fire hazard assessments on a recurrent basis, avoiding oil fille transformers

underground, ensuring fireproofed facilities are used for flammable and hazardous material, fully equipped, and located. Additional measures for gaseous mines are described in the EHS mining guideline.

REFUGE BAYS AND SELF RESCUERS

Underground mines require secondary, or auxiliary exists and mine refuge chambers. These should be designed to be clearly identified, within 15 min traveling time, equipped with independent connections to the surface and constructed from non-combustible material and sealing mechanism. Based on an assessment of potential risk of encountering oxygen deficient atmospheres underground mining workers should be trained and equipped in the use of self-contained self-rescue devices (SCSRs) carried at all times and providing at least double the time to reach an exist or chamber.

ILLUMINATION

Illumination should adhere to the standards for safe working conditions and be adequate for the safe performance of work functions as well as the movement of workers and equipment in the travel paths and mine working areas. Underground workers should have an approved cap lamp at all times while underground. Guidelines for permanent lighting and separate, independent emergency light sources are given in the EHS Guideline for Mining.

TABLE 3-4 below provides illumination guidelines for mining activities.

TABLE 3-4: MINIMUM AVERAGE ILLUMINATION FOR DESIGNATED MINE LOCATIONS AND ACTIVITIES

LOCATION / ACTIVITY	MINIMUM ILLUMINATION (LUX)
Emergency lighting	5
Walkways and Passages	5-10
Dynamic Locations-production and development areas	5-50
Areas with occasional and simple manual tasks	50-100
Workstations and areas with medium to high precision manual tasks	150-400

GENERAL OCCUPATIONAL HEALTH AND SAFETY MEASURES

- Hazardous Substances should be managed at safe levels as prescribed in the General EHS Guidelines. Eyewash stations and emergency shower systems should be provided in areas where the possibility of chemical contamination exists and rapid treatment Materials Safety Data Sheets (MSDSs) should be available for all hazardous materials held on site.
- Explosives should be used in accordance with local or national safety regulations, operated by certified blasters or explosives experts, actively managed. Procedures, training and warning devices specifically for handling explosives should be implemented.
- Management practices for electrical safety and isolation should be adhered to
- Physical hazards may include rockfalls, face slumping, land collapse and landslides, transport hazards, heights or moving machinery. Prevention and control strategies recommended with regards to physical hazards are described in the EHS Guideline for Mining.
- Possible activities requiring fitness for work should be identified through a risk assessment to prevent injuries, equipment damage or environmental impact that could result from fatigue or impaired fitness for work.
- Mitigation measures should be in place to minimize travel and remote site health impacts often associated with remote regions and frequent travel.

Noise and vibration resulting from earth moving equipment, blasting and mining should be managed as prescribed in the EHS Guideline for Mining.

3.3.2.3 Community health and safety

There are many community health and safety concerns that may be associated with mining activities and transport safety along corridors. Community concerns include amongst others transport and handling of dangerous goods, impacts to water quality and quantity, development of new vector breeding sites and the transmission of communicable diseases.

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction, operation and decommissioning. Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards.

Recommendations for the management of these issues are described in the General EHS and Mining Guidelines. Important factors to consider are:

- Tailing Dam Safety as it is dependent on location with regards to human settlement;
- Water Storage Dams that will affect patterns of vector breeding sites;
- Land Subsidence as it leaves the land prone to flooding and can lead to damages to property;
- Communicable diseases that can be prevented by improved sanitation;
- Emergency Preparedness and Response Plan; and
- Specific vector control and prevention strategies.

Groundwater and surface water represent essential sources of drinking and irrigation water in developing countries, particularly in rural areas where piped water supply may be limited or unavailable and where available resources are collected by the consumer with little or no treatment. Project activities involving wastewater discharges, water extraction, and diversion or project activities should not compromise the availability of water for personal hygiene needs and should take account of potential future increases in demand. The overall target should be the availability of 100 litres per person per day although lower levels may be used to meet basic health requirements. Water volume requirements for well-being-related demands such as water use in health care facilities may need to be higher.

3.3.3 Mine Closure and Post-Closure

Mine closure and post-closure activities should be considered as early as possible in the planning and design of the mine, giving consideration to financial feasibility, future public health, land-use and sustainability in the long tern and possible adverse socio-economic impacts. Mine sponsors should prepare a Mine Reclamation and Closure Plan (MRCP) prior to the start of production wherein sustainable funding sources are identified.

3.3.4 Human Rights Considerations

International best practice requires that Business should respect and support the protection of international human rights. Business should integrate human rights commitments into their company policies and decision-making processes and assess actual and potential human rights impacts of their activities and relationships. Additionally, companies should ensure that all stakeholders have access to effective grievance mechanisms to redress adverse human rights impacts.

Avesoro has commissioned a Human Rights Impact Assessment (HRIA) to assist the company with assessing potential human rights impacts/risks and developing measures to address human rights risks within the context of the RAP and CDP. The objectives of the HRIA were to:

- Identify any potential and/or existing human rights risks associated with the Project;
- Assess any potential and/or existing human rights risks and impacts; and
- Develop measures for incorporating human rights in the RAP implementation and overall project management process.

The findings and recommendations of the HRIA are presented in the NLGM HRIA report (refer to Digby Wells, 2013: New Liberty Gold Mine Human Rights Impact Assessment).

3.3.5 Corporate Policies

As a local operating company of Avesoro, the conduct and operations of BMMC (Bea Mountain Mining Corporation) in Liberia will be and are dictated by a suite of guidelines, policies and plans which set out the company's commitment to the environment, sustainability, and social issues.

These are summarised in the revised environmental policy statement:

- Implementation of environmental management systems that are compatible with ISO 14001 EMS;
- ISO 14001 certification for all production facilities;
- Compliance with all relevant environmental laws and regulations and other company commitments;
- Continuous and sustainable improvement in environmental performance, taking advantage of systematic monitoring and aiming at pollution prevention;
- Development, improvement and application of low impact, environmental production methods taking benefit of locally available materials;
- Efficient use of natural resources, energy and land;
- Management and reduction where technically and economically feasible of the CO_2 footprint of gold production;
- Employment commitment and responsibility in environmental performance;
- Supplier and contractor awareness and respect of the environment policy; and
- Open communication and dialogue with all stakeholders affected by BMMC's Mining operations.

Key elements of these policies are:

- The implementation of environmental management systems including an EMS, compatible to ISO 14001 system;
- Compliance with all relevant national environmental and community engagement laws and regulations and other company commitments, keeping the Company's environmental impact to a minimum; and
- Working towards a goal of zero accidents, zero significant environmental incidents, social incidents and health injuries to establish and maintain a safe working environment.

To ensure that these policies and plans are delivered at the local level, BMMC is putting into place a management and monitoring framework which will place the onus on its national and international operating companies to deliver the company commitment.

3.3.6 Other Legislation and Policy

This relates principally to legislation and policy applicable to social, economic and community issues which are currently being addressed. It is anticipated that this will include legislation and policy relating to economic development, land tenure, labour laws, health and safety, and community rights, etc.

3.3.6.1 Terms of the mineral development agreement

Section 16 of the MDA between BMMC and the Government of Liberia is of relevance to the ESIA which reads "16.1 Environmental Impact Statement: The Parties recognize that operations may result in some pollution, contamination or other environmental damage to land, water and the atmosphere within the Contract Area and elsewhere. Accordingly, the Operator shall submit to the Minister before the commencement of Exploration and Production an Environmental Impact Statement (EIS). The EIS shall show the adverse effect operations will have on the environment and review plans to mitigate such effects".

3.3.6.2 Bea Mountain Mining Corporation Mineral Development Agreement

As was mentioned, BMMC holds a Class A mining license to mine the New Liberty gold deposit for a period of 25 years. The MDA came into effect on 14 March 2002. The following conditions in the MDA are of relevance for the Matambo OP Project:

- Section 10 states that the MDA holder shall, in the case of private land, endeavour, by direct agreement with the owner, to enter upon and use private land within the MDA contract area, as required for/by its operations. Private land refers to any land (including creeks, streams, rivers or bodies of water contained thereon, and their residue) owned by a person other than the government.
- If the operator and owner of private land in the Contract Area which the operator reasonably require for operations, cannot agree, the Government shall, at the request of the operator, acquire such land and all improvements thereon, in the public interest. The operator shall reimburse the Government for all reasonable costs in connection with such expropriation, including just compensation paid to the prior owner. Title to the property thus acquired shall vest in the Government and the Government shall grant the operator the right to enter upon, utilize and possess such land which shall be deemed part of the Contract Area.
- Section 15 of the MDA states that it is the objectives of the MDA parties that operations shall be carried out in a manner that is consistent with the continuing economic and social viability of centres of population that have formed and may form as a result of operations during the term of the MDA.
- Upon request of the Government, the operator shall consult with the Government to mutually establish plans and programmes for the implementation of the above objectives. Thereafter the operator shall cooperate with Government in its efforts concerning the realisation of such plans and programmes.
- Under Section 6.8 of the MDA, Government undertakes not to grant any Class B licenses within the Exploration Area, and furthermore warrants that all mining operations undertaken within the exploration area under Class C type licenses will not be allowed to interfere with or hinder the exploration and/or mining activities of the Operator.

3.3.7 First Amendment to the Restated and Amended Mineral Development Agreement by and between the Government of Liberia and Bea Mountain Mining Corporation (2023)

Section 8 of the First Amendment to the Restated and Amended MDA of September 2013 stipulates that BMMC shall contribute to a government managed Community Development Fund (CDF). All such contributions will be earmarked for 'community development purposes' and shall be payable annually to the Government. In addition to the CDF, the Company shall make contributions to the Clan development Funds as provided for in the Memorandum of Understanding between the Company and each host Clan.

3.3.8 International Obligations, Commitments and Conventions

Liberia is a party to a range of international conventions, a number of which have relevance to the project. Those of most relevance are presented in TABLE 3-5 below.

TABLE 3-5: INTERNATIONAL CONVENTIONS UNDER WHICH LIBERIA HAS OBLIGATIONS RELEVANT TO THE PROJECT

CONVENTION/TREATY	DATE OF APPROVAL/ CONSENT	MAIN OBLIGATIONS	RELEVANCE TO PROJECT
Convention on Biological Diversity (UN, 1992a)	08-Nov-00	Three main goals: ➲ The conservation of biological diversity; ➲ The sustainable use of its components; and ➲ The fair and equitable sharing of the benefits from the use of genetic resources.	Construction and operation of the project should lead as far as possible to **no** net loss of biological resources including genetic diversity.
Ramsar Convention on Wetlands of International Importance (UNESCO, 1971)	02-Nov-03	Advances conservation and wise use of wetlands and their resources.	Wetlands of International Importance must not be damaged in any way.

CONVENTION/TREATY	DATE OF APPROVAL/ CONSENT	MAIN OBLIGATIONS	RELEVANCE TO PROJECT
Convention on International Trade in Endangered Species of Wild Fauna & Flora (Cites)(UNEP, 1979a)	09-Jun	Strictly controls trade in endangered species.	Limits hunting of rare species.
African Convention on the Conservation of Nature and Natural Resources (OAU, 1968)	21-Sep-78	Encourage action to conserve use and develop soil, water, flora and fauna sustainably from an economic nutritional, scientific, educational, cultural and aesthetic points of view.	Needs action to conserve soil and prevent erosion; control pollution; and conserve flora and fauna.
United Nations Framework Convention on Climate Change (UN, 1992b) UNFCCC – The Paris Agreement	2003 04-Nov-2016	Requires efforts to combat global warming and a key tool in promoting sustainable development.	Various sources of CO_2 emissions.

3.4 INSTITUTIONAL FRAMEWORK

The important institutions that have a statutory role pertaining to the mining sector are briefly described below:

3.4.1 Government Ministries

3.4.1.1 The ministry of lands, mines and energy

The Ministry of Lands, Mines and Energy is tasked to protect the sustainable management and utilisation of the country's lands, mines, and energy resources. The Ministry is mandated to ensure that all issues pertaining to the environmental and social aspects related to mining operations are satisfied when a mining permit is issued.

The Lands Department within the Ministry administers land tenure, land policy, land reform, land registration, land survey and land use planning. This Department is responsible for the administration of state land and properties leased to the Government. It assists the National Housing Authority in the upgrading and resettlement of squatter areas. The Department is responsible for examining and approving land surveys and overseeing the accuracy of land surveys undertaken by registered surveyors in the country.

3.4.1.2 Ministry of internal affairs

This Ministry oversees local governance, including interaction with traditional authorities over land matters. The Ministry oversees and coordinates the activities of county superintendents, who are assisted by district commissioners. The latter are assisted by paramount, clan, and general town chiefs.

3.4.1.3 Ministry of agriculture

This Ministry oversees the agricultural lands sector and has established regulations whereby equitable and just compensation are paid for the destruction of economic trees as a result of government projects.

The valuation of crops is estimated by guidelines set by the Technical Services Directorate, in the absence of a statutory regulation. For crops not considered under these guidelines, its valuation must be estimated on what a prudent and well-informed purchaser would be willing to pay, at a fixed time, for the right to receive the income produced by that particular crop.

3.4.1.4 Ministry of public works

This Ministry is responsible for land-use zoning and enforcement of government construction and building standards. It has the responsibility to approve the design and construction of all civil works. In addition, it undertakes urban and town planning and provides architectural and engineering supervision for the construction of civil structures and waste management. The Ministry is responsible for appointing government valuers and land surveyors to assist with the implementation of government infrastructure projects.

3.4.1.5 Ministry of health and social welfare

This Ministry has a Department of Environmental and Occupational Health which manages matters relating to water and sanitation as well as general environmental issues. Its mandate requires that sanitary and working environments are conducive for all in the workplace, and that the health and safety of workers and nearby residents are ensured.

3.4.1.6 Liberia refugee, repatriation and resettlement commission

The Liberia Refugee, Repatriation and Resettlement Commission (LRRRC) was established as part of Liberia's post war reconstruction programmes. As the name indicates, the LRRRC is primarily concerned with the plight of war refugees.

3.4.1.7 Environmental protection agency of Liberia

The Environmental Protection Agency of Liberia (EPAL or EPA) is responsible for the monitoring, coordination, and supervision of the sustainable management of Liberia's environment. It is mandated to oversee the implementation of environmental impact assessment for projects and activities that are likely to have significant adverse effects on the environment.

The EPAL is further mandated to promote the preservation of important historic, cultural, and spiritual values of natural resources heritage and, in consultation with traditional authorities, enhance indigenous methods for effective natural resource management.

3.4.1.8 Local government

Key role-players in resettlement matters at the county and district levels are the offices of the County Superintendent (County Planning), and the District Commissioner, respectively. Both institutions are directly involved in matters relating to land acquisition and town planning. In this, they are supported by general town chiefs (representing towns within an area), who in turn are assisted by the town's chiefs of the respective towns.

3.4.1.9 Traditional authorities

Traditional authorities are directly involved in customary land administration in their areas of jurisdiction, as well as in upholding cultural traditions, norms, and practices. These authorities include the offices of paramount chiefs and clan chiefs.

The Paramount Chief, in conjunction with his Council of Elders, is responsible for enforcing tribal customs, aspects of law and order, as well as the collection of taxes and the promotion of development in his area of jurisdiction. He is usually elected by the clan chiefs and elders but serves at the discretion of the President of Liberia, who may veto the election.

The Paramount Chief is responsible for the actions of a number of clan chiefs, each with a council of elders. Traditionally, the jurisdiction of clan chiefs is largely determined by their control of land.

3.5 STANDARDS AND GUIDELINES

3.5.1 Legal Requirements and Noise Level Guidelines for the Republic of Liberia

The Noise Pollution Control & Standards Regulation was published by the Republic of Liberia Environmental Protection Agency on 07/04/2017 (EPA, 2017). The regulations prescribe the maximum permissible noise and vibration levels for general environment (TABLE 3-6).

TABLE 3-6: MAXIMUM PERMISSIBLE NOISE LEVELS FOR GENERAL ENVIRONMENT

FACILITY	NOISE LIMITS (dBA) (L_{Aeq})	
	DAY (6:00 TO 22:00)	NIGHT (22:00 TO 6:00)
Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms,	45	35

public library, environmental or recreational sites.		
Residential buildings	50	35
Mixed residential (with some commercial and entertainment)	55	45
Residential + industry or small-scale production + commerce	60	50
Industrial	70	60

In addition to above, the regulations also prescribe maximum permissible noise levels created from factories and workshops (TABLE 3-7), impact or impulsive noise (TABLE 3-8), construction sites (TABLE 3-9), places of entertainment, areas of worship and accelerating vehicles (TABLE 3-10). Maximum permissible noise levels for places of entertainment and areas of worship are not shown as they are not applicable to this project.

TABLE 3-7: MAXIMUM PERMISSIBLE NOISE LEVELS (CONTINUOUS OR INTERMITTENT) FROM A FACTORY OR WORKSHOP

L_{Aeq} (dBA)	DURATION (DAILY)	DURATION (WEEKLY)
85	8 hours	40 hours
88	4 hours	20 hours
91	2 hours	10 hours
94	1 hour	5 hours
97	30 minutes	2.5 hours
100	15 minutes	1.25 hours
103	7.5 minutes	37.5 minutes
106	3.75 minutes	18.75 minutes
109	1.875 minutes	9.375 minutes

TABLE 3-8: MAXIMUM PERMISSIBLE NOISE LEVELS FOR IMPACT OR IMPULSIVE NOISE

SOUND LEVEL (dBA) (L_{MAX})	PERMITTED NUMBER OF IMPULSES OR IMPACTS PER DAY
140	100
130	1 000
120	10 000

TABLE 3-9: MAXIMUM PERMISSIBLE NOISE LEVELS FOR CONSTRUCTION SITE

NOISE CONTROL ZONE	DAYTIME (L_{Aeq}) (dBA)	NIGHT-TIME (L_{Aeq}) (dBA)
Residential Area	60	40
Commercial Area	75	50
Industrial Area	85	65

TABLE 3-10: MAXIMUM PERMISSIBLE NOISE LEVELS FOR ACCELERATING VEHICLES

VEHICLE TYPE		(L_{Aeq}) (dBA)
Vehicles intended for carriage of passengers and equipped with not more than nine seats, including the driver's seat		78
Vehicles intended for carriage of passengers, and equipped with not more than nine seats, including the driver's seat and having maximum	with an engine power of more than 150 kW	80
	with an engine power of less than 150 kW	83

permissible mass of more than 3.5 tones		
Vehicles intended for carriage of passengers and equipped with more than nine seats including the driver's seat: vehicles intended for carriage of goods	with a maximum permissible mass not exceeding 2 tonnes	79
	with a maximum permissible mass exceeding 2 tonnes but not exceeding 3.5 tonnes	80
Vehicles intended for the carriage of goods and having a maximum permissible mass exceeding 3,5 tonnes	-with an engine power of less than 75 kW	81
	with an engine power of not less than 75 kW but less than 150kW	83
	with an engine power of not less than 150 kW	84

3.5.2 Water Quality Standards and Guidelines

The standards and guidelines described below were considered for this assessment.

TABLE 3-11 presents an overview of the water quality standards described by the World Health organisation (WHO), the IFC EHS Guidelines and the Liberian industrial, recreational, irrigation and fishery standards.

TABLE 3-11: WATER QUALITY GUIDELINES

	DRINKING WATER	EFFLUENT DISCHARGE	LIBERIAN INDUSTRIAL, RECREATIONAL, IRRIGATION AND FISHERY STANDARDS	
GUIDELINES	**WHO DRINKING WATER GUIDELINES (2017/2022)**	**IFC EHS MINING GUIDELINES (IFC, 2007)**	**LIBERIAN STANDARDS (1987) CLASS 2**	**LIBERIAN STANDARDS (1987) CLASS 3**
Al[3]	0.9h	-	-	-
As (soluble)	0.01		-	-
As (total)	0.01	0.1	≤ 0.05	≤ 0.2
BOD	50	50	-	-
Cd	0.003	0.05	≤ 0.001	≤ 0.01
CI	5		≤ 350.0	≤ 450.0
COD	250	150	-	-
EC (uS/m)	-	-	-	-
Cr (hexavalent)	-	0.1	≤ 0.1	≤ 0.1
Cr (total)	0.05		≤ 0.5	≤ 0.8
Cu	2	0.3	≤ 0.1	≤ 0.2
CN (free)	0.07	0.1	-	-
CN (total)	0.17a 0.5h	1	≤ 0.02	≤ 0.05
CN WAD	-	0.5	-	-
Faecal Coliform	0	-	0	≤ 5
Escherichia coli	0	-	-	-
Total coliforms	0	-	≤ 10	≤ 50
Fe	0.3a 2h	2	≤ 1.5	≤ 2.0
F	1.5	-	≤ 1.5	≤ 2.0
Hg	0.006	0.002	≤ 0.005	≤ 0.01

[3] No guideline established - A health-based value of 0.9 mg/l could be derived, but this value exceeds practicable levels based on optimization of the coagulation process in drinking-water plants using aluminium based coagulants: 0.1 mg/l or less in large water treatment facilities and 0.2 mg/l or less in small facilities

	DRINKING WATER	EFFLUENT DISCHARGE	LIBERIAN INDUSTRIAL, RECREATIONAL, IRRIGATION AND FISHERY STANDARDS	
GUIDELINES	**WHO DRINKING WATER GUIDELINES (2017/2022)**	**IFC EHS MINING GUIDELINES (IFC, 2007)**	**LIBERIAN STANDARDS (1987) CLASS 2**	**LIBERIAN STANDARDS (1987) CLASS 3**
Ni	0.07	0.5	≤ 1.0	≤ 0.1
Mn	0.08	-	≤ 0.3	≤ 0.8
PO_4	-	-	≤ 0.02	≤ 0.05
NO_3	50	-	≤ 60.00	≤ 80.0
NO_2	3	-	≤ 0.5	≤ 1.0
Oil and grease	-	10	-	-
Pb	0.01	0.2	≤ 0.1	≤ 0.1
pH	6.5-8.5s	6-9	6.0-9.0	5.5-9.0
Chlorophenols	0.2	0.5	≤ 0.02	≤ 0.05
Se	0.04	0.1	-	-
Na	200 (not of health concern)	-	-	-
SO4	250	-	≤ 200	≤ 250
TDS	1000		≤ 1000.00	≤ 1200
Temp increase	-	< 3	-	-
Total hardness	-	-	≤ 300	≤ 600
TSS	-	50	≤ 30.0	≤ 50
Turbidity (NTU)	5	-	-	-
Zn	3	0.5	-	-
Ag	-	-	≤ 0.01	≤ 0.01
V	-	-	≤ 1.0	≤ 1.0
B	2.4	-	≤ 1.0	≤ 1.0
Detergents	-	-	≤ 2.0	≤ 3.0

- The EPA documents indicate the following: In the Environmental Protection and Management Law of Liberia (EPA 2003) the Liberian government states that the agency is in place to provide clear guidelines for water management and environmental monitoring with regards to water quality (Part IV, Section 35); and
- The above instruction has, however, not been completed, and upon research into the topic no clear water quality standards for drinking water or discharge guidelines have been established by the Liberian government post 1987, except a recommendation for the use of WHO standards until new guidelines are produced.
  - This is confirmed by the National Integrated Water Resources Management Policy of Liberia (EPA 2007) that quotes the following regarding drinking water quality: "WHO drinking water standards (guidelines) should be used until one is produced according to section 35 of the Environmental Protection and Management Law of the Republic of Liberia. Due consideration shall be given to specific local conditions and water use habits which may dictate a local relaxation of these standards." (EPA, 2007).

Based on the above research, it is recommended that all drinking water classification should adhere to the Liberian drinking water standard.

The Liberian government last issued water quality guidelines in 1987 with three classes of water guidelines identified:

- Class 1 was for drinking water, which in this study, will be replaced by the WHO drinking water standards as discussed;
- Class 2 was issued for classification of water to be used for natural and cultivated fisheries, public bathing places and recreational water sports; and
- Class 3 was issued for classification of water to be used for industrial supplies and irrigation of agricultural land.
- The Liberian drinking water guideline (Class 1) has in recent legislation been replaced with the WHO standards. However, Class 2 and Class 3 can still be applicable based on a current lack of legislation for the impact on downstream users besides drinking water guidelines;
- No guidelines for effluent discharge exist in Liberian legislation and thus: Effluent discharge water quality at the point of discharge into the environment should adhere to IFC guidelines.
- If discharged waters do adhere to IFC standards, then it should also be ensured that any downstream water users do not have their water use quality compromised.

3.5.2.1 Dissolved oxygen

There are no set limits for Dissolved Oxygen in terms of Liberian legislation or the WHO Guidelines. It is important to understand that Dissolved Oxygen can be used as a measure for assessing the potential for survival of aquatic biota in a river system as biota require oxygen for respiration. With respect to the acceptable threshold, the South African standards for aquatic environments compiled by Department of Water Affairs and Forestry (DWAF, 1996) were considered.

3.5.2.2 Arsenic (As)

The IFC effluent guideline states 0.1 mg/l as the limit for Arsenic (As) in effluent water for release into the environment. The WHO guidelines for drinking water are set at 0.01 mg/l.

3.5.2.3 Iron

On the basis of iron's limited toxicity and bioavailability, it is classified as a non-critical element. Iron is an essential micronutrient for all organisms and is required in the enzymatic pathways of chlorophyll and protein synthesis, and in the respiratory enzymes of all organisms. It also forms a basic component of haeme-containing respiratory pigments (for example, haemoglobin), catalyses, cytochromes, and peroxidases. Under certain conditions of restricted availability of iron, photosynthetic productivity may be limited.

Iron criteria for the natural aquatic environment are based on dissolved iron concentrations. Because iron may occur in different forms in water, for example, in the oxidised or reduced states, in the dissolved state, as suspended particles, and as complexes with other substances, analyses need to take account of the relative proportions of each of these states. The iron concentration should not be allowed to vary by more than 10 % of the background dissolved iron concentration at a specific time.

3.5.3 Air Quality

3.5.3.1 IFC and word bank guidelines

As of April 30, 2007, new versions of the International Finance Corporation (IFC) Environmental, Health, and Safety Guidelines (known as the 'EHS Guidelines') are now in use. IFC is a member of the World Bank Group. These guidelines replace those documents previously published in Part III of the Pollution Prevention and Abatement Handbook and on the IFC website.

The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account (IFC, 2007).

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 alternate performance levels is protective of human health and the environment.

The World Bank has developed a set of guidelines and standards (TABLE 3-12) for specific process (including mining and milling Processes) and for individual pollutants (such as particulates, sulphur dioxide and oxides of nitrogen).

TABLE 3-12: WORLD HEALTH ORGANIZATION AMBIENT AIR QUALITY GUIDELINES (AS USED BY IFC)

WHO AMBIENT AIR QUALITY GUIDELINES[4]		
POLLUTANT	**AVERAGING PERIOD**	**GUIDELINE VALUE IN µG/M³**
Sulphur dioxide ($S0_2$)	24-hour	125 (Interim target -1) 50 (Interim target-2) 20 (guideline)
Sulphur dioxide ($S0_2$)	10 minute	500 guideline
Nitrogen dioxide (NO_2)	1-year	40 guideline
Nitrogen dioxide (NO_2)	1-hour	200 guideline
Particulate Matter (PM_{10})	1-year	70 (Interim target -1) 50 (Interim target -2) 30 (Interim target -3) 20 (guideline)
Particulate Matter (PM_{10})	24-hour	150 (Interim target -1) 100 (Interim target -2) 75 (Interim target -3) 50 (guideline)
Particulate Matter ($PM_{2.5}$)	1-year	35 (Interim target -1) 25 (Interim target -2) 15 (Interim target -3) 10 (guideline)
Particulate Matter ($PM_{2.5}$)	24-hour	75 (Interim target -1) 50 (Interim target -2) 37.5 (Interim target -3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target -1) 100 (guideline)

In literature, no specific guideline value has been developed for Benzene in air. Since Benzene is carcinogenic to humans, no safe level of exposure can be recommended. For general guidance, the concentrations of airborne benzene associated with an excess lifetime risk of leukaemia of 10^{-4}, 10^{-5} and 10^{-6} are 17, 1.7 and 0.17 µg/m^3, respectively (WHO 2010).

Settleable dust standards and acceptable rates have been adopted from SANDCR (South African National Dust Control Regulations - 2013). Permitted frequency of exceeding dust fall rate is two within a year, not sequential months. The local acceptable settleable dust rates are shown in TABLE 3-13.

[4] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile. Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

TABLE 3-13: SANDCR ACCEPTABLE SETTLEABLE DUST RATES

Restriction Areas	Dust fall rate (D) (mg/m^2-day)-averaged over 30 days	Permitted frequency of exceeding dust fall rate
Residential area	D<600	Two within a year, not sequential months
Non-residential area	D<1200	Two within a year, not sequential months

TABLE 3-14: SMALL COMBUSTION FACILITIES EMISSIONS GUIDELINES (3MWTH – 50 MWTH)

SMALL COMBUSTION FACILITIES EMISSIONS GUIDELINES (3MWTH – 50 MWTH) – (IN MG/NM3 OR AS INDICATED)				
COMBUSTION TECHNOLOGY / FUEL	**PARTICULATE MATTER (PM)**	**SULPHUR DIOXIDE (SO2)**	**NITROGEN OXIDES (NOX)**	**DRY GAS, EXCESS O2 CONTENT (%)**
Engine				
Gas	N/A	N/A	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Turbine				
Liquid	50 or up to 100 if justified by project specific considerations	1.5 percent Sulphur or up to 3.0 percent Sulphur if justified by project specific considerations	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.) If bore size diameter [mm] > or = 400: 1,850	15
Natural Gas =3MWTH to < 15 MWth	N/A	N/A	42 ppm (Electric generation) 100 ppm (Mechanical drive)	15
Natural Gas =15 MWth to < 50 MWth	N/A	N/A	25 ppm	15
Fuels other than Natural Gas =3MWTH to < 15 MWth	N/A	0.5 percent Sulphur or lower percent Sulphur (e.g. 0.2 percent Sulphur) if commercially available without significant excess fuel cost	96 ppm (Electric generation) 150 ppm (Mechanical drive)	15
Fuels other than Natural Gas =15 MWth to < 50 MWth	N/A	0.5% S or lower % S (0.2%S) if commercially available without significant excess fuel cost	74 ppm	15
Boiler				
Gas	N/A	N/A	320	3
Liquid	50 or up to 150	2000	460	6

Solid	50 or up to 150	2000	650	6
Notes: -N/A/ - no emissions guideline; Higher performance levels than these in the Table should be applicable to facilities located in urban / industrial areas with degraded airsheds or close to ecologically sensitive areas where more stringent emissions controls may be needed.; MWth is heat input on HHV basis; Solid fuels include biomass; Nm^3 is at one atmosphere pressure, 0°C.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. Guidelines values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent.				

3.5.3.2 Gaseous monitoring programme

Approved methods should be used to monitor gaseous pollutants (NO_x, SO_2), as well particulate matter. Recommendations for the stack measurements are Method 7 for determining NO^x, and Method 6 for determining SO_2 as prescribed by the US EPA, as well as Method 5 for Particulate Matter to acquire more accurate stack measurement

The IFC EHS guidelines recommend that the following be considered in the reduction and control of GHG emissions:

- Enhancement of energy efficiency (energy efficiency measures have already been taken into consideration in the form of conveyor belt design and layout so as to minimise inclines and promote gravity feeds);
- Protection and enhancement of carbon sinks and reservoirs (e.g. forests). This includes promoting reforestation and actively engaging in 'planting initiatives' to counterbalance the land clearing activities that will result in a loss of carbon sequestration;
- Promotion of sustainable forms of agriculture and forestry in the community;
- Promotion, development and increased use of renewable forms of energy;
- Investments in research and development of carbon capture and storage (CCS) technologies; and
- Limitation and/or reduction of methane emissions through recovery and use in waste management.

Sources of GHG emissions:

- Diesel generators
- Sewage treatment Plant
- Vehicle fleet
- Food waste

3.5.3.3 General EHS guidelines - noise and vibration

Sources of noise emissions associated with mining may include noise from vehicle engines, loading and unloading of rock into steel dumpers, chutes, power generation, and other sources related to construction and mining activities. Additional examples of noise sources include shovelling, ripping, drilling, blasting, transport (including corridors for rail, road, and conveyor belts), crushing, grinding, and stockpiling. Good practice in the prevention and control of noise sources should be established based on the prevailing land use and the proximity of noise receptors such as communities or community use areas. Recommended management strategies include:

- Noise levels at the nearest sensitive receptor should meet the noise guidelines in the General EHS Guidelines;
- Where necessary, noise emissions should be minimized and controlled through the application of techniques which may include:
- Implementation of enclosure and cladding of processing plants

Installation of proper sound barriers and / or noise containments, with enclosures and curtains at or near the source equipment (e.g. crushers, grinders, and screens)

- Installation of natural barriers at facility boundaries, such as vegetation curtains or soil berms
- Optimization of internal- traffic routing, particularly to minimize vehicle reversing needs (reducing noise from reversing alarm) and to maximize distances to the closest sensitive receptors

The most significant vibrations are usually associated with blasting activities; however, vibrations may also be generated by many types of equipment. Mines should minimize significant sources of vibration, such as through adequate design of crusher foundations. For blasting-related emissions (e.g. vibrations, air blast, overpressures, or fly rock), the following management practices are recommended:

- Mechanical ripping should be used, where possible, to avoid or minimize the use of explosives;
- Use of specific blasting plans, correct charging procedures and blasting ratios, delayed / micro delayed or electronic detonators, and specific in-situ blasting tests.
- Development of blast design, including a blasting-surfaces assessment, to avoid over confined charges, and a drill-hole assessment to check for deviation and consequent blasting recalculations;
- Implementation of ground vibration and overpressure control with appropriate drilling grids;
- Adequately designing the foundations of primary crushers and other significant sources of vibrations.

3.6 MINE CLOSURE

A Mine Reclamation and Closure Plan (MRCP) should be prepared by the sponsors in a draft form prior to the start of production, clearly indicating allocated and sustainable funding sources to implement the plan. The plan should be in accordance with the Environmental Protection Agency Act and the constitution of Liberia, as well as in compliance with the IFC performance standards, EPs and WB guidelines. Future land use should be addressed in the MRCP, approved by the relevant national authorities after consultation with local communities and government representatives.

An MRCP that incorporates both physical rehabilitation and socio-economic considerations should be an integral part of the project life cycle and should be designed so that:

- Future public health and safety are not compromised;
- The after-use of the site is beneficial and sustainable to the affected communities in the long term;
- Adverse socio-economic impacts are minimized and socio-economic benefits are maximized

Central to the closure plan is the development of a progressive rehabilitation plan which will ensure:

- 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; and
- Success criteria are agreed with relevant stakeholders, monitored, and reported to stakeholders.

The development of a mining operation, including associated processing facilities and infrastructure, usually involves the permanent alteration of existing landforms, disturbance to vegetation and flora, disruption of fauna habitats, hydrological impacts and potentially some level of contamination.

The closure plan should be regularly updated and refined to reflect changes in mine development and operational planning, as well as the environmental and social conditions and circumstances. Records of the mine works should also be maintained as part of the post-closure plan. Closure and post closure plans should include appropriate aftercare and continued monitoring of the site, pollutant emissions, and related potential impacts.

Post-mine-closure monitoring typically require a minimum period of five years or longer, based on the risk assessment as well as some form of progressive restoration during operations. While plans may be modified, as necessary, during the construction and operational phases, plans should include contingencies for temporary

suspension of activities and permanent early closure to meet the objectives for financial feasibility and physical (failure or deterioration), chemical (surface water and groundwater) and ecological (replacement of habitat) integrity.

3.6.1 Financial Feasibility

The business feasibility analysis should incorporate the mine-closure and post-closure activities already during the planning and design phases. The cost of closure at any stage in the mine life and provision for early, or temporary closure should be considered amongst other factors. Funding for these operations should be by either cash accrual system or a financial guarantee.

CHAPTER 4
PROJECT DESCRIPTION

TABLE OF CONTENTS

4 PROJECT DESCRIPTION 4-3

4.1 SUMMARY 4-3
4.1.1 Temporary Construction Permits 4-5
4.2 PROJECT LOCATION 4-5
4.3 MINE CONCESSION AREA 4-6
4.4 GEOLOGY AND MINERALIZATION 4-7
4.5 PLANNED STRUCTURES AND INFRASTRUCTURE ASSOCIATED WITH THE PROJECT 4-7
4.5.1 Matambo Open Pits and Supporting Infrastructure 4-7
4.6 EXISTING STRUCTURES AND INFRASTRUCTURE TO BE USED AT NLGM FOR THE MATAMBO PROJECT 4-15
4.7 MINING METHODOLOGY 4-15
4.7.1 Open Pits 4-15
4.7.2 Mining Fleet 4-15
4.7.3 Recruitment 4-16
4.7.4 Life Of Mine (LOM) 4-16
4.8 MINE SUPPORT ACTIVITIES 4-16
4.8.1 Storm Water Management 4-16
4.8.2 At-Source Waste Separation 4-17
4.8.3 On-Site Waste Sorting 4-19
4.8.4 Disposal and Recycling 4-19
4.8.5 Waste Management Monitoring 4-19
4.8.6 Wastewater/ Sewage/ Effluent Management 4-19
4.8.7 Hazardous Waste Management 4-20
4.9 RECOVERY METHOD AT NLGM 4-20
4.9.1 Gold Processing Plant 4-20
4.9.2 Ore Receipt and Crushing 4-20
4.9.3 Milling 4-20
4.9.4 Intensive Leach Reactors 4-21
4.9.5 Thickening and CIL 4-21
4.9.6 Elution 4-21
4.9.7 Gold Room 4-21
4.9.8 INCO 4-21
4.9.9 Tailings Storage Facility (TSF) 4-22
4.9.10 Reagents 4-22

LIST OF FIGURES

FIGURE 4-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC-MDA 4-4
FIGURE 4-2: REGIONAL SETTING OF THE MATAMBO RESOURCE WITHIN THE BMMC MDA 4-6
FIGURE 4-3: PIT SHELLS 4-8
FIGURE 4-4: GENERAL LAYOUT FOR THE MATAMBO MINE PROJECT 4-9
FIGURE 4-5: CAMP DESIGN 4-13
FIGURE 4-6: PLANNED STORMWATER DIVERSIONS 4-17
FIGURE 4-7: DRAINAGE AREAS RELATED TO MATAMBO 4-18
FIGURE 4-8: MINE SITE LAYOUT AND SELECTED PHOTOS FROM JANUARY 2024 4-23

LIST OF TABLES

TABLE 4-1: PROJECT ACTIVITIES ASSOCIATED WITH THE PROJECT 4-10
TABLE 4-2: APPROXIMATE DIMENSIONS OF WRDS AND STOCKPILES 4-11
TABLE 4-3: APPROXIMATE PIT DIMENSIONS 4-15
TABLE 4-4: REQUIRED MINING EQUIPMENT 4-16

4 PROJECT DESCRIPTION

4.1 SUMMARY

Avesoro Resources Inc. (Avesoro) is a privately-owned gold production subsidiary of Avesoro Jersey Limited. Avesoro explores for, develops, and operates gold assets in West Africa. The company primarily owns interests in the New Liberty Gold Mine (NLGM) located in Liberia.

Bea Mountain Mining Company (BMMC) is a wholly owned in-country subsidiary of Avesoro. BMMC signed a Mineral Development Agreement (MDA) with the Government of the Republic of Liberia on 28 November 2001 to conduct exploration for gold within the MDA area boundary for a period of 25 years, with an option to extend this term for additional terms of 25 years. The parties entered the Restated and Amended Mineral Development Agreement on 7 September 2013 and the first amendment to the Restated and Amended Mineral Development Agreement was approved by the President of the Republic of Liberia on 14 September 2023 for 25 years commencing from the first Amendment Effective Date. BMMC hold a class A mining license for the MDA area, which was issued by the Liberian Ministry of Mines and Energy (MME) on 29 July 2009 and amended on October 23, 2023. The entire MDA property covers an area of 537 km^2 (FIGURE 4-1**)**.

The Matambo Resource is situated in the north-west of the MDA area. BMMC proposes developing the Matambo Resource by means of open pit mining of three pits. High-grade ore will be transported to the existing plant at NLGM via a private road, where the ore will be processed via the existing Carbon-in Leach (CIL) processing plant.

The development of the proposed Matambo Mine (the Project) will include the following activities and infrastructure (FIGURE 4-4):

- Establishment of three open pits (one large pit to the northeast and two smaller pits to the west) and associated saprolite, topsoil stockpiles and Waste Rock Dumps (WRD);
- Ore stockpiles (including low-grade ore stockpile);
- Ore transportation to NLGM for further processing at the existing CIL Plant;
- Mine services area;
- Storm water management infrastructure;
- Dewatering infrastructure and equipment;
- Haul road, internal access roads and associated borrow pits for road building material;
- Support facilities and infrastructure at the mine site, including water and waste storage facilities;
- Staff accommodation and associated facilities such as a sewage treatment plant;
- Power and water supply;
- Ancillary facilities and buildings, such as administrative offices, service buildings, hydrocarbon storage, workshops, and explosives storage.

The proposed mining activity is listed as item 15 in Annex I of the Environment Protection and Management Law of The Republic of Liberia. Accordingly, in terms of Section 6 of the Act, BMMC is required to apply for an environmental license to conduct the activity.

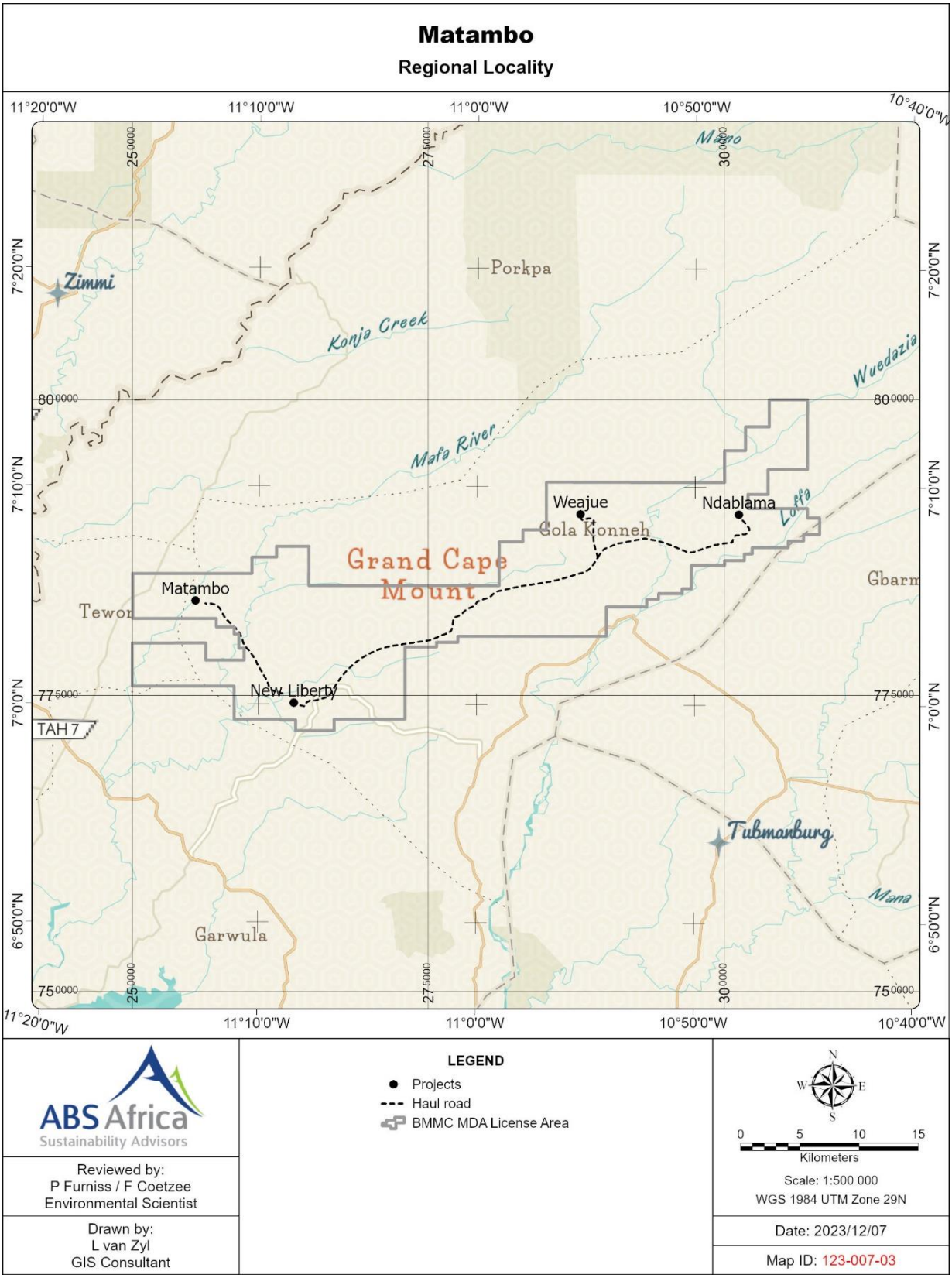


FIGURE 4-1: LOCALITY OF THE MATAMBO RESOURCE AREA IN RELATION TO THE BMMC-MDA

4.1.1 TEMPORARY CONSTRUCTION PERMITS

In October 2023, the Environment Protection Agency (EPA) granted BMMC permission and conditional temporary permits to proceed with the following activities:

- clearing of vegetation[1];
- preparatory works for construction of housing units, fabricated buildings, mine camp and explosives storage[2]; and
- removal and establishment of stockpiles of topsoil and saprolite[3].

The permits have a four-month validity period. Permitted activities are ongoing at the ESIA report preparation.

4.2 PROJECT LOCATION

The Project is located within the Grand Cape Mount County of Liberia, situated within the greater Bea Mountain Mining Corporation Mineral Development Agreement (BMMC-MDA) property/concession area. A small portion of the greater Bea Mountain Mineral Development Agreement intersects the Gbarpolu County, but no infrastructure is planned in the Gbarpolu County for this Project.

The planned Matambo development area is host to various artisanal small-scale mining [ASM] activities located West of the Mafa River. The area is rural and remote with several villages and communities including some of the oldest villages of Bangorma, believed to be nearly 200 years old.

The Mafa River system is located to the East of the Matambo development area, flowing Northeast to Southwest. Another river system (unnamed) traverses through the planned Matambo Mine Area. The proposed development is within the boundaries of the Class A mining license.

Ore from the open pit mining will be processed at the existing NLGM processing plant as the infrastructure is already established, thus reducing the capital requirements as well as the environmental and social impacts associated with the proposed development. Tailings from the processing will be managed at the existing TSF at NLGM. High-grade ore will be stockpiled temporarily at Matambo Mine Area and then transported to the processing plant at NLGM. Low-grade ore will be stockpiled for future processing at Matambo via heap leach technology, followed by transport to NLGM for further processing.

Please refer to FIGURE 4-1 for the general location of the Matambo site in relation to the BMMC-MDA, FIGURE 4-2 for the regional locality of the proposed development, as well as FIGURE 4-4 for the general layout of the proposed development. The length of the haul road from the Matambo site to the NLGM is approximately 10 km.

[1] EPA Reference: ED/EPA-01/02173/23/RL
[2] EPA Reference: EPA/TSR/TEMP.EP/001-1023
[3] EPA Reference: EPA/TSR/TEMP.EP/002-2023

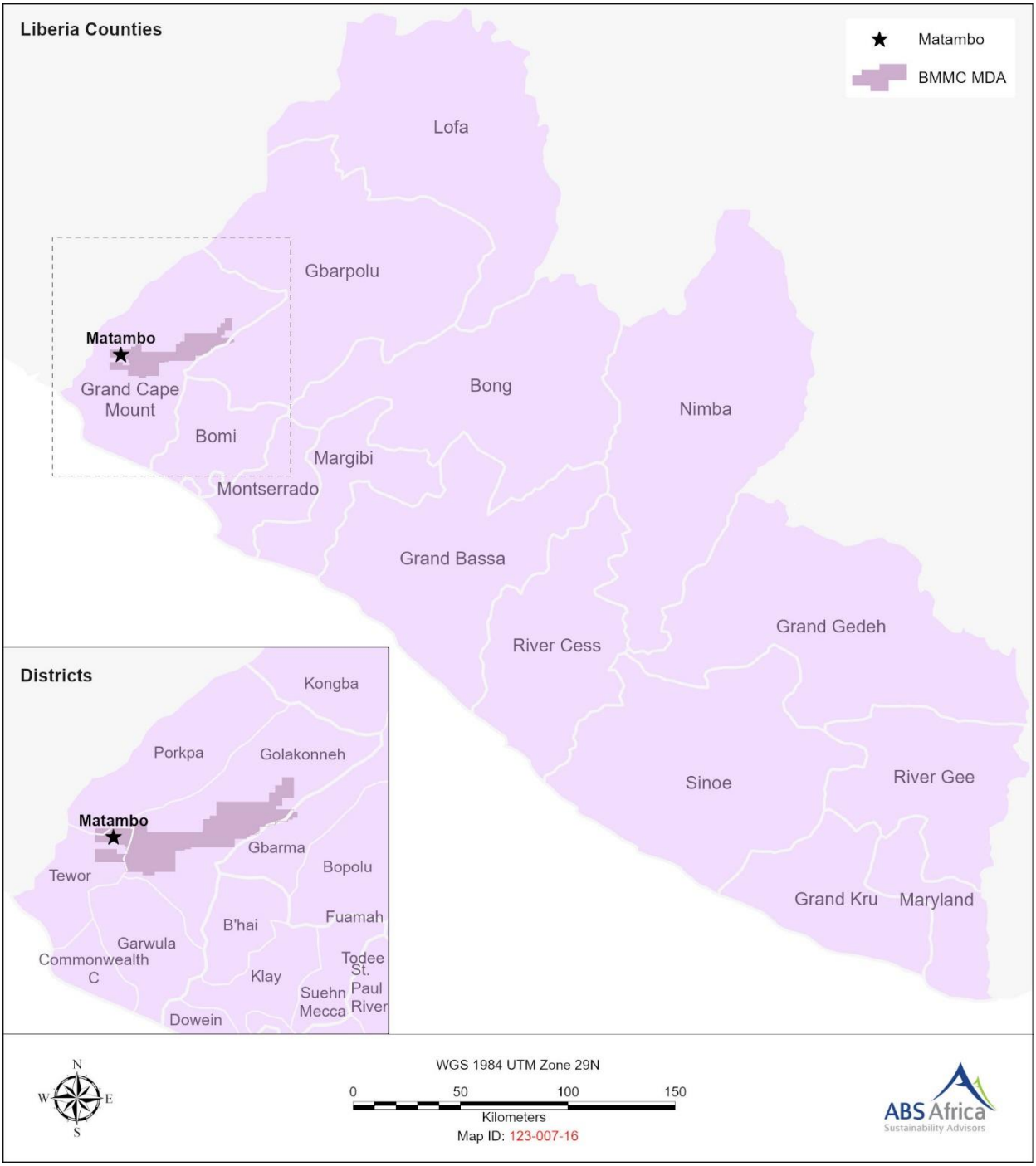


FIGURE 4-2: REGIONAL SETTING OF THE MATAMBO RESOURCE WITHIN THE BMMC MDA

4.3 MINE CONCESSION AREA

The BMMC-MDA concession is situated 90 km northwest of the capital, Monrovia, in Grand Cape Mount County, in the north-western portion of the Republic of Liberia. Other mining sites already in operation within the BMMC-MDA include the Ndablama Underground Gold Mine, NLGM, and Weajue Underground Gold Mine.

The BMMC-MDA property covers an area of 537 km^2 with boundaries described as cadastral and cartographic maps at the Ministry of Mines and Energy of Republic of Liberia.

4.4 GEOLOGY AND MINERALIZATION

Liberia is situated within the West African Craton, which has remained stable since about 1.7 Ga. The craton consists of two major basement domains; the Reguibat shield (in the north around Mauritania) and the ManShield (within which Liberia sits). The two shields are separated by the Taodeni basin of Proterozoic to Paleozoic age, while the ManShield lies to the west of the Proterozoic Birimian Belts.

The west of Liberia is comprised of Liberian age (3.0–2.5 Ga) greenstone belts and granitic gneisses. To the east of the country lies Eburnian age (2.1 Ga) material from the Birimian: a proto continent that accreted to Africa during the Eburnean Orogeny, 2.1 Ga. Pan African material extends along the southern edge of the country and represents the formation of Gondwana.

Within the BMMC-MDA concession area there is both pan-African material (in the south-west corner) and Liberian age material, covering the majority of the concession area (AMC, 2012).

The lithologies underlying the proposed mining area consist of a sequence of highly deformed granitic gneisses into which sequences of ultramafic schists have been folded. Most of the felsic gneisses are strongly foliated and layered, and their structural relationship with intercalated iron-formations, quartzite, schist, and amphibolite is highly suggestive that the gneisses are metasedimentary. Granite dykes (aplitic to pegmatite) intrude the schist.

There are several known areas of gold mineralisation within the BMMC-MDA property, located in major imbricate shear zones and possibly associated rotational fold hinges close to greenstone belt contacts, forming coevally with calc-alkaline granitoid intrusions. The shears and associated splays acted as structural channels for hydrothermal solutions, which deposited gold in suitable structures or chemical traps, typical of Upper Archean to Lower Proterozoic styles of metallogeny within greenstone belts.

Following extensive gold exploration, a gold potential mineralization was discovered within the Matambo project area. BMMC therefore proposes developing the Matambo Resource Area by means of an open pit mine and associated infrastructure. The ore mined at the pits will be processed at NLGM, making use of the existing plant and associated infrastructure.

It is estimated to produce approximately 14.7Mt Ore from the Matambo Mine.

4.5 PLANNED STRUCTURES AND INFRASTRUCTURE ASSOCIATED WITH THE PROJECT

4.5.1 MATAMBO OPEN PITS AND SUPPORTING INFRASTRUCTURE

Mining will be undertaken by conventional open pit methods, drilling, blasting, excavating, stockpiling and road haulage of ore and waste. The mining area will be cleared of vegetation and topsoil, prior to rock excavation, and stored for rehabilitation purposes. Before starting open pit production, saprolite material will be removed from the open pit areas and stockpiled in the designated areas. After selective blasting within the planned open pits, the blasted ore and waste rock will be loaded onto trucks using excavators.

The pit shells are shown in FIGURE 4-3 and the approximate dimensions of the pits are provided in TABLE 4-3.

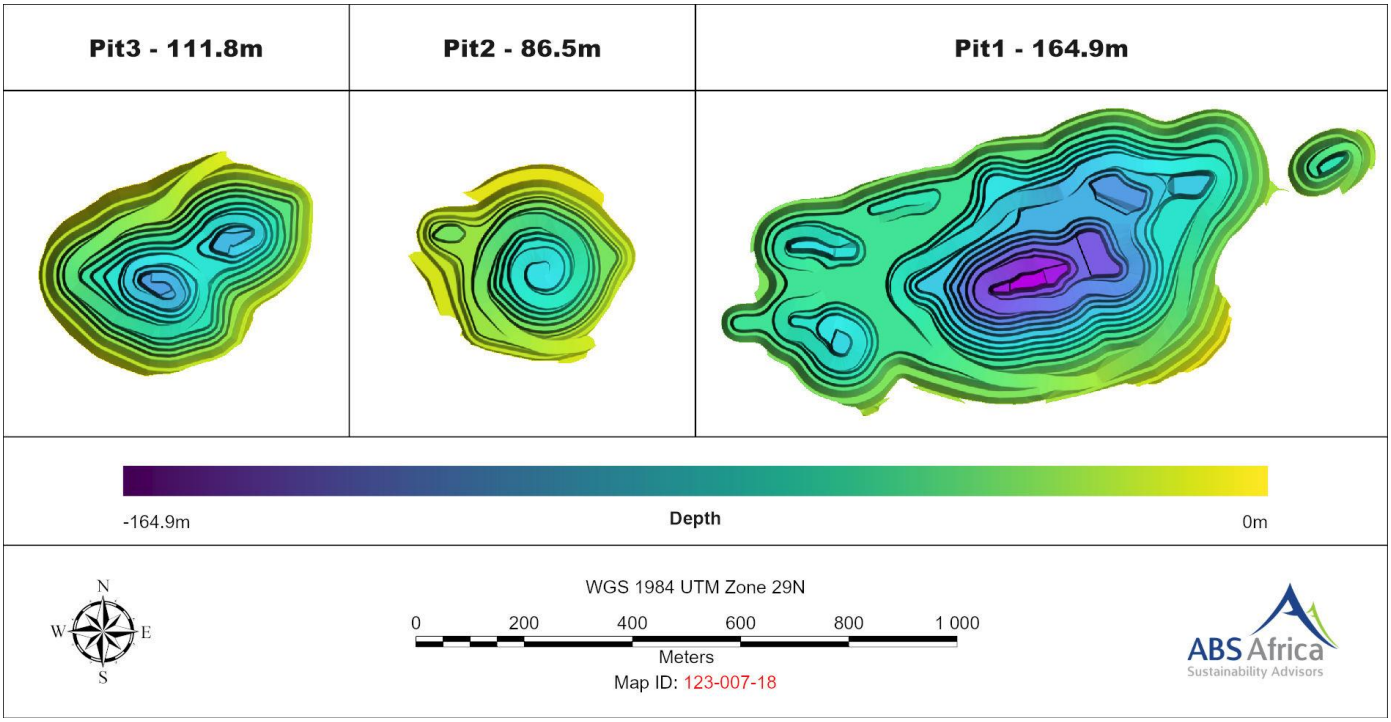


FIGURE 4-3: PIT SHELLS

The high-grade ore will be stockpiled temporarily at the Matambo Mine Area and then transported to the processing plant at NLGM via the proposed haul road making use of dump trucks. Waste rock will be used internally to construct haul roads, the run of mine (ROM) pad, and associated facilities. Low-grade ore will be stockpiled at Matambo for further processing via the Cyanide Heap Leaching Process at a later stage.

The mine schedule proposes mining Pit 2 first, followed by Pit 3 and then Pit 1.

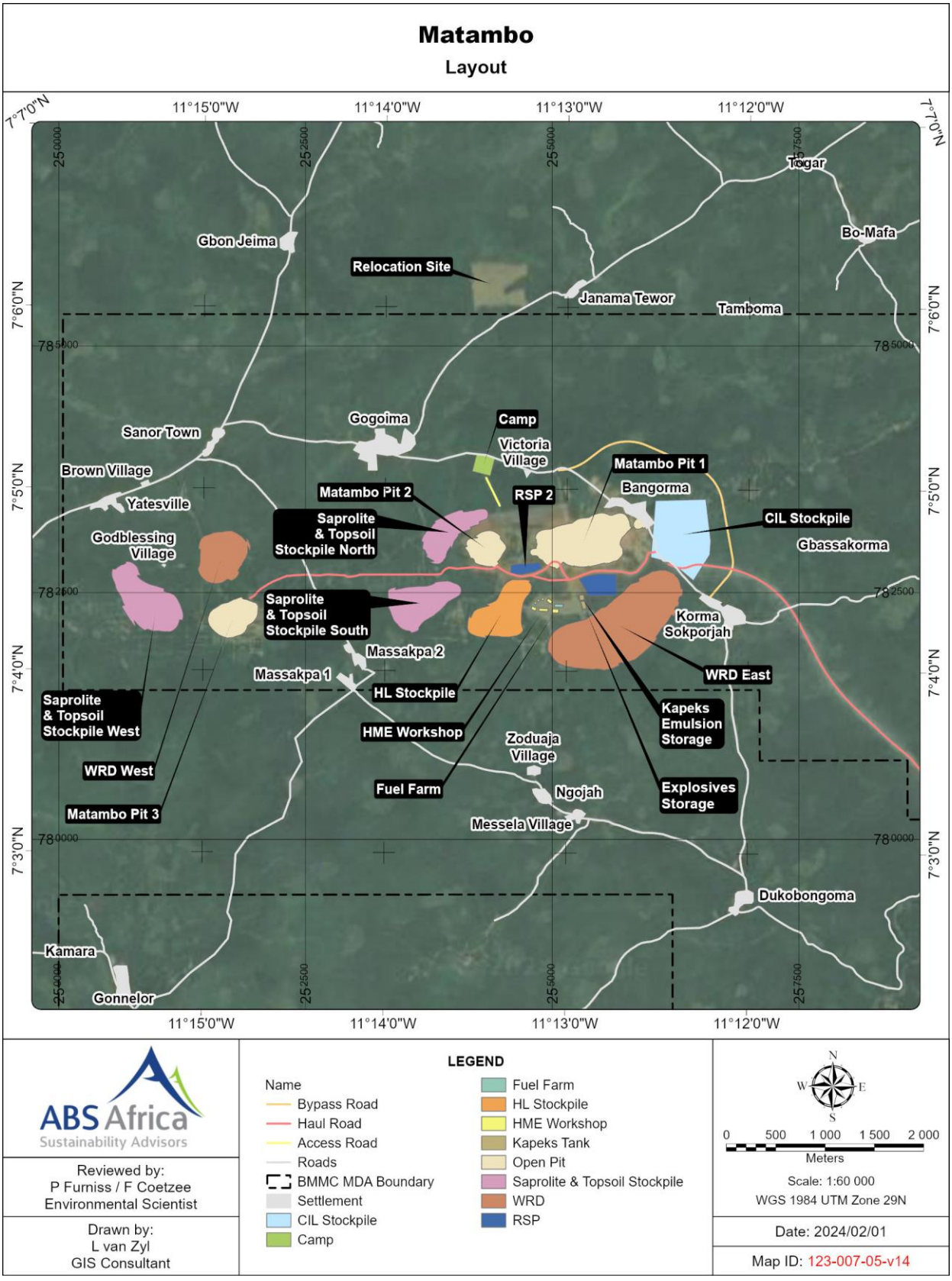


FIGURE 4-4: GENERAL LAYOUT FOR THE MATAMBO MINE PROJECT

A summary of the activities to be undertaken during the construction, operational, decommissioning and closure phase are presented below. It is important to note that the table includes activities associated with the current operation of NLGM, since the proposed project will share infrastructure and facilities with NLGM.

TABLE 4-1: PROJECT ACTIVITIES ASSOCIATED WITH THE PROJECT

PROJECT PHASE	ACTIVITIES/TASKS
CONSTRUCTION PHASE	• Recruitment, procurement, and employment of local and international staff; • Clearance and stripping of vegetation and topsoil from the project area; • Construction of internal haul road and access roads to transport waste rock, high-grade ore and low-grade ore material from the pit to the associated WRD, ore stockpile area and then to the existing processing plant at NLGM or Low-grade Ore Stockpile; • Stripping saprolite material from the proposed open pit area (limited blasting if required); • Development of the initial bench for access to the pit; • Stockpiling of waste rock, topsoil and subsoil and ore related material; • Compaction of laydown areas and construction areas; • Transportation of construction material to the site; • Construction of the diversion channels for surface water management • Construction of the new Camp for the accommodation; • Construction of the offices & laundry & meal hall; • Construction and the laying down of supporting infrastructure, such as pipes, power lines etc; • Establishment of a warehouse & consumables storage facility. • Construction of workshop for servicing of equipment and machinery; • Construction of explosive magazine; • Demarcation and signage of heritage sites if any; and • Compensation of parties affected by the establishment of infrastructure.
OPERATIONAL PHASE	• Drilling of holes for blasting; • Blasting within the pits; • Stockpiling of WRDs; • Stockpiling of ore material at the ROM stockpile; • Transporting of ore to the existing processing plant at NLGM; • and • Use of the private haul roads and access roads. • Stockpiling of Low-Grade Ore for further processing via Cyanide Heaping Leach Process. Hydrocarbon management activities, including: • Hydrocarbon storage and dispensing; and • Storage of used oil. Water and stormwater management: • Use and maintenance of storm water management systems; and • Water diversion berms. Waste management activities, including: • Collection and separation of waste; • Management of waste facility; and • Clean-up of hydrocarbon spills. Progressive closure and rehabilitation.
DECOMMISSIONING	• Retrenchment of local and international work force. Rehabilitation activities, including:

PROJECT PHASE	ACTIVITIES/TASKS
	• Removal of certain infrastructure (Certain infrastructure will be moved to other projects–offices and accommodation facilities); • Construction of a bund for safety and also to minimise clean runoff into the pits; • Allowing the pit to become a pit lake; • Shaping of the pit edges; • Introduction of aquatic vegetation around pit lake; • Treatment/removal of any contaminated soil; • Rehabilitation of haul and access roads by ripping and allowing natural vegetation to recolonise if they will not be used by communities; • The storm water management infrastructure will remain permanent features; • Establishment of vegetation; and • Environmental monitoring of decommissioning activities.
POST CLOSURE	• Surface water quality monitoring; • Groundwater quality monitoring; • Reclamation monitoring; and • Care and maintenance.

4.5.1.1 Waste Rock Dumps (WRDs)

Two WRDs will be established as part of the mine development. One dump will be located near pit 1 (WRD East) and the other near pit 3 (WRD West). The WRDs will primarily be required for the waste rock material arising from the works. Approximately 63Mt of waste rock will be produced during the operation of Matambo Pits. The approximate surface area and final height of the stockpiles is indicated in TABLE 4-2.

4.5.1.2 Saprolite and Topsoil Stockpile

Saprolite and topsoil stockpiles will be established near to the pits. Two saprolite and topsoil stockpiles (north and south) are associated with the mining of Pits 1 and 2 and one saprolite and topsoil stockpile is required for Pit 3 (Saprolite and Topsoil Stockpile 3).

4.5.1.3 Resampling Stockpiles

The resampling areas (RSP 1 and RSP 2) will be used for sampling and grade control of the ores. Initially these areas will be also used as interim stockpile areas for the stockpiling of ore from pits. These will be in operation until the CIL Stockpile has been established.

4.5.1.4 CIL Stockpile

The CIL Stockpile comprises of the ore which is to be transported for Carbon-in Leach (CIL) processing at the existing plant at New Liberty.

4.5.1.5 Low Grade Ore (HL) Stockpile

Low-grade ore will be stockpiled at Matambo, for further processing via the Cyanide Heap Leaching Process later.

TABLE 4-2: APPROXIMATE DIMENSIONS OF WRDS AND STOCKPILES

STRUCTURE	SURFACE AREA (HA)	FINAL HEIGHT (M)
WRD East	19.4	60
WRD West	75.9	60
Saprolite & Topsoil Stockpile 3	30.9	20
Saprolite & Topsoil Stockpile North	17.5	30
Saprolite & Topsoil Stockpile South	23.5	30
RSP 1	7.0	-

RSP 2	2.8	-
HL Stockpile	23.5	30
CIL Stockpile	38.5	20

4.5.1.6 Accommodation/ Camp Area

An accommodation/ camp area of some 3,6 ha will be constructed to the north of the Matambo site. The camp will have housing units for mine and contractor personnel. An indicative layout is provided in FIGURE 4-5. It is estimated that the Matambo Mine will have 500 people on site at peak activity.

The camp will consist of the following:

- internal roads,
- offices,
- recreational building,
- kitchen and canteen,
- clinic,
- mosque,
- laundry room, and
- security office.

Other infrastructure will include:

- water distribution pipelines,
- electricity infrastructure (transformers and 11kV distribution lines),
- generators and associated fuel storage.



FIGURE 4-5: CAMP DESIGN

4.5.1.7 Workshop Area

The workshop area provides facilities for storage of parts and equipment as well as for the servicing and maintenance of equipment, vehicles and machinery.

4.5.1.8 Explosives Storage Area

An explosive magazine of about 0,3 ha will be constructed and utilised for the safe storage of the explosives and associated equipment.

There will be one emulsion storage tank with a capacity of 22 000 L (approximately 30 000 kg).

Explosives will be stored in containers in a separate area to the emulsion storage tank. There will be a maximum of 4 containers for the explosives, in the area and each container will cover a 12 m x 2.4 m area.

4.5.1.9 Haul Road

A private haul road of about 10 km has been established, in line with the environmental permit issued in March 2022, to ensure the safe transportation of ore between Matambo and the processing plant at NLGM.

4.5.1.10 Water And Waste Management

Potable water will be supplied to Matambo via the existing water treatment and bottling facility at NLGM. No bulk water infrastructure will be established.

Non-potable water requirements for the mining, workshop and other activities will be provided through two boreholes, one at the camp area and one at the workshop area.

General waste generated by the Matambo activities, including the camp and workshop area, will be collected and transported to an area between Pit 1 and the camp. There are no engineered landfill sites in the region where general waste can be disposed of. Accordingly, the general waste will either be incinerated or buried.

Hazardous waste and scrap materials will be temporarily stored at the waste storage area which is next to workshop and sent to EPA licensed waste handling company Medical waste from the clinic will be transferred to NLGM for incineration at the current facility.

4.5.1.11 Power Supply

No grid connected power is available at Matambo. As with NLGM, power will be provided through generator sets. The workshop area will have two generator sets with a capacity of 550 kW and the main camp will have two generator sets with a capacity of 350 kW. Power will be distributed via overhead powerlines to the offices and buildings.

4.5.1.12 Access

The mine accommodation area is fenced off, with gates to control the access of personnel and vehicles entering and leaving the facilities. Currently, four gate entry points have been provided long dedicated routes to separate heavy and light vehicle traffic in the Pit-1 and Pit-2 areas. Additional gate entries will be considered for Pit-3 area.

4.5.1.13 Fuel Storage

Fuel storage will also be established in the workshop area for refuelling of mine vehicles and equipment. The facility comprises of 5 diesel storage tanks (cylindrical) stored in the Fuel Farm area.

Four of the tanks will have capacity of 26 m^3 each and one will have a storage capacity of 20 m^3.

The fuel and oil storage areas are present with a concrete pad and a roof covering. A dedicated fire protection system is also present.

4.5.1.14 Waste and Sewage

A wastewater treatment plant (package plant) will be established at the camp area for the treatment of sewage. No bulk wastewater infrastructure will be established. French drains will be established at the camp and workshop area. These will be emptied by a wastewater vacuum truck on a regular basis and the effluent taken to the package plant at the camp area for treatment. Treated water from the package plant will be discharged.

4.5.1.15 Fire Protection

Provision will be made at the Matambo Mine for a fire protection system includes extinguishers in all surface buildings and water truck with a 5000L capacity.

4.6 EXISTING STRUCTURES AND INFRASTRUCTURE TO BE USED AT NLGM FOR THE MATAMBO PROJECT

The existing facilities at the NLGM that will be used for the processing of ore mined at Matambo is given below:

- Gold Processing Plant;
- Ore Receipt and Crushing;
- Milling;
- Gravity Concentration;
- Thickening & CIL;
- Acid Wash and Elution;
- Electro-Winning and Gold Room;
- Detox and Residue Disposal;
- Power Plant; and
- Tailings Storage Facility (TSF).

4.7 MINING METHODOLOGY

4.7.1 OPEN PITS

Mining will be undertaken by conventional open pit methods, drilling, blasting, excavating, stockpiling and road haulage of ore and waste. Three open pits are to be developed at Matambo. The mining area will be cleared of vegetation, topsoil, prior to rock excavation, and stored for rehabilitation purposes. After vegetation and topsoil removal, saprolite material will be removed from the open pit areas and stockpiled in the designated areas. After selective blasting within the planned open pits, the blasted ore and waste rock will be loaded onto trucks using excavators.

The approximate pit dimensions are indicated in TABLE 4-3.

The pit design for Matambo assumes that the mining equipment and mining method will be the same as New Liberty. Therefore, the same design criteria for the roads have been adopted with a standard running width of 25 m and maximum gradient of 10%. Single-lane ramps (16 m wide) have been adopted for the lowest benches.

A standard bench height of 10 m is used with 6 m berm width. Where possible, the blasting will be on 10 m benches for waste polygons, but ore blasting will be 5 m bench height to improve selectivity.

The mining sequence is primarily driven by the stripping ratio rather than grade and mining progresses down dip in hanging-wall to footwall direction.

TABLE 4-3: APPROXIMATE PIT DIMENSIONS

PIT	SURFACE AREA (HA)	FINAL DEPTH (M)
Pit 1	41.7	140
Pit 2	10.74	80
Pit 3	14.59	100

4.7.2 MINING FLEET

The mining equipment fleet at Matambo has been selected with the production rate, mine design, orebody dimensions and geometry in mind and is aimed at a balance between minimizing dilution and losses while maximizing productivity.

TABLE 4-4: REQUIRED MINING EQUIPMENT

MACHINE TYPE	MODEL	UNIT
Surface Excavator	PC1250	8
Excavator	PC850	10
Drill Rigs	Sandvick Pantera	12
Drill Rigs	Sandvick Ranger DX800	6
Trucks	Volvo A40G/F	10
Dump Truck	Komatsu 785 HD	30
Water Cars	Mercedes 4142	3
Loader	CAT 980H	4
Dozer	CAT D9	4
Grader	CAT 140M	3
Cylinder	Bomag	2
Fuel Truck	Mercedes 4142	3
Light Vehicle		6

4.7.3 RECRUITMENT

Approximately 500 people are expected to work on the Matambo Mine site during the peak development, preparation and production stages of the proposed project.

4.7.4 LIFE OF MINE (LOM)

The LOM of the Matambo Resource is expected to be approximately 3 years. Details of the working hours and working days per year are provided in the table below.

SHIFTS PER DAY	2
WORKING HOURS PER SHIFT (HRS)	12
WORKING DAYS PER YEAR	335

4.8 MINE SUPPORT ACTIVITIES

4.8.1 STORM WATER MANAGEMENT

Storm water (clean rainfall runoff water) will be channelled away from the mine structures and infrastructure by means of diversion berms and drains.

The diversions are intended to ensure that clean runoff water, (rainfall runoff from outside of the mining footprint area) remains separate to dirty runoff water (rainfall runoff from within the mining footprint area) and is returned to the resource downstream of the mining activities.

Where it is necessary to prevent sedimentation and contamination of water resources, use will be made of settling ponds to capture and attenuate rainfall runoff from within the mining footprint area. Water from these ponds will be released to the environment if the water quality is in compliance with the applicable discharge standards to water resources.

A significant diversion of the watercourse that drains through the Matambo site from north to south is also planned to be constructed to ensure that the mining area remains safe for mining, especially in the wet season.

This diversion will drain water around Pit 1 and flow into the unnamed watercourse to the south of the mining area.

The diversion of the watercourse north of Pit 1 will divert the water into Pit 2. Flooding of the pit will only be done once the mining of Pit 2 (less than one year) has been completed. A second diversion will be established at the southern boundary of Pit 2, allowing for the water to flow and join with the existing unnamed watercourse to the south of the Matambo Mine Area.

Further stormwater diversions are planned to be developed over the LOM. These are indicated in FIGURE 4-6.

The water will be managed within the same catchment (East Catchment in FIGURE 4-7) thus, no inter-catchment transfer of water will be necessary to affect the diversion. The volume of water introduced to the unnamed watercourse through the diversion is expected to be similar to the normal runoff volume thus no additional flooding risk to communities downstream of the diversion/watercourse confluence is expected.

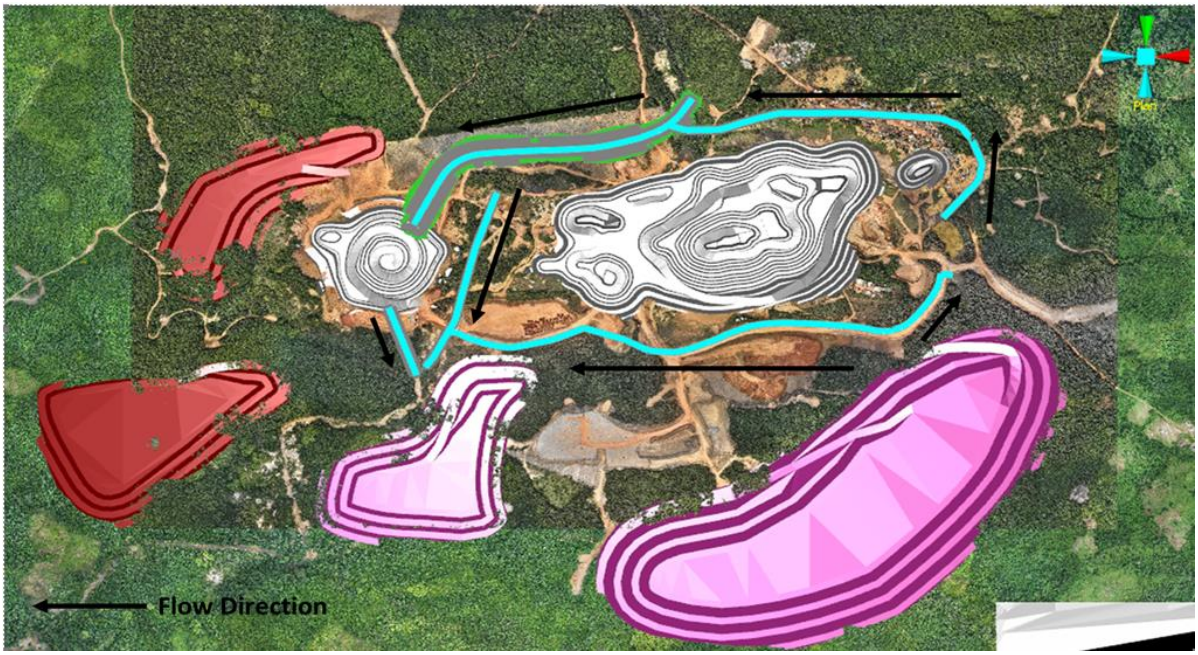


FIGURE 4-6: PLANNED STORMWATER DIVERSIONS

4.8.2 AT-SOURCE WASTE SEPARATION

Waste generated at the various areas of the Project site is separated at source and placed into separate bins: labelled "Non-hazardous Waste" and "Hazardous Waste". Additional labelled bins will be provided in areas known to generate specific types of non-hazardous or hazardous wastes. For example: Paper Waste; Food Waste; Glass Bottles; Metal; Oily Rags; Fluorescent Bulbs; etc. Recyclable waste is deposited into designated bins to ensure that the maximum amount of recyclable material is diverted away from landfill sites. General waste is kept separated from recyclable waste to avoid the contamination of the recyclables. The separation of waste at the source of generation also creates awareness and ensures that the sorting of waste can take place as effectively as possible.

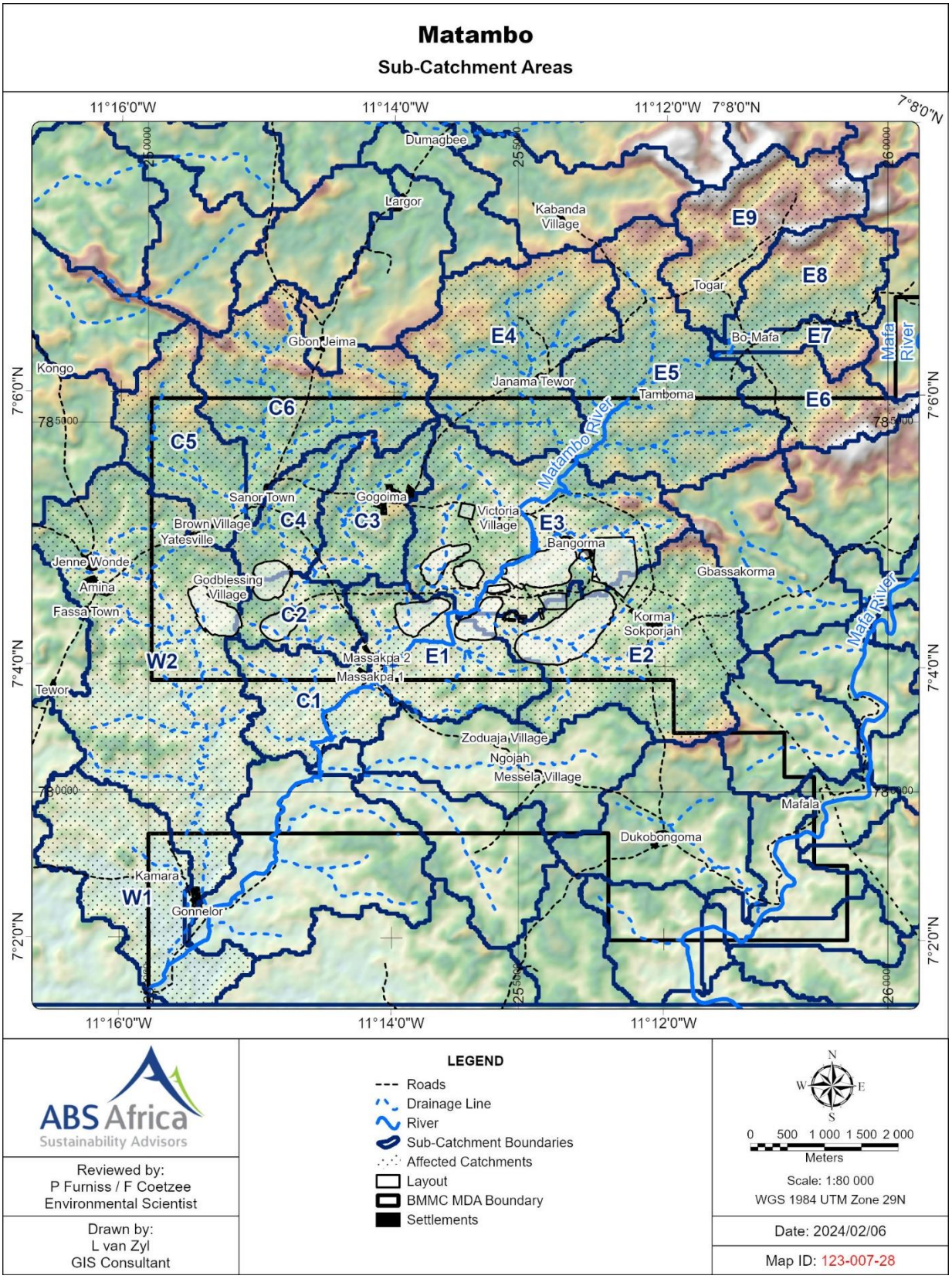


FIGURE 4-7: DRAINAGE AREAS RELATED TO MATAMBO

4.8.3 ON-SITE WASTE SORTING

Waste is collected from points of generation on a regular basis and taken to the on-site waste sorting facility. The waste management employees (either employees of BMMC or an appointed waste management company) manually sort the incoming waste into various waste streams, which are likely to include the following:

- General waste (mainly house hold/office waste);
- Cardboard and other paper products;
- Scrap wood;
- Scrap metals;
- Plastic;
- Glass;
- E-Waste (electronic waste);
- Medical waste;
- Printer cartridges;
- Light bulbs; and
- Used vehicle and household batteries.

The types of equipment that are available and will continuously be used to effectively sort the waste includes a sorting table, bins, skips, cleaning equipment, etc.

4.8.4 DISPOSAL AND RECYCLING

There are no engineered landfill sites in the region where general waste can be disposed of. Accordingly, the general waste will either be incinerated or buried.

4.8.5 WASTE MANAGEMENT MONITORING

A waste management monitoring system is in place to track waste generation to final disposal point. The system will involve:

- The collection and review of waste data;
- A database to track quantities of waste generated and details of disposal;
- Regular site inspections;
- Regular audits of Matambo internal and contracted waste management practices; and
- Annual review of the Waste Management Plan.

4.8.6 WASTEWATER/ SEWAGE/ EFFLUENT MANAGEMENT

Wastewater from the Project is managed by means of sediment/settling ponds.

Run-off water from the stores and storage areas around the site, that cannot be redirected is classified as dirty water and will drain into a sump for collection. The sump will be connected to an oil separation system to remove the hydrocarbons and the clean water will be available for general site use.

A sewage treatment plant and system services the accommodation camp.

French drains will be established at the camp and workshop areas. These will be emptied by a wastewater vacuum truck on a regular basis and the effluent taken to the package plant at the camp area for treatment. Treated water from the package plant will be discharged.

No effluent from chemical processing or related activities will be generated at Matambo.

4.8.7 HAZARDOUS WASTE MANAGEMENT

Hazardous waste and scrap materials will be temporarily stored at the workshop area (HME Workshop) and sent to EPA-licensed waste handling company. Hazardous materials are disposed of in accordance with all applicable host country regulations. Used motor oil, coolant, and hydraulic oil is recycled.

Hazardous waste bins are stored in the waste storing facility and store all hazardous material generated.

4.9 RECOVERY METHOD AT NLGM[4]

The existing facilities at the New Liberty mine will be used for the processing of ore mined at Matambo is summarised below. No processing plant will be provided at the Matambo resource area. The section below describes the processing and recovery infrastructure currently used at NLGM.

4.9.1 GOLD PROCESSING PLANT

NLGM Process Plant has two main plants which are MAPA-1 and MAPA-2. These main plants consist of their own crushing, milling-thickening, gravity, leaching and elution circuits. In addition to these plants, MAPA 2.5 plant has its own grinding and leaching circuits, which will be explained in the following sections. Each milling equipment also has its own falcon and each plant (MAPA-1, MAPA-2, MAPA 2.5) has its own intensive leach reactor (ILR). All the pregnant solutions are fed to their electrowinning cells which are in the gold room.

4.9.2 ORE RECEIPT AND CRUSHING

Ore will be hauled by trucks and stockpiled on a ROM pad or delivered directly into a ROM bin by a truck or front-end loader.

MAPA-1 and MAPA-2, both have the same type of crushers but different screens and flowsheets.

In MAPA-1, run of mine ore (ROM) is fed into ROM bin and it goes directly into jaw crusher with an apron feeder. Jaw crusher product goes to a double deck screen and is divided into 3 different products namely, secondary cone crusher feed, tertiary cone crusher feed, and final product. Also, secondary crusher and tertiary crusher are operated as closed circuit with the same double deck screen.

In MAPA-2, run of mine ore is fed to a grizzly screen from ROM bin. Jaw crusher is fed by grizzly screen's oversize. Grizzly screen's undersize and jaw crusher product goes to RF screen, which is double deck screen. The oversize of the top deck is fed to the secondary cone crusher, oversize of the bottom deck is fed to the tertiary cone crusher and undersize of the bottom take reports to the final product conveyor. Different from MAPA-1, secondary and tertiary cone crusher products are fed to the MF screen which is another a double deck screen, and cone crushers are operated as closed circuit with MF screen.

4.9.3 MILLING

Both MAPA-1 and MAPA-2 grinding sections are identical to each other. Crushed material is fed into a ball mill. Ball mill product goes to primary cyclones and cyclone underflows goes to a scalping screen which controls the feed size of the ball mill falcons. While scalping screen undersize goes to ball mill falcons, oversize goes back to ball mill with ball mill falcon rejects.

Primary cyclones overflow goes to splitter tank 1 in MAPA-1 and splitter tank 2 in MAPA-2. From the splitter tank 1 and 2, desired amount of flow is sent to the MAPA-1, MAPA 2 and MAPA-2.5 secondary cyclones. Secondary cyclones feed the vertimill falcons and falcon's rejects are fed to the vertimill. Vertimills are working in closed circuit with vertimill falcons.

[4] August 2023, NLGM Process Plant Flowsheet Explanation rev1

Secondary cyclones overflow goes to linear screen and to thickeners of MAPA-1 and MAPA-2. In MAPA-2.5, secondary cyclones overflow goes to its scalping screen and from there it goes to the splitter tank 3. Oversize of MAPA 2.5 scalping screen and linear screens consist of plastics from mine blasting and mica minerals which is considered as trash. Splitter tank 3 divides the flow into three streams as a MAPA-1 thickener, MAPA 2 thickener and splitter tank 4.

4.9.4 INTENSIVE LEACH REACTORS

Heavy products (Gold concentrate) of the falcons go to the intensive leach reactors. In MAPA-1 and MAPA-2, both ball mill and vertimill falcons feed same ILR, in MAPA 2.5, vertimill falcon feed its own ILR. Intensive leach reactors leaches falcon products in excess amount of cyanide. ILR's are operated with batch cycles. The combination of 1 day falcon concentrates are fed in to ILR's. Leaching takes approximately 17 hours. At the end of the leaching, pregnant solutions of the 3 ILR's are combined and fed in to ILR pregnant solution tank.

4.9.5 THICKENING AND CIL

Carbon-In-Leaching (CIL) type leaching is used at NLGM. In MAPA-1 and MAPA-2 there are 7 and in MAPA-2.5 there are 5 CIL tanks which are 1,000 m3 each. The flow from the splitter tank 4 are divided according to the total number of the active tanks at each CIL circuits.

From splitter tank 4, slurry is transferred to each plant's pre-oxidation (pre-ox) tanks. Each pre-ox tank has its own shear reactor to increase dissolved oxygen in the pulp. From the pre-ox tanks slurry goes into CIL tanks where leaching occurs. MAPA-1 and MAPA-2 tailings are combined and discharged to tailing storage facility (TSF) whereas, MAPA-2.5 CIL discharges by its own tailing pumps to the TSF. While slurry goes from CIL-1 to last CIL tank, barren carbon is moved in the opposite direction by carbon transfer pumps from last CIL tank to CIL-1. From CIL Tank 1, loaded carbon is transferred to harvest screens in the elution. MAPA-1 has its own elution circuit, MAPA-2 and MAPA-2.5 use their own elution circuit. The harvest screen oversize, which is loaded carbon, is fed to the loaded carbon tank and undersize, which is slurry, returns to MAPA-1 CIL 1 in MAPA-1 elution, returns to MAPA-2 in MAPA-2 and 2.5 elution.

4.9.6 ELUTION

There are 2 AARL type Elution plants at the process plant. When desired amount of loaded carbon is collected in the loaded carbon tank, acid wash is done with dilute acid for the removal of inorganic ions such as Ca+2 and Na+. After acid wash loaded carbon is fed into the elution column. Gold is stripped from loaded carbon with determined chemicals, temperature, and pressure inside of the column. Each elution plant sends its own pregnant solution to its electrowinning tanks and each electrowinning tank has its own electrowinning cell.

After the elution, barren carbons are sent to regeneration kilns to destroy the absorbed components contained on active carbons surface. Regenerated carbons are sent to the last CIL tanks of the circuits.

4.9.7 GOLD ROOM

There are three different cells in the gold room specified for MAPA-1 elution, MAPA-2 elution and ILR's. Pregnant solutions are pumped and circulates between cells and pregnant solution tanks. When return solution's gold content has dropped to desired value, electrowinning finishes and pregnant solution are transferred to barren solution tank. MAPA-1 pregnant solution and ILR pregnant solution tanks are transferred to MAPA-1 barren solution tank whereas, MAPA-2 pregnant solution tank is transferred to MAPA-2 barren solution tank. Each solution batch is sent back to its own CIL tank 1.

In the cells, gold is accumulated on the cathodes, and they are washed in certain intervals. Collected slurry from cathodes is dewatered by press filter and dried in the oven. The dry gold concentrate obtained as a result of these processes are being poured with specified chemicals in induction furnace as high-grade gold bullion.

4.9.8 INCO

The detoxification of the tailing water is being made in the MAPA-2.5 INCO tank by INCO SO_2 and air process. Desired amount of TSF return water is pumped to INCO tank and the water is being treated with pressurised air,

sodium metabisulphate and copper sulphate in specific pH to reduce the free, wad and total cyanide of the return water for dischargable limits.

4.9.9 TAILINGS STORAGE FACILITY (TSF)

The existing TSF at the NLGM will be used for storing and managing the tailings received from the processing plant associated with the processing of ore from Ndablama. Tailings leave the processing plant in the form of slurry via pipelines, consisting of a mixture between solid material (sand-like in texture) and process water.

In the TSF, solid and liquid separation takes place. The solid material forms the bulk of the capacity in the TSF. The slurry will settle down and the water will collect in the TSF pool. This water is then recycled back into the processing plant for re-use. The remaining water from the TSF will be sent to the INCO system for the treatment before discharging to the environment under controlled conditions.

The key components of this facility are:

- Containment dam;
- Geomembrane liner on TSF embankments;
- Underdrain;
- Non-contact water diversion system;
- Contact water collection system.

4.9.10 REAGENTS

Sodium Cyanide: NaCN which is well known gold dissolving chemical is fed into CIL tank 1 at all plants, to prepare strip solution in elution plants and to ILR's.

Caustic Soda: NaOH which is a base to adjust pH and adjust the conductivity due to its electrolytes. It is being used in the elutions to prepare strip solutions, in the sodium cyanide preparation to adjust pH and in the electrowinning to adjust the conductivity.

Flocculant: Flocculant is a polymer which is used to enhance the settling of the particles to increase solid density and to achieve particle free water/solutions. In the plant they are being used in the thickeners and in the ILR's.

Lime: CaOH is being used as a lime milk to adjust the pH in the preox's and in the INCO tank.

Copper Sulphate: CuSO4 is used for its Cu^{+2} content in INCO process as a catalyst in the INCO tank.

Sodium Metabisulphate: SMBS is used for its SO_2 content to oxidize cyanide to cyanate in INCO process in the INCO tank.

Lead Nitrate: PbNO3 is widely used chemical in gold leaching to promote the oxidation and reduce the cyanide consumption by assisting with passivation of reactive sulfides in the ore. It is fed to splitter tank 4.

Ferric Chloride: FeCl3 is used for the precipitation of dissolved arsenic in the slurry. It is being used from MAPA-2 Detox tank 2.

Hydrochloric Acid: HCl is being diluted and used for acid wash of loaded carbon before elution. All the reagents conform to safety, health, and environmental standards as per site procedures which are compliant with international standards.

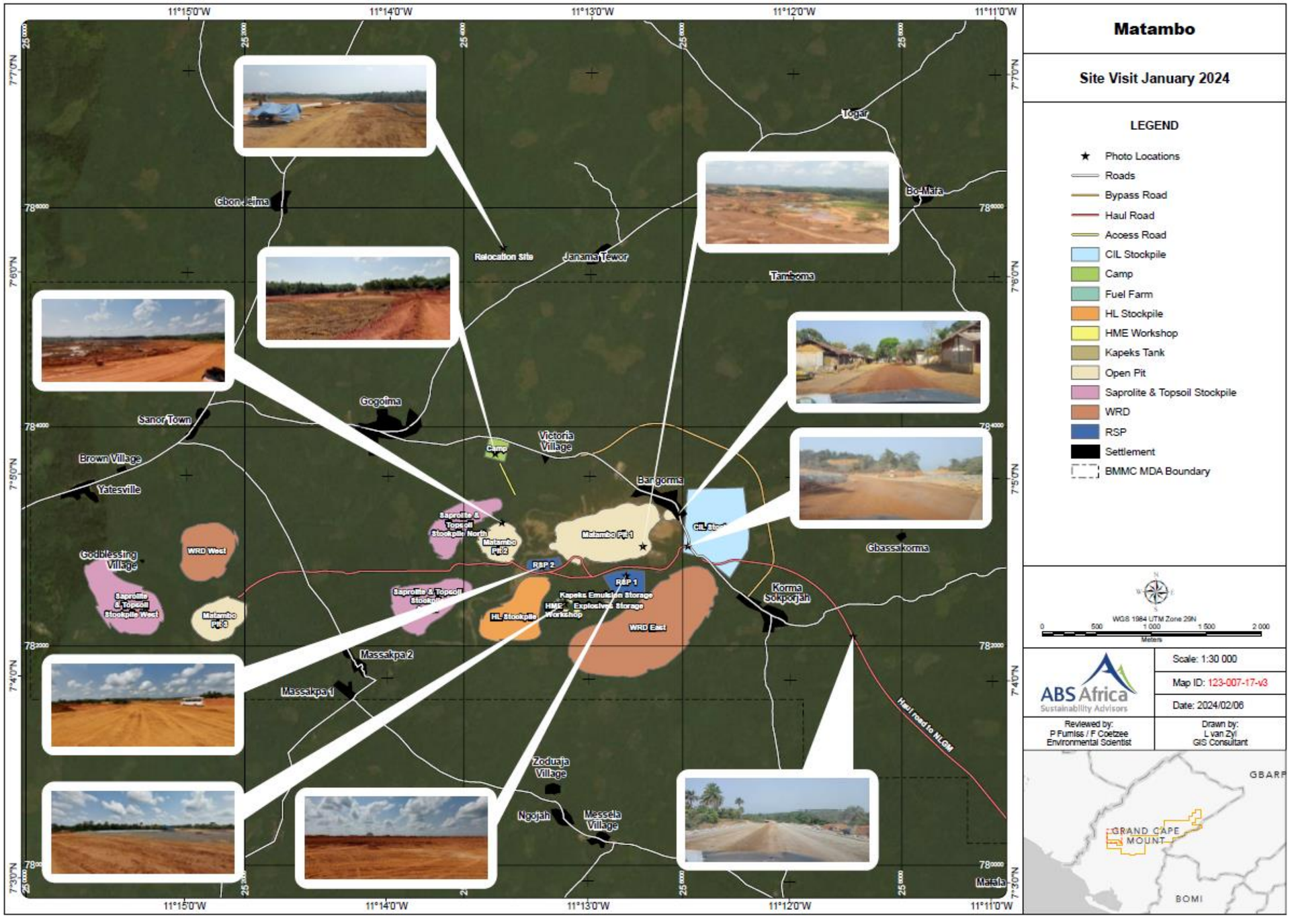


FIGURE 4-8: MINE SITE LAYOUT AND SELECTED PHOTOS FROM JANUARY 2024

CHAPTER 5
PHYSICAL AND BIOLOGICAL BASELINE

TABLE OF CONTENTS

5 PHYSICAL AND BIOLOGICAL BASELINE 5-5

5.1 GEOLOGY 5-5
5.2 GEOCHEMICAL ASSESSMENT 5-5
5.2.1 Geochemical Characterization- Composite Simples 5-5
5.3 CLIMATE 5-10
5.3.1 Precipitation 5-10
5.3.2 Evaporation 5-12
5.3.3 Temperature 5-13
5.3.4 Humidity 5-14
5.3.5 Surface Wind Field 5-14
5.4 DRAINAGE AND TOPOGRAPHY 5-15
5.4.1 Hydrological Characteristics 5-15
5.4.2 Surface Water and Hydrogeology 5-16
5.5 WATER QUALITY 5-28
5.5.1 Groundwater Quality 5-28
5.5.2 Surface Water Quality Analysis 5-33
5.6 SOILS AND LAND CAPABILITY 5-36
5.6.1 Soil Sampling Analysis 5-36
5.6.2 Land Capability Classification and Rating 5-36
5.6.3 Baseline Soils and Survey Results 5-36
5.6.4 Land Use and Land Capability 5-41
5.6.5 Site Sensitivity 5-43
5.7 AIR QUALITY 5-45
5.7.1 Sensitive Receptors 5-45
5.8 NOISE 5-49
5.8.1 Description Of Receiving Environment 5-49
5.8.2 Noise Survey And Results 5-50
5.9 ECOLOGICAL OVERVIEW 5-54
5.9.1 Global Perspective 5-54
5.9.2 Regional Perspective 5-54
5.9.3 Local Perspective 5-56
5.9.4 General Results and Survey Coverage 5-56
5.9.5 Habitat and Plant Species 5-56
5.9.6 Avifauna 5-62
5.9.7 Mammals 5-65
5.9.8 Herpetofauna 5-66

LIST OF FIGURES

FIGURE 5-1: LOCATION OF DRILL CORES (MDD0134, MDD0087, MDD0298, MDD0198) AND MDD0563) AND CORE PROFILE SHOWING THE MINERALOGY OF THE SECTION OF THE CORE ANALYSED – SAMPLES MT_DE_00006, 00013, 00014, 00015, AND MT_DE_00034 5-7
FIGURE 5-2: MONTHLY PRECIPITATION RECORDED AT DARU WEATHER STATION FROM 1951 – 1997 5-11
FIGURE 5-3: MONTHLY PRECIPITATION RECORDED AT HARBEL WEATHER STATION FROM 1933-1993 5-11
FIGURE 5-4: ANNUAL PRECIPITATION CYCLES FOR DARU WEATHER STATION 5-12
FIGURE 5-5: ANNUAL PRECIPITATION CYCLES FOR HARBEL WEATHER STATION 5-12
FIGURE 5-6: REGIONAL MEAN ANNUAL POTENTIAL EVAPORATION MAP 5-13
FIGURE 5-7: DIURNAL TEMPERATURE PROFILE (MODELLED MM5 DATA, 2015 TO 2017) 5-14
FIGURE 5-8: PERIOD, DAY AND NIGHT-TIME WIND ROSES (MODELLED MM5 DAT, 2015 TO 2017) 5-15
FIGURE 5-9: MATAMBO PRE-DEVELOPMENT SUB-CATCHMENTS 5-16
FIGURE 5-10: ESTIMATED MEAN ANNUAL RUNOFF COEFFICIENTS FOR TROPICAL AFRICA 5-18
FIGURE 5-11: AFRICA'S MEAN ANNUAL RUNOFF COEFFICIENTS CONTOURS 5-19
FIGURE 5-12: LOCALITY MAP OF MINE HYDROGEOLOGICAL BOREHOLES AND COMMUNITY WELLS (GEOSTRATUM, 2024) 5-24
FIGURE 5-13: DOMINANT SOILS MAP 5-38
FIGURE 5-14: PRE-CONSTRUCTION LAND CAPABILITY 5-42
FIGURE 5-15: SITE SOIL SENSITIVITY MAP 5-44
FIGURE 5-16: AIR QUALITY SENSITIVE RECEPTOR LOCATIONS 5-45
FIGURE 5-17: PARTICULATE CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-47
FIGURE 5-18: CO_2 CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-48
Figure 5-19: HCHO CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-48
FIGURE 5-20: TVOC CONCENTRATIONS SAMPLED DURING DECEMBER 2023 5-49
FIGURE 5-21: NOISE SENSITIVE RECEPTOR LOCATIONS AND NOISE SAMPLING LOCATIONS .. 5-50
FIGURE 5-22: LOCATIONS OF PRELIMINARY SHORT-TERM NOISE SAMPLING 5-53
FIGURE 5-23: REMAINING UPPER GUINEA FOREST EXTENT 5-55
FIGURE 5-24: FROM LEFT TO RIGHT: THE SEASONAL PHENOLOGY OF FOREST TREES, THE MONTHLY BREEDING INTENSITY FOR FOREST BIRDS (NON-PASSERINE, PASSERINE AND RIVER BIRDS), AND SELECTED NON-PASSERINE BIRD FAMILIES (GATTER, 1997) 5-56
FIGURE 5-25: DISTRIBUTION OF HABITATS / VEGETATION COMMUNITIES WITHIN THE MATAMBO AREA 5-59
FIGURE 5-26: DRONE PHOTOS TAKEN IN 2021 OF SPECIFIC HABITATS IN THE EASTERN PORTION OF THE MATAMBO AREA 5-60
Figure 5-27: DRONE PHOTOS TAKEN IN 2023 OF THE MATAMBO AREA 5-61
FIGURE 5-28: A PHOTO OF *Didelotia idae* FOUND IN THE STUDY AREA 5-62
FIGURE 5-29: COLLAGE ILLUSTRATING (CLOCKWISE) 1: A STOCK PHOTOGRAPH OF IUCN VULNERABLE PICATHARTES. 2: A PICATHARTES RECORDED BY CAMERA TRAP WITHIN THE SPECIES' OPTIMAL ROCKY CAVE/ DRAINAGE LINE HABITAT ON THE INTERFACE BETWEEN WESTERN SILVER HILLS AND EASTERN MATAMBO 5-64

LIST OF TABLES

TABLE 5-1: SUMMARY OF MAJOR AND TRACE ELEMENT COMPOSITION AS DETERMINED BY HANDHELD XRF. VALUES EXPRESSED AS MASS %. ND INDICATES CONCENTRATION IS BELOW THE DETECTION LIMIT. 5-8
TABLE 5-2: PARTIAL ACID BASE ACCOUNTING DATA FOR THE 11 SAMPLES TESTED 5-9
TABLE 5-3: SUMMARY OF NAG DATA FOR THE 11 SAMPLES TESTED. TOTAL ACID GENERATION IS THE SUM OF THE NAG 4.5 AND NAG 7 VALUES 5-9
TABLE 5-4: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A NORMAL YEAR 5-10
TABLE 5-5: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A DRY YEAR 5-10
TABLE 5-6: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A WET YEAR 5-11
TABLE 5-7: MEAN MONTHLY AND ANNUAL RAINFALL FOR A NORMAL YEAR 5-11
TABLE 5-8: MONROVIA MEAN ANNUAL AND MONTHLY POTENTIAL EVAPORATION 5-12
TABLE 5-9: RECOMMENDED MEAN ANNUAL AND MONTHLY EVAPORATION 5-13
TABLE 5-10: MINIMUM, MAXIMUM AND AVERAGE HOURLY TEMPERATURES (MODELLED MM5 DATA, 2015 TO 2017) 5-13
TABLE 5-11: BASIC PHYSICAL CHARACTERISTICS OF THE CATCHMENTS 5-15
TABLE 5-12: BASELINE FLOOD PEAKS AND VOLUMES (PRE-DEVELOPED) 5-17
TABLE 5-13: FLOOD PEAKS AND VOLUMES (POST-DEVELOPED) 5-17
TABLE 5-14: ESTIMATED MEAN ANNUAL RUNOFFS (PRE-DEVELOPED) 5-19
TABLE 5-15: ESTIMATED MEAN ANNUAL RUNOFFS (POST-DEVELOPED) 5-19
TABLE 5-16: RECOMMENDED MONTHLY DISTRIBUTION OF THE MEAN ANNUAL RUNOFF 5-20
TABLE 5-17: HYDROGEOLOGICAL TEST AND MONITORING BOREHOLES 5-21
TABLE 5-18: HYDROCENSUS POINTS OF SURROUNDING COMMUNITY WELLS 5-22
TABLE 5-19: PUMPING TEST RESULTS 5-26
TABLE 5-20: GROUNDWATER QUALITY RESULTS – HYDROCENSUS POINTS 5-30
TABLE 5-21: SURFACE WATER QUALITY RESULTS SAMPLED AT LOCATIONS AS SEEN IN MAP 5-2 5-34
TABLE 5-22: ANALYTICAL RESULTS 5-40
TABLE 5-23: BASELINE NOISE MEASUREMENT SURVEY RESULTS 5-51
TABLE 5-24: BASELINE NOISE MEASUREMENT SURVEY DETAILS AND BROADBAND RESULTS 5-51
TABLE 5-25: PRELIMINARY SHORT-TERM NOISE SAMPLING RESULTS 5-52
TABLE 5-26: LAND COVER STATISTICS FOR LIBERIA 2014/2015 5-54
TABLE 5-27: HABITAT TYPES OF THE MATAMBO AREA 5-57
TABLE 5-28: THREATENED AVIFAUNA SPECIES OBSERVED WITHIN THE MATAMBO AREA 5-63
TABLE 5-29: THREATENED MAMMAL SPECIES OBSERVED/ REPORTED IN THE MATAMBO AREA 5-65
TABLE 5-30: AMPHIBIAN SPECIES AND COUNTS OBSERVED DURING THE 2021 MATAMBO BASELINE SURVEYS 5-66
TABLE 5-31: REPTILE SPECIES OBSERVED DURING THE MATAMBO AREA BASELINE SURVEYS 5-67

LIST OF MAPS

MAP 5-1: TOPOGRAPHY 5-68

MAP 5-2: 2023 SAMPLING LOCATIONS 5-69

LIST OF APPENDICES

APPENDIX 5-1: PUMPING TEST GRAPHS (GEOSTRATUM, 2024) 5-70
APPENDIX 5-2: RAPID ECOLOGICAL BASELINE STATUS VERIFICATION REPORT 5-75
APPENDIX 5-3: AVIFAUNA SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS MATAMBO RESOURCE AREA 5-76
APPENDIX 5-4: MAMMAL SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS THE MATAMBO RESOURCE AREA 5-78
APPENDIX 5-5: AMPHIBIAN SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS THE MATAMBO RESOURCE AREA 5-80
APPENDIX 5-6: REPTILE SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS MATAMBO RESOURCE AREA 5-81

5 PHYSICAL AND BIOLOGICAL BASELINE

This section of the ESIA provides a summary of the physical and biological baseline (pre-mining) environmental conditions at the Matambo Mine area.

Baseline specialist studies were conducted in 2020/2021 for various locations within the BMMC-MDA, including the Matambo Mine area. Relevant aspects of these studies have been used for this ESIA supplemented by further specialist studies conducted in 2023 and 2024.

5.1 GEOLOGY

Liberia is situated within the West African Craton, which has remained stable since about 1.7 Ga. The craton consists of two major basement domains; the Reguibat shield (in the north around Mauritania) and the ManShield (within which Liberia sits). The two shields are separated by the Taodeni basin of Proterozoic to Paleozoic age, while the ManShield lies to the west of the Proterozoic Birimian Belts.

The west of Liberia is comprised of Liberian age (3.0–2.5 Ga) greenstone belts and granitic gneisses. To the east of the country lies Eburnian age (2.1 Ga) material from the Birimian: a proto continent that accreted to Africa during the Eburnean Orogeny, 2.1 Ga. Pan African material extends along the southern edge of the country and represents the formation of Gondwana.

Within the Bea-MDA concession area there is both pan-African material (in the south-west corner) and Liberian age material, covering the majority of the concession area (AMC, 2012).

The lithologies underlying the proposed mining area consist of a sequence of highly deformed granitic gneisses into which sequences of ultramafic schists have been folded. Most of the felsic gneisses are strongly foliated and layered, and their structural relationship with intercalated iron-formations, quartzite, schist, and amphibolite is highly suggestive that the gneisses are metasedimentary. Granite dykes (aplitic to pegmatite) intrude the schist.

5.2 GEOCHEMICAL ASSESSMENT

5.2.1 GEOCHEMICAL CHARACTERIZATION- COMPOSITE SIMPLES

For the Matambo Resource Area, a total of 11 samples were collected:

- MT_DE_00006
- MT_DE_00013
- MT_DE_00014
- MT_DE_00015
- MT_DE_00021
- MT_DE_00026
- MT_DE_00030
- MT_DE_00033
- MT_DE_00034
- MT_DE_00041
- MT_DE_00067.

The samples were selected to provide the most comprehensive coverage of material type and depth from Pit 1 and Pit 2. Detailed information on the location and mineralogy of six of the 11 samples have been provided and this is presented in FIGURE 5-1. It was reported that the lithology comparison between the three pits indicate that all three demonstrates similar lithology. Therefore, the results from selected samples (at Pit 1 and 2) is also representative to the Pit-3 area.

5.2.1.1 Whole Rock Analysis

The whole rock analysis provides an indication of the elemental composition of the material. The major and trace elements, as estimated using handheld XRF are presented in TABLE 5-1.

The data show that silicon is the predominant element, which is consistent with the granite host rock. The handheld XRF did not quantify aluminium, which is typically the second most common element in granitic rock.

Several of the samples had relatively high calcium concentrations, suggesting alkaline minerals and potentially high acid neutralising capacity. A number of the samples also contained elevated iron concentrations, but the low sulphur grades suggest the iron is not present as acid-generating pyrite or pyrrhotite.

The samples will be subjected to a more accurate assay to quantify total sulphur, but the XRF data suggest only two of the 11 samples have a sulphur grade above 0.15%, suggesting limited acid generating potential.

The XRF analysis did not pick up detectable concentrations of arsenic, which is often an element of concern in gold-bearing ores, where some arsenopyrite may be present, but this may be due to the detection limit of the instrument. More accurate data will be provided by the acid digestion and leaching tests, where ICP can detect elements in the µg/l range.

5.2.1.2 ABA test results

The results for the acid base accounting, based on the data available at this stage, are summarised in TABLE 5-2. At this stage the detailed quantification of total sulphur has not been completed so it is not possible to calculate the maximum potential acidity (MPA) value. However, the handheld XRF analysis suggests that only two samples (MT_DE_00015 and MT_DE_00021) have sulphur grades in excess of 0.15%, so the MPA values are anticipated to be low.

The acid neutralising capacity tests have been completed and the data indicate that six of the 11 samples have significant acid neutralising capacity (>100 kg H2SO4/t). These samples showed a visible “fizz” reaction when exposed to 8% hydrochloric acid, suggesting the presence of carbonate minerals. These are relatively soluble so it is anticipated that these samples will result in alkaline pH values during the NAG and deionised water leach tests.

The samples with the high ANC values all appeared to contain acid soluble iron minerals. The assay requires two drops of 30% hydrogen peroxide to be added during the back titration at pH 5. A rapid decrease in pH indicates the oxidation of ferrous iron and subsequent hydrolysis of the ferric iron. This is accompanied by a visible colour change, consistent with the formation of ferric hydroxide. The XRF analysis confirmed that the samples with the high ANC had the highest iron concentrations.

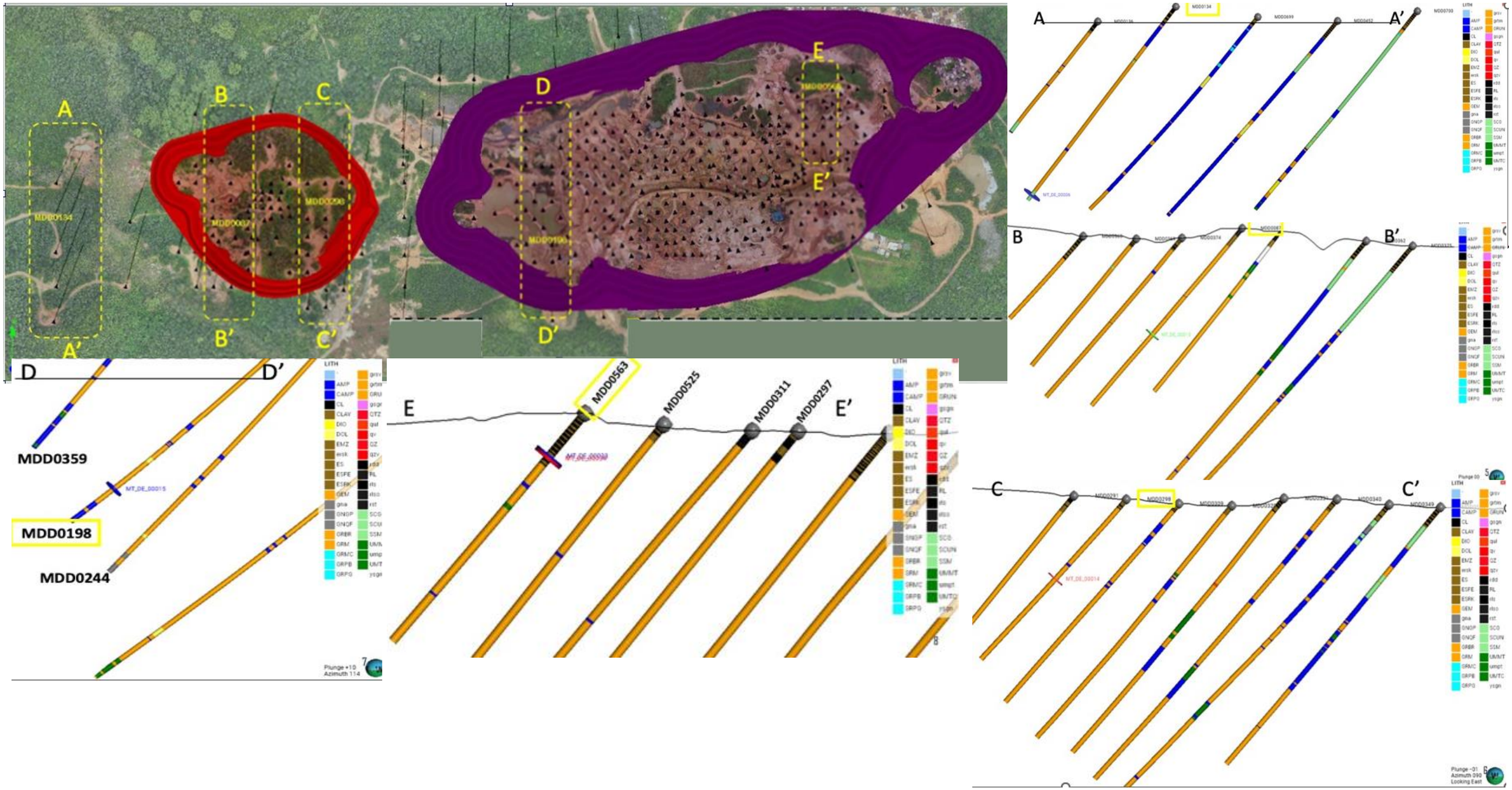


FIGURE 5-1: LOCATION OF DRILL CORES (MDD0134, MDD0087, MDD0298, MDD0198) AND MDD0563) AND CORE PROFILE SHOWING THE MINERALOGY OF THE SECTION OF THE CORE ANALYSED – SAMPLES MT_DE_00006, 00013, 00014, 00015, AND MT_DE_00034

TABLE 5-1: SUMMARY OF MAJOR AND TRACE ELEMENT COMPOSITION AS DETERMINED BY HANDHELD XRF. VALUES EXPRESSED AS MASS %. ND INDICATES CONCENTRATION IS BELOW THE DETECTION LIMIT.

SAMPLE CODE	SI	P	S	K	CA	TI	V	CR	MN	FE	CO
	%	%	%	%	%	%	%	%	%	%	%
MT_DE_00006	14.765	ND	ND	2.309	0.700	0.069	0.022	0.096	0.084	1.117	ND
MT_DE_00013	10.215	ND	ND	1.831	3.660	0.233	0.051	0.068	0.519	4.920	ND
MT_DE_00014	9.215	ND	ND	1.730	3.600	0.364	0.047	0.066	0.131	6.185	0.042
MT_DE_00015	9.725	ND	0.160	2.128	3.735	0.402	0.061	0.050	0.137	6.395	0.041
MT_DE_00021	6.995	ND	0.098	0.211	0.150	0.216	0.020	0.053	0.024	4.715	0.036
MT_DE_00026	11.890	ND	ND	2.320	2.055	0.233	0.058	0.082	0.089	3.230	0.032
MT_DE_00030	12.470	0.210	ND	2.252	1.464	0.178	0.045	0.080	0.089	2.985	0.031
MT_DE_00033	11.335	ND	ND	2.126	2.689	0.246	0.054	0.081	0.103	4.000	0.032
MT_DE_00034	9.850	ND	ND	1.394	0.125	0.170	0.039	0.038	0.186	2.196	0.021
MT_DE_00041	11.655	ND	ND	1.757	0.179	0.216	0.053	0.051	0.106	2.478	0.025
MT_DE_00067	12.560	ND	ND	2.461	1.234	0.159	0.054	0.091	0.054	1.657	0.021

SAMPLE CODE	NI	CU	ZN	AS	MO	CD	SN	SB	PB	TH	U
	%	%	%	%	%	%	%	%	%	%	%
MT_DE_00006	0.037	ND	ND	ND	0.004	0.010	0.018	0.028	0.002	ND	ND
MT_DE_00013	0.025	0.011	0.006	ND	0.002	0.011	0.018	0.029	0.003	ND	ND
MT_DE_00014	0.025	ND	0.009	ND	ND	0.011	0.018	0.035	0.003	ND	ND
MT_DE_00015	0.024	ND	0.009	ND	ND	0.011	0.018	0.031	0.003	ND	ND
MT_DE_00021	0.021	ND	ND	ND	0.002	0.010	0.017	0.029	0.002	ND	ND
MT_DE_00026	0.028	ND	0.006	ND	0.002	0.012	0.017	0.027	0.003	ND	ND
MT_DE_00030	0.027	ND	0.005	ND	0.002	0.011	0.018	0.028	0.004	ND	ND
MT_DE_00033	0.028	ND	0.006	ND	0.002	0.011	0.018	0.029	0.003	ND	ND
MT_DE_00034	0.015	ND	0.006	ND	ND	0.008	0.012	0.024	0.007	ND	ND
MT_DE_00041	0.019	ND	0.004	ND	0.002	0.009	0.015	0.026	0.009	ND	ND
MT_DE_00067	0.030	0.008	ND	ND	0.002	0.010	0.019	0.031	0.003	ND	ND

TABLE 5-2: PARTIAL ACID BASE ACCOUNTING DATA FOR THE 11 SAMPLES TESTED

SAMPLE	ANC (KG H_2SO_4/T)
MT_DE_00006	9.03
MT_DE_00013	151.74*
MT_DE_00014	122.66*
MT_DE_00015	135.30*
MT_DE_00021	107.48*
MT_DE_00026	118.86*
MT_DE_00030	101.16*
MT_DE_00033	13.90
MT_DE_00034	6.45
MT_DE_00041	3.87
MT_DE_00067	25.93*

* pH decreased by more than 1 unit after peroxide addition

5.2.1.3 Net acid generation (NAG)

The net acid generation (NAG) tests have been completed and the data are presented in TABLE 5-3.

The NAG is a confirmatory test, where the material is subjected to accelerated oxidation conditions that will oxidise reduced sulphur compounds as well as quantify potential acidity from the hydrolysis of metal ions. In addition, if the material has acid neutralising potential the test will account for that.

The NAG pH values (TABLE 5-3) were above pH 4.5 for all of the samples and only four of the 11 samples registered NAG pH values below pH 7. These results are consistent with the low sulphur grades and relatively high acid neutralising capacity values.

The data from the acid base accounting and NAG tests can be used classify material as either "potentially acid forming" (PAF), "non-acid forming" (NAF) or "uncertain". The geochemical classification plots will be generated once the more accurate total sulphur data become available, but the data from the NAG tests strongly suggest all 11 samples will be classified as NAF.

TABLE 5-3: SUMMARY OF NAG DATA FOR THE 11 SAMPLES TESTED. TOTAL ACID GENERATION IS THE SUM OF THE NAG 4.5 AND NAG 7 VALUES

SAMPLE	NAG PH	NAG 4.5 (KG H_2SO_4/T)	NAG 7 (KG H_2SO_4/T)
MT_DE_00006	6.98	0	0
MT_DE_00013	8.04	0	0
MT_DE_00014	8.06	0	0
MT_DE_00015	7.88	0	0.10
MT_DE_00021	7.94	0	0
MT_DE_00026	7.97	0	0
MT_DE_00030	7.93	0	0.69
MT_DE_00033	6.89	0	0
MT_DE_00034	6.90	0	0
MT_DE_00041	6.10	0	0.20
MT_DE_00067	7.79	0	0

5.2.1.4 Preliminary Conclusions

The interpretation of the data generated during the preliminary stages of the static test programme allows a number of conclusions to be drawn:

- The handheld XRF analysis showed that the major elements are consistent with the host rock.

- The sulphur grade for all samples was low, with only two of the samples reporting sulphur grades in excess of 0.15%. More accurate data will be generated by the LECO analysis to confirm this. The implication is that the material has limited acid generating potential.
- All but three of the samples had ANC values >10 kg H2SO4/t, with six of the 11 samples showing significant neutralising potential (>100 kg H2SO4/t).
- The NAG test results showed that the majority of the samples reported NAG pH values higher than pH 7, confirming the acid base accounting results. Four of the samples resulted in NAG pH values marginally below pH 7, but the magnitude of acidity was low (< 1 kg H2SO4/t) and most likely due to the oxidation of metals such as iron or aluminium. The data from the NAG tests strongly suggest all 11 samples will be classified as non-acid forming (NAF).

In summary, the completed static tests performed on the 11 samples indicate that there is very limited risk of acid generation and most of the samples have significant acid neutralising potential.

5.3 CLIMATE

The movement of the Inter Tropical Front (ITF) is largely responsible for the climate of West Africa, including Liberia. The ITF is formed by the meeting of the hot, dry Tropical Continental Air Mass over the Sahara and the cool, moist Equatorial Maritime Air Mass over the equator. The interface plane between these two air masses is known as the frontal surface. During the Liberian dry season (October to March), a low-pressure belt builds up over Southern Africa and a high-pressure belt builds up over North Africa resulting in a north-eastern wind known as the Harmattan. The Harmattan is a dry, hot and often dust laden wind, which can be seen as the manifestation of the Tropical Continental Air Mass. Conversely, during the Liberian wet season (April to September), a low-pressure belt builds up over the Sahara and a high-pressure belt builds up over Southern Africa resulting in the south-west monsoon winds, which can be seen as the manifestation of the Equatorial Maritime Air Mass.

5.3.1 PRECIPITATION

In addition to regional weather station data, historical 24-hour rainfall from New Liberty mine was obtained for the period 2011 to 2018.

The mean annual rainfall for New Liberty Mine was calculated as 3 372 mm. The monthly rainfall for the following scenarios was calculated, a normal year, an average wet and an average dry year. The normal year is taken as the statistical average year, the dry year as the thirty percentile values and the wet year as the seventy percentile values.

The tables below summarise the mean monthly and annual values for the three scenarios.

TABLE 5-4: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A NORMAL YEAR

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2013										6	226	121,4	353,4
2014	74	26	71	100	512	387,2	616	684,6	539,2	247,4	156,4	96,2	3510
2015	9	36	59,4	142	256,6	375,6	405	347	788,2	262	262	0	2942,8
2016	7	0	61,7	151,5	204,2	280,4	430	533,7	552	252,5	227,5	24,2	2724,7
2017	0	99,5	85,5	163	368,3	337,2	597,7	716,3	698,2	288,5	142,3	37,4	3533,9
2018	0	0	188,6	287,6	177,8	536,9	496,5	574,2	378,4	286,6	166	13	3105,6
2019	0	10	55	194	185	343	586	736	793	282	202	41	3427
2020	31	0	88	140	370,4	350,3	603,5	14,8					1598
AVERAGE	**17**	**25**	**87**	**168**	**296**	**373**	**534**	**515**	**625**	**232**	**197**	**48**	**2649**

TABLE 5-5: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A DRY YEAR

MONTH	JAN	FEB	MAR	APR	MA	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mm	1	8	42	81	264	414	421	758	555	271	172	6	2 993

TABLE 5-6: MEAN MONTHLY AND ANNUAL PRECIPITATION FOR A WET YEAR

MONTH	JAN	FEB	MAR	APR	MA	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mm	18	52	66	144	308	471	449	823	699	315	288	37	3 670

TABLE 5-7: MEAN MONTHLY AND ANNUAL RAINFALL FOR A NORMAL YEAR

MONTH	JAN	FEB	MAR	APR	MA	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mm	17	47	62	104	289	461	431	740	667	310	221	24	3 372

In addition, monthly precipitation data was sourced from the KNMI Climate Explorer for the Daru weather station[1] in Sierra Leone (approximately 90 km north of the site) and Harbel weather station[2] in Liberia (approximately 100 km south-east from the site). The Daru weather station contained 47 years of precipitation data ranging from 1951-1997. The Harbel weather station contained 59 years of precipitation data ranging from 1933-1993. The precipitation patterns recorded at the Daru and Harbel weather station, are provided in FIGURE 5-2 and FIGURE 5-3.

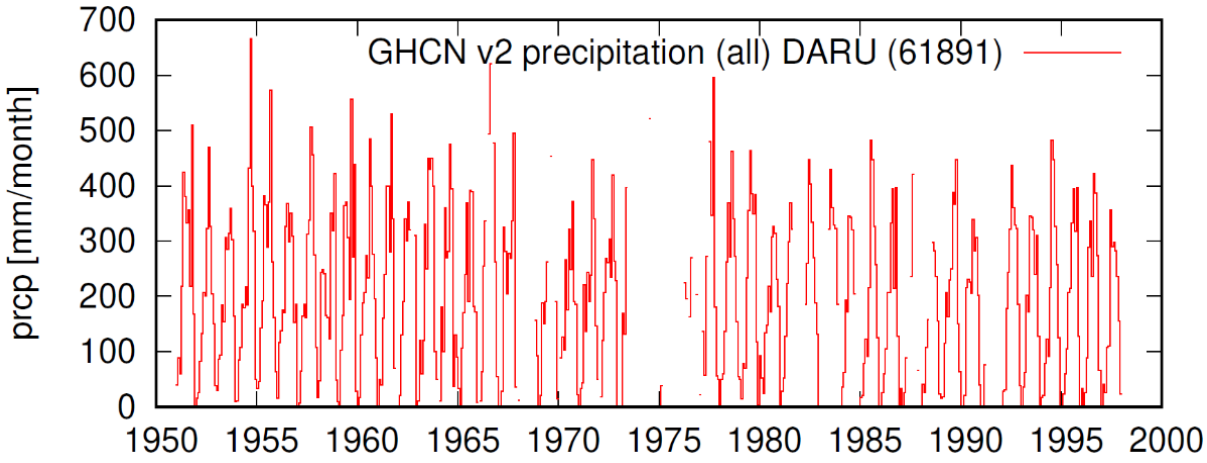


FIGURE 5-2: MONTHLY PRECIPITATION RECORDED AT DARU WEATHER STATION FROM 1951 – 1997

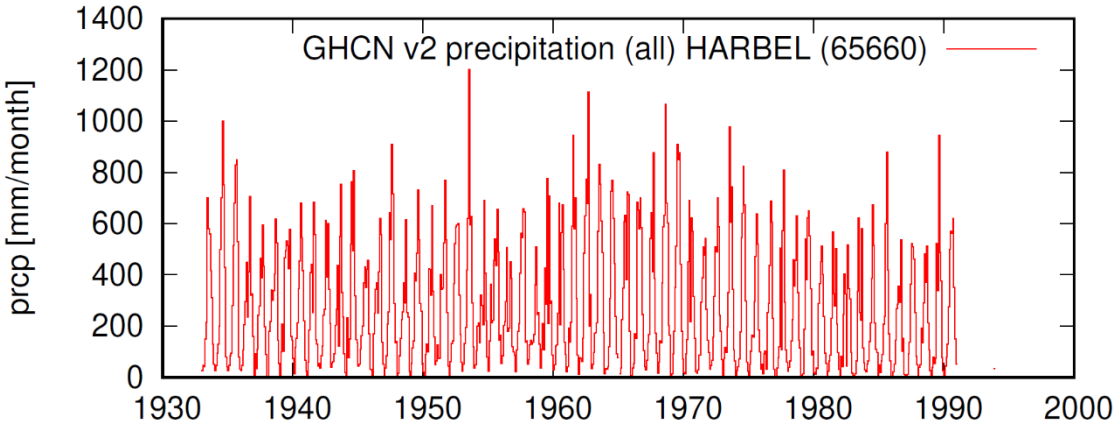


FIGURE 5-3: MONTHLY PRECIPITATION RECORDED AT HARBEL WEATHER STATION FROM 1933-1993

The annual cycles computed with all precipitation data available at the Daru and Harbel weather stations are provided in FIGURE 5-4 and FIGURE 5-5. As per the graphs for the Daru and Harbel weather stations, the months

[1] https://climexp.knmi.nl/getprcpall.cgi?id=someone@somewhere&WMO=61891&STATION=DARU&extraargs=
[2] https://climexp.knmi.nl/getprcpall.cgi?id=someone@somewhere&WMO=65660&STATION=HARBEL&extraargs=

of August and September contained the highest mean monthly precipitation, whereas January had the lowest mean monthly precipitation.

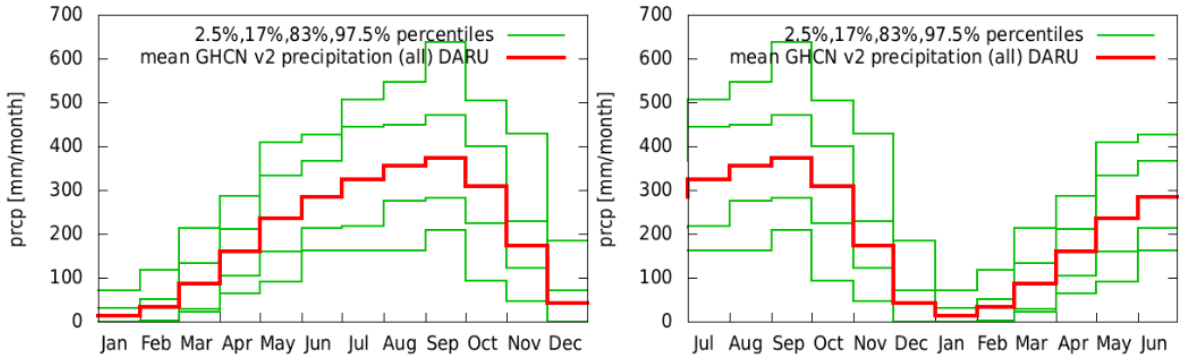


FIGURE 5-4: ANNUAL PRECIPITATION CYCLES FOR DARU WEATHER STATION[3]

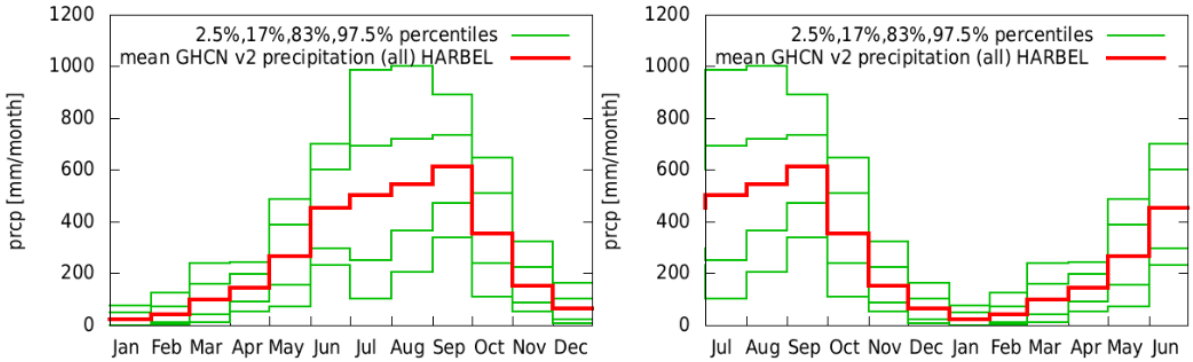


FIGURE 5-5: ANNUAL PRECIPITATION CYCLES FOR HARBEL WEATHER STATION[4]

5.3.2 EVAPORATION[5]

No historical evaporation records could be obtained from surrounding weather stations for long-term statistical analysis. Previous reporting[6] lists the mean monthly and annual potential evaporation for various surrounding weather stations. TABLE 5-8 below summarises the mean annual potential evaporation for Monrovia.

Daily potential evaporation readings were obtained from the New Liberty Mine weather station from May 2011 to September 2012 and from October 2017 to September 2018, which is the only raw data available.

A regional mean annual potential evaporation map was obtained from the book "Climatology of West Africa" – D Hayward and J Oguntoyinbo. FIGURE 5-6 below shows the estimated mean annual potential evaporation for West Africa. The location of Matambo Open Pit is shown on the figure that indicates an expected mean annual potential evaporation of just less than 1 000 mm per year.

TABLE 5-8: MONROVIA MEAN ANNUAL AND MONTHLY POTENTIAL EVAPORATION

MONTH	JAN	FEB	MAR	APR	MA	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mm	99	81	96	91	81	70	68	71	68	79	83	97	984

[3] https://climexp.knmi.nl/getprcpall.cgi?id=someone@somewhere&WMO=61891&STATION=DARU&extraargs=
[4] https://climexp.knmi.nl/getprcpall.cgi?id=someone@somewhere&WMO=65660&STATION=HARBEL&extraargs=
[5] Peens and Associates, 2024. Surface Water Quantity Assessment
[6] Report number 10612898-11406-2 compiled by Golder and Associates for the New Liberty Mine

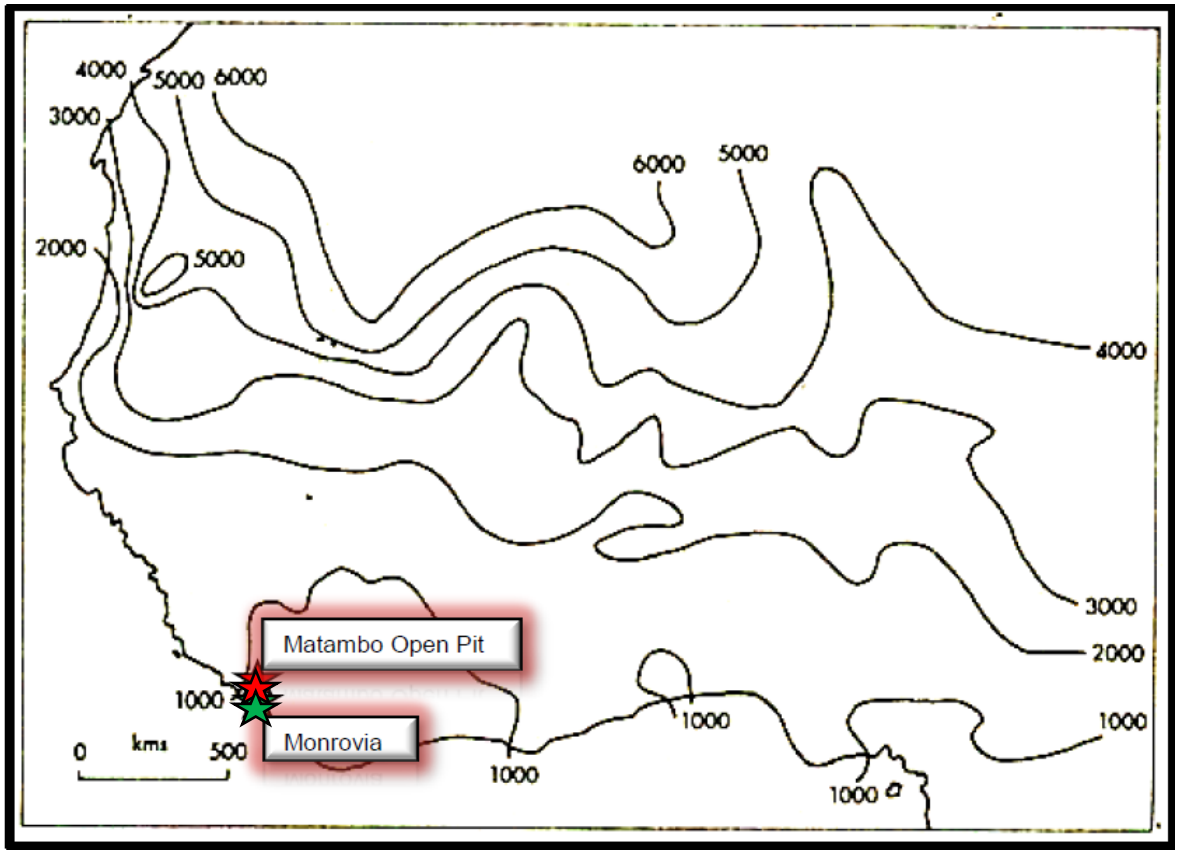


FIGURE 5-6: REGIONAL MEAN ANNUAL POTENTIAL EVAPORATION MAP

Studying FIGURE 5-6 above it is evident that evaporation does not vary significantly over large areas as is the case with rainfall. Hence it would be reasonable to assume that the potential evaporation at the Matambo Mine area, New Liberty Mine and Monrovia will not vary significantly.

The recommended values adopted are the averages between Monrovia and New Liberty Mine weather stations and is summarised in TABLE 5-9 below.

TABLE 5-9: RECOMMENDED MEAN ANNUAL AND MONTHLY EVAPORATION

MONTH	JAN	FEB	MAR	APR	MA	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mm	86	80	90	92	85	72	64	63	68	76	80	86	942
%	9.1	8.5	9.6	9.8	9.0	7.6	6.8	6.7	7.2	8.1	8.5	9.1	100

5.3.3 TEMPERATURE

Diurnal temperature trends are presented in FIGURE 5-6 Monthly mean, maximum and minimum temperatures are given in TABLE 5-10. Temperatures ranged between 17.6°C and 34.1°C. The highest temperature occurred in March and the lowest in December. During the day, temperatures increase to reach a maximum at around 16:00. Ambient air temperatures decrease to reach a minimum at around 06:00 i.e. just before sunrise.

TABLE 5-10: MINIMUM, MAXIMUM AND AVERAGE HOURLY TEMPERATURES (MODELLED MM5 DATA, 2015 TO 2017)

MONTH	MINIMUM TEMPERATURE	MAXIMUM TEMPERATURE	AVERAGE TEMPERATURE
January	18.6	33.1	26.2
February	18.9	33.8	26.7

March	20.1	34.1	27.1
April	22.6	33.9	27.5
May	23	34	27.7
June	21.5	33.1	26.7
July	21.2	31.8	25.6
August	21.6	30.6	25.3
September	21.6	32.1	25.6
October	21.4	33.4	26.4
November	21	33.8	26.4
December	17.6	33.5	26.1

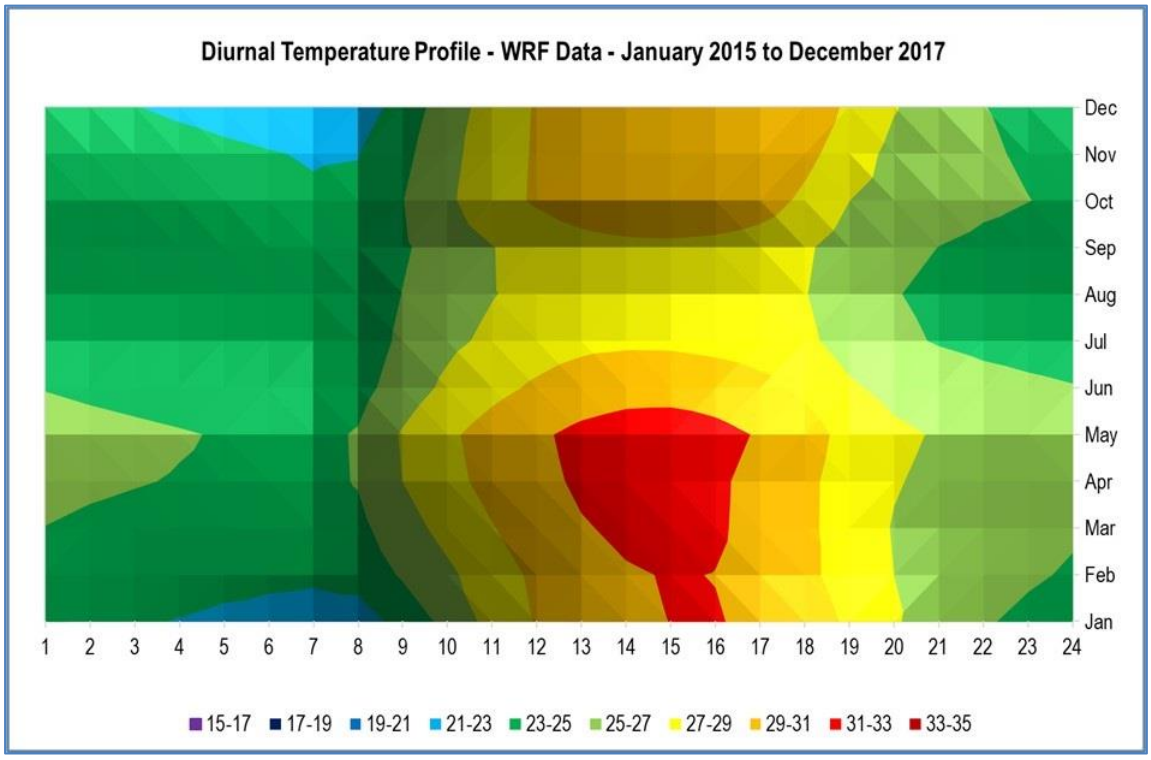


FIGURE 5-7: DIURNAL TEMPERATURE PROFILE (MODELLED MM5 DATA, 2015 TO 2017)

5.3.4 HUMIDITY[7]

The average annual relative humidity is 80% and average monthly relative humidity ranges from 76% in February to 86% in September.

5.3.5 SURFACE WIND FIELD

Wind roses comprise 16 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses below, reflect the different categories of wind speeds; the light blue area, for example, representing winds in between 1 and 2 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 0.5 m/s are also indicated.

The period wind field and diurnal variability in the wind field are shown in FIGURE 5-8.

There was very little variation in the diurnal wind field. During both daytime and night-time conditions, the wind field is mostly from the southwestern sector with an average wind speed of 1.9 m/s and 25% calm conditions

[7] https://weather-and-climate.com/average-monthly-Humidity-perc,Monrovia-li,liberia

(wind speeds < 0.5m/s). During the day higher wind speeds were observed compared to during the night, but a higher frequency of calms also occurs during the day. Most high wind speed episodes (wind speeds >5 m/s) occurred during the day.

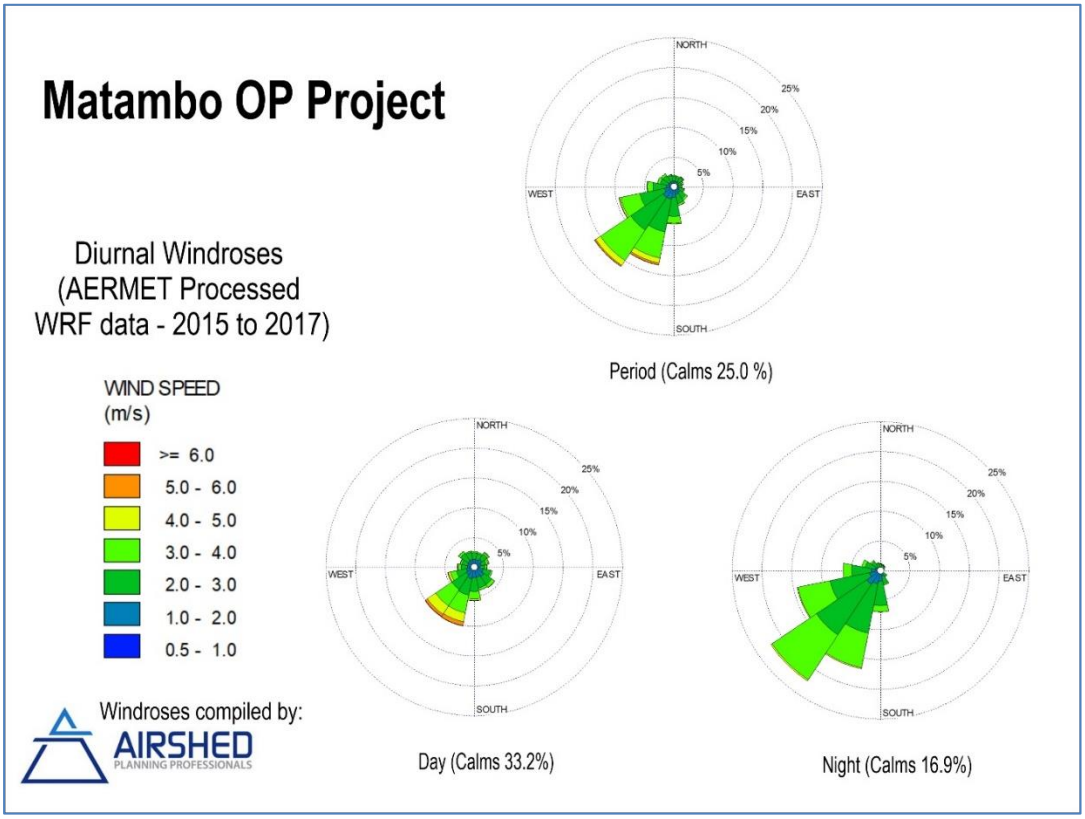


FIGURE 5-8: PERIOD, DAY AND NIGHT-TIME WIND ROSES (MODELLED MM5 DAT, 2015 TO 2017)[8]

5.4 DRAINAGE AND TOPOGRAPHY

5.4.1 HYDROLOGICAL CHARACTERISTICS

The figure below indicates the three catchments affected by the Project, namely "SW-West", "SW-Central" and "SW-East".

The catchments were selected to find the smallest catchment in a watercourse that can be potentially affected by the proposed mining activities. As can be seen from the figure below most of the proposed mining infrastructure is within catchment SW-East.

All three catchments are predominantly flat with minor areas in the upper reaches of catchment SW-East being hilly. The permeability of the catchments is classified as predominantly semi-permeable to impermeable as a result of high catchment saturation levels. All three catchments are rural with vegetation cover predominantly forest.

TABLE 5-11: BASIC PHYSICAL CHARACTERISTICS OF THE CATCHMENTS

CATCHMENT NODE	TOTAL AREA (km^2)	AREA WITHIN MINE (km)	AVERAGE SLOPE OF OVER LAND (%)	LONGEST WATER COURSE (km)	AVERAGE SLOPE OF WATERCOURSE (%)
SW-East	36,7	0.2	15.0	11.0	0.34
SW-Central	13.8	0.7	2.0	6.2	0.37
SW-West	7.9	0.5	3.7	5.0	0.24

[8] Airshed. 2024. Air Quality Impact Assessment –Matambo Open Pit Project, Liberia

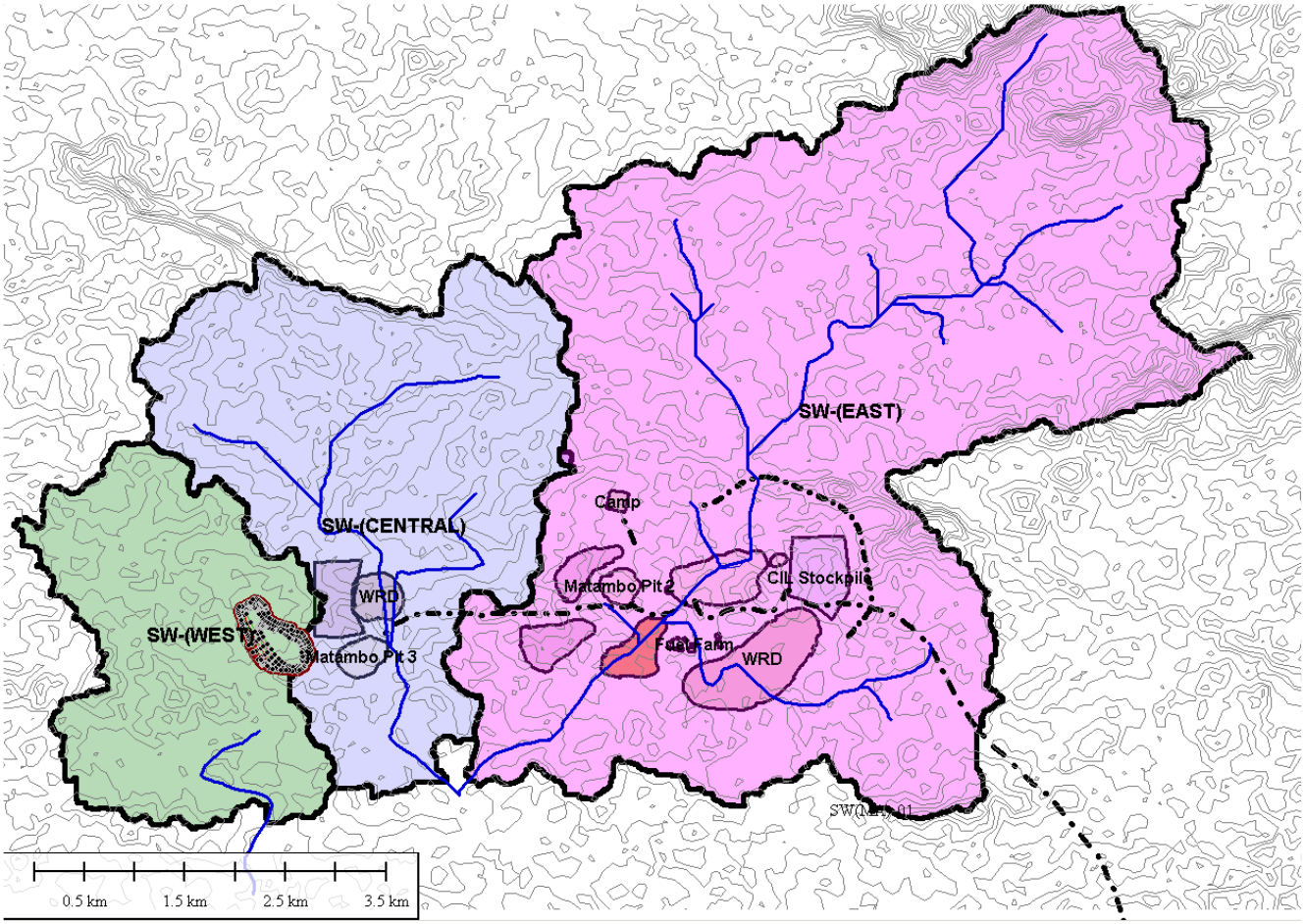


FIGURE 5-9: MATAMBO PRE-DEVELOPMENT SUB-CATCHMENTS

5.4.2 SURFACE WATER AND HYDROGEOLOGY

5.4.2.1 Flood peaks and volumes

The flood peaks were estimated utilising the Rational Method. The flood volumes were calculated assuming a uniform storm distribution that result in triangular hydrograph where the time of concentration is equal to one third of the total storm duration.

In the absence of measurement river flow hydrographs, this method provides an indication of expected volumes. The tables below list the estimated pre- and post-development values for each catchment.

TABLE 5-12: BASELINE FLOOD PEAKS AND VOLUMES (PRE-DEVELOPED)

CATCHMENT NAME		RECURRENCE INTERVAL					
		1:2	1:5	1:10	1:20	1:50	1:100
SW-East	Flood Peak (m^3/s)	70	100	124	154	199	241
	Flood Volume (10^3 m^3)	1 547	2 218	2 755	3 399	4 402	5 330
SW-Central	Flood Peak (m^3/s)	32	46	57	71	91	111
	Flood Volume (10^3 m^3)	548	794	987	1 220	1 573	1 914
SW- West	Flood Peak (m^3/s)	202	28	35	44	57	69
	Flood Volume (10^3 m^3)	319	459	569	707	918	1 114

TABLE 5-13: FLOOD PEAKS AND VOLUMES (POST-DEVELOPED)

CATCHMENT NAME		RECURRENCE INTERVAL					
		1:2	1:5	1:10	1:20	1:50	1:100
SW-East	Flood Peak (m^3/s)	66	95	118	146	189	229
	Flood Volume (10^3 m^3)	1 469	2 107	2 617	3 229	4 182	5 063
SW-Central	Flood Peak (m^3/s)	31	45	57	70	90	110
	Flood Volume (10^3 m^3)	543	786	977	1 207	1 558	1 895
SW-West	Flood Peak (m^3/s)	202	28	35	44	57	69
	Flood Volume (10^3 m^3)	319	459	569	707	918	1 114

5.4.2.2 Mean annual runoff

The mean annual runoff should ideally be estimated from long river flow records preferably in excess of 30 years. No river gauging data could be obtained for the Matambo River catchment in which Matambo Open Pit is situated. Therefore, the adjacent Lofa River basin were utilised where a river gauging site was established during 2013 approximately 13km downstream of the mine at the Lofa River Bridge.

Only two years of flow record is available from the Liberian Hydrological Services and the estimated mean annual runoff for two years is 947mm. The estimated mean annual rainfall of the Lofa River catchment based on the rainfall contours obtained from the "Climatology of West Africa" is approximately 2 500mm. The mean annual runoff as a percentage of mean annual rainfall is calculated as 38%.

In the absence of long river flow records a literate review was done to establish a likely annual runoff. The best available published information is for the book "Hydrology and Water Resources of Africa" - M. Shahin.

The textbook "Hydrology and Water Resources of Africa" lists several rivers in tropical Africa for which the mean annual runoff is expressed as a percentage of mean annual rainfall. This data was plot in excel and a polynomial curve fitting provided a good fit to the data. Based on the curve fitting a catchment with a mean annual rainfall of 2 500mm have a mean annual runoff of 40%. FIGURE 5-10 below shows the data plot and curve fitting. *The estimated mean annual runoff coefficient for Matambo Open Pit site with a mean annual rainfall of 3 372mm is 60%.*

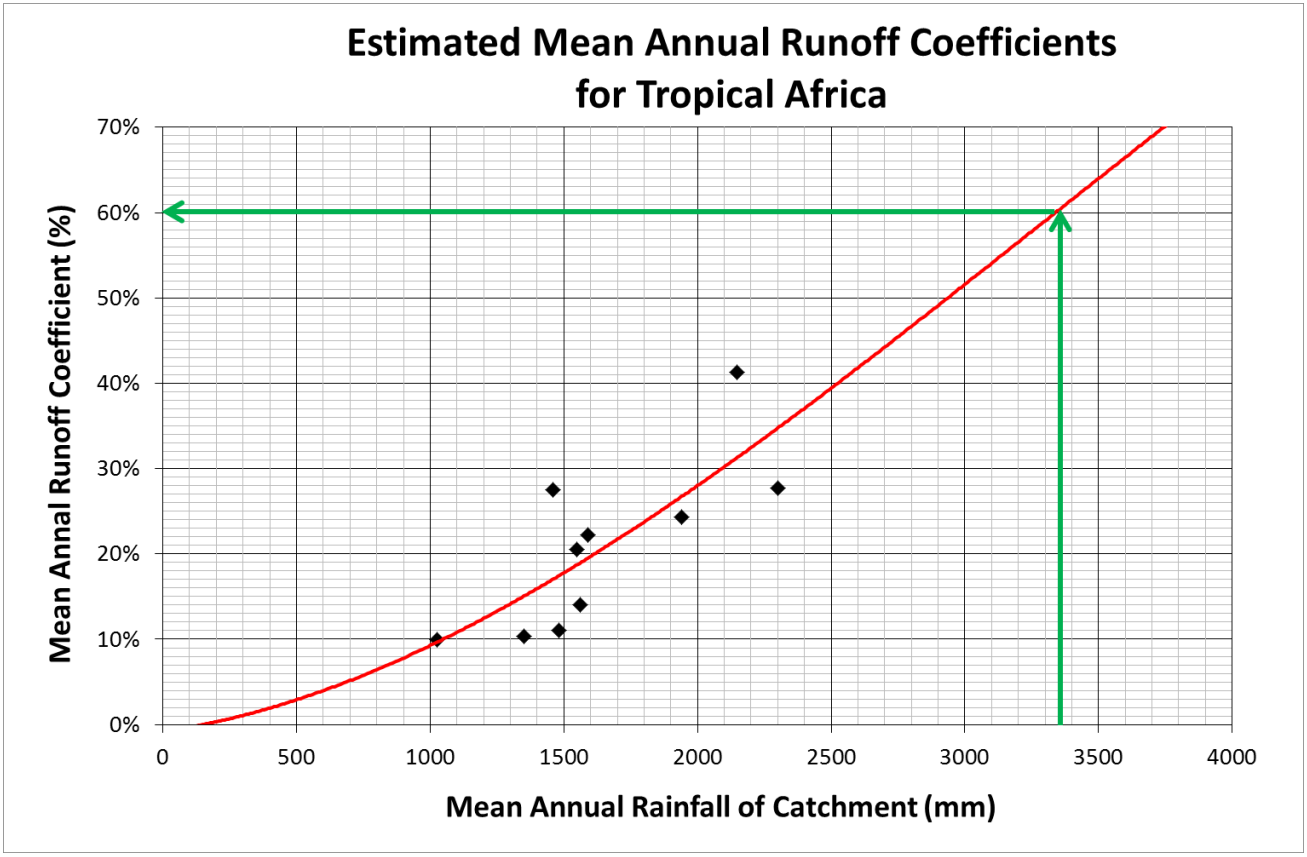


FIGURE 5-10: ESTIMATED MEAN ANNUAL RUNOFF COEFFICIENTS FOR TROPICAL AFRICA

FIGURE 5-11 below is an abstract for the textbook, with Matambo Open Pit position shown on. The estimated mean annual runoff coefficient, i.e. ratio to mean annual rainfall range from 30% in the upper reaches to 70% at the coastline.

The mean annual runoff ratios increase with increase in mean annual rainfall which appears to be a trend for tropical Africa; this further supports the recommended mean annual runoff coefficient as shown in FIGURE 5-10

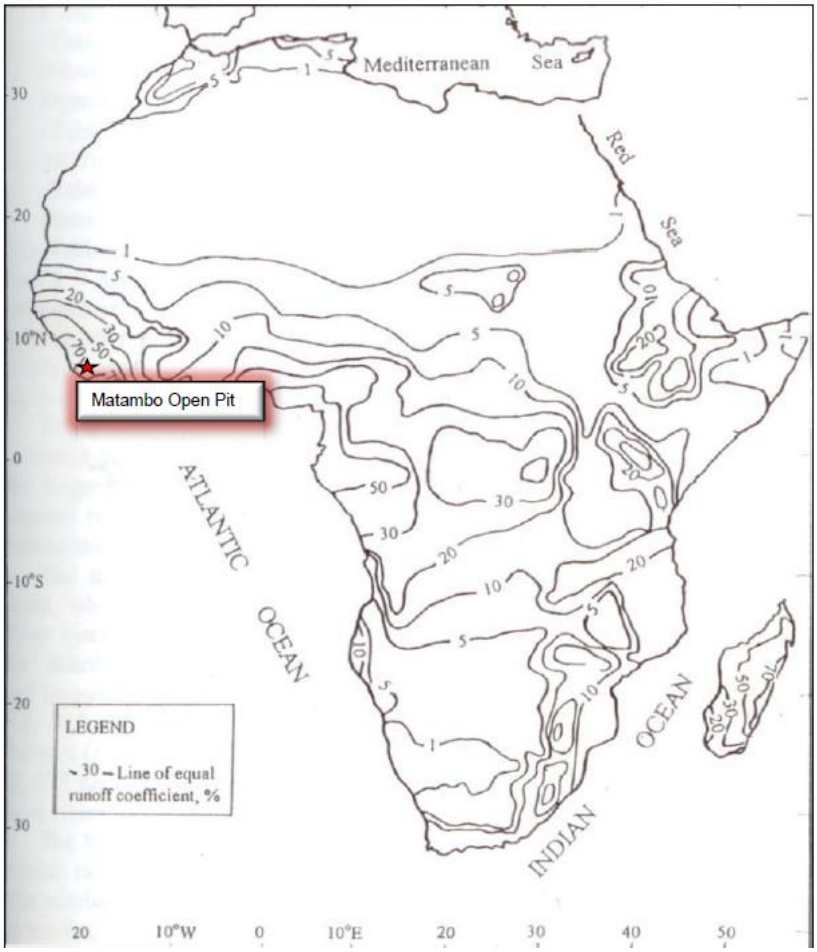


FIGURE 5-11: AFRICA'S MEAN ANNUAL RUNOFF COEFFICIENTS CONTOURS

The pre-developed estimated mean annual runoff (MAR) volumes for the two identified sub-catchments are listed in TABLE 5-14 below.

TABLE 5-14: ESTIMATED MEAN ANNUAL RUNOFFS (PRE-DEVELOPED)

CATCHMENT NAME	MAR (10^6 m^3)	MAR (M^3/S)
SW-East	74.25	23.5
SW-Central	27.92	8.9
SW-West	15.98	5.1

The post-developed estimated mean annual runoff (MAR) volumes for the two identified sub-catchments are listed in TABLE 5-15 below.

TABLE 5-15: ESTIMATED MEAN ANNUAL RUNOFFS (POST-DEVELOPED)

CATCHMENT NAME	MAR (M^3)	MAR (M^3/S)
SW-East	702.1	22.3
SW-Central	276.2	8.8
SW-West	159.8	5.1

TABLE 5-16 below summarises the recommended monthly distribution of the mean annual runoff based on the flow records for the Lofa River at Lofa Bridge River gauging site.

TABLE 5-16: RECOMMENDED MONTHLY DISTRIBUTION OF THE MEAN ANNUAL RUNOFF

Month	Jan	Feb	Mar	Apr	Ma	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
%	2.0	1.2	0.7	0.8	3.0	5.7	8.2	21.9	27.0	16.4	8.6	4.5	100

5.4.2.3 Boreholes and community wells

A list of hydrogeological test boreholes, specifically drilled for the Matambo hydrogeological study, is provided in TABLE 5-17. Existing community boreholes and hand-dug wells within the study area are provided in TABLE 5-18. The localities of these groundwater points are shown in FIGURE 5-12.

The hydrogeological or MHB-series boreholes were sited based on infrastructure layout, taking site access restrictions into account. Five (5) boreholes are located at Matambo Center, and three (3) boreholes are located at the Matambo West site. Localities of boreholes, where possible, also considered dolerite dyke intrusions and potential geological lineaments as identified from the airborne magnetic data.

MHB borehole depths were based on the adjacent open pit mining depths. Borehole diameter was unfortunately restricted, based on the available RC drilling equipment made available by the mine. The maximum hole diameter is 151 mm. Casing consists of 114 mm uPVC pipes. Pumping tests were performed on 6 of these boreholes, however, the yield of the constant discharge tests was restricted by the casing size to less than 1 l/s. Borehole lithological and hydrogeological logs were received for two (2) boreholes, i.e. MHB2 and MHB5.

Hydrocensus information of surrounding community boreholes and hand-dug wells were obtained from BMMC, apart from the Matambo# points which was identified by Geostratum. A total of 23 points were identified, with most groundwater abstraction points located at Bangorma village next to the proposed Matambo 1 Center pit. A large fraction of the wells was equipped with handpumps for water abstraction. The villages Gogoima (north, between Matambo West and Matambo Center) and Korma Sokporjah (southeast of Matambo Center) also have a substantial number of water supply wells, with estimated populations of 1 250 and 1 615 respectively.

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TABLE 5-17: HYDROGEOLOGICAL TEST AND MONITORING BOREHOLES

BOREHOLE ID	LOCALITY			MAIN LITHOLOGY	ELEVATION	BOREHOLE DEPTH	STATIC GROUNDWATER LEVEL (DEPTH)	GROUNDWATER STRIKE (UPPER)
	COORDINATES UTM29, WGS84		DESCRIPTION		mamsl	m	m	m
	mE	mN						
MHB1	254086	783055	Matambo Pit 1 & 2	Meta-Granite-Gneiss (some quartz veining)	61.5	73	5.76	10 - 23
MHB2	255298	783396		Amphibolite/Meta-Granite. Shallow weathering	65.47	111	5.18	7 - 24
MHB3	254666	782827		Meta-Granite-Gneiss	58.4	73	3.77	4
MHB4	254808	783197		Meta-Granite-Gneiss (some amphibolite), Shallow weathering about 10 m	59.6	68	No information	67
MHB5	255792	782954		Meta-Granite-Gneiss (some amphibolite).	66.13	142	6.87	23 - 40
MHB6	251972	782156	Matambo Pit 3	Meta-Granite-Gneis near dolerite contact)	63.9	72	5.38	10
MHB7	251495	782153		Meta-Granite/Gneiss/Ultamafics (near Dolerite contact)	70.9	100	5.07	No information
MHB8	251932	782577		Amphibolite/ultramafic	65.1	40	No information	No information

TABLE 5-18: HYDROCENSUS POINTS OF SURROUNDING COMMUNITY WELLS

POINT NO	BOREHOLE/ WELL ID	DISTRICT	COMMUNITY / OWNER	POPULATION	UTM 29N/ WGS84		ELEVATION (mamsl)	WELL/ EQUIPMENT	USE	DEPTH TO WATER LEVEL (m)
					mE	mN				
22	NTB_NEW -B-2	Tewor	Yatesville/Bakana	N/A	250485	783355	64	Hand pump	Use as drinking source for the community	-
26	NTB_NEW _C-3	Tewor	Yatesville/Bakana	N/A	250656	783510	67	Damaged Hand pump	Damaged drinking water source for the community	-
48		Gola Konneh	Korma Sokporjah	1615	256907	782209	46	Damaged Hand pump	Damaged hand pump. No pump head.	-
54		Gola Konneh	Korma Sokporjah	1615	256601	782421	51	Hand pump	Use as drinking source for the community	-
56		Gola Konneh	Korma Sokporjah	1615	256637	782441	51	Hand pump	Use as drinking source for the community	-
57		Gola Konneh	Korma Sokporjah	1615	256679	782316	52	Hand pump	Use as drinking source for the community	-
59		Gola Konneh	Korma Sokporjah	1615	256823	782209	49	Hand pump	Use as drinking source for the community	-
104	G-8	Tewor	Massakpa	N/A	253032	781787	37	Hand pump	Use as drinking source for the community	-
114		Tewor	Massakpa	N/A	252971	781901	41	Hand pump	Drinking source for the school	-
141		Tewor	Gogoima	1250	252950	784113	61	Hand pump	Use as drinking source Gogoima School. 6 classrooms.	-
142		Tewor	Gogoima	1250	253050	784000	53	Hand pump	Use as drinking source for the community	-
143		Tewor	Gogoima	1250	253170	784030	57	Not Functioning - Hand pump	Use as drinking source for the community	-
144		Tewor	Gogoima	1250	253224	784029	62	Hand pump	Use as drinking source for the community	-
MTB-10	MTB-10	Tewor	Saano	N/A	251334	783987	49.4	Open well	None	-
MTB-15	MTB-15	Gola Konneh	Bangorma	N/A	255380	783575	40.7	Hand pump	Use as drinking source at Bangorma School	7.7

MTB-16	MTB-16	Gola Konneh	Bangorma	N/A	255611	783420	34.2	Hand pump	Use as drinking source for the community	-
MTB-17	MTB-17	Gola Konneh	Bangorma	N/A	255740	783378	37	Open well	None	-
Mat1	Matambo 1	Gola Konneh	Bangorma	N/A	255967	783249	40.39	Hand pump	Use as drinking source for the community	-
Mat2	Matambo 2	Gola Konneh	Bangorma	N/A	255823	255823	34.87	Hand dug well	Use as drinking source for the community	2.76
Mat3	Matambo 3	Gola Konneh	Bangorma	N/A	255763	783327	35.2	Hand dug well	Use as drinking source for the community	2.67
Mat4	Matambo 4	Gola Konneh	Bangorma	N/A	255803	783423	38.3	Hand pump	Use as drinking source for the community	-
Mat5	Matambo 5	Gola Konneh	Bangorma	N/A	255553	783396	32.3	Hand dug well	Use as drinking source for the community	2.4
Mat7	Matambo 7	Gola Konneh	Bangorma	N/A	255497	783594	38.4	Hand dug well	Use as drinking source for the community	6.14

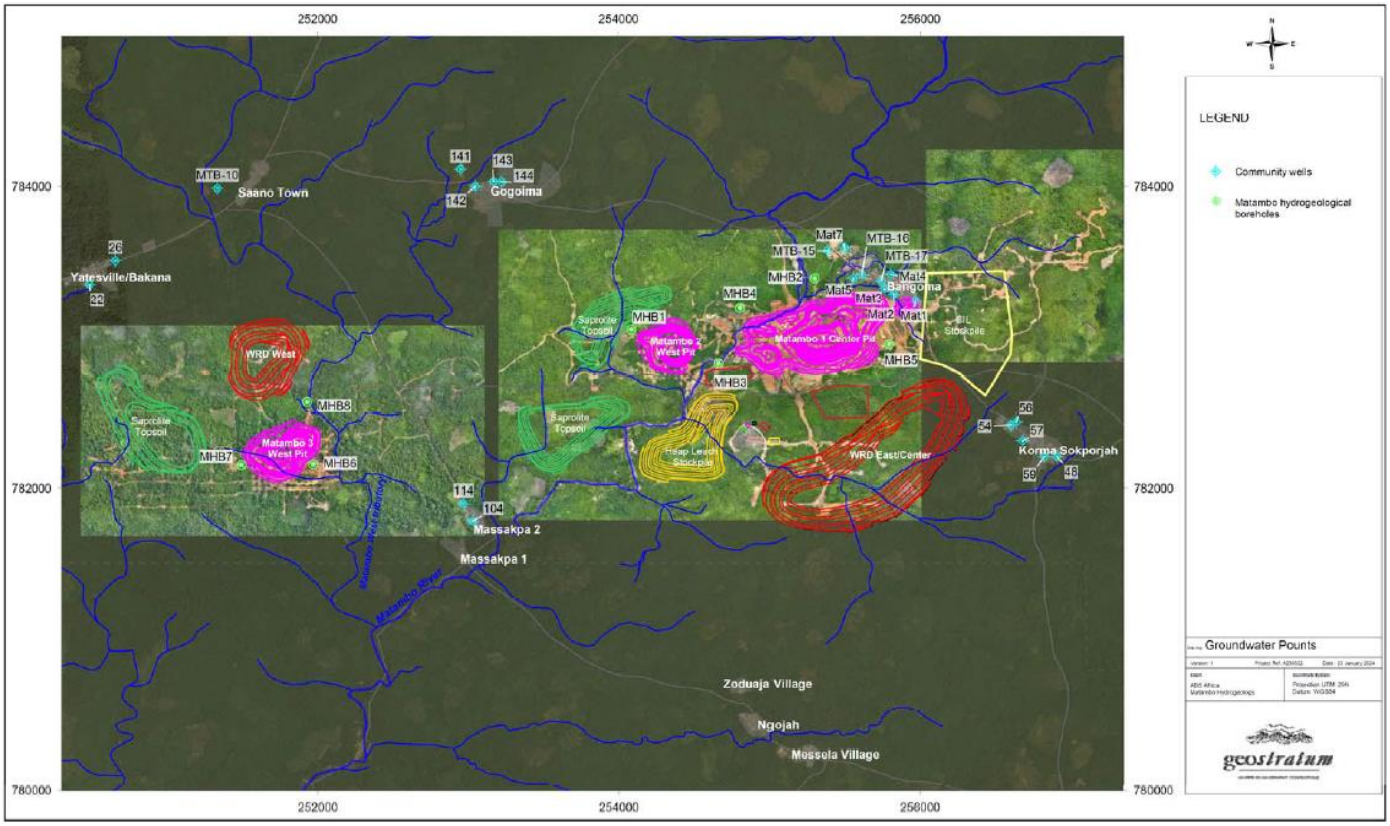


FIGURE 5-12: LOCALITY MAP OF MINE HYDROGEOLOGICAL BOREHOLES AND COMMUNITY WELLS (GEOSTRATUM, 2024)

5.4.2.4 Aquifer tests

Pumping tests were performed by mine staff on six (6) of the hydrogeological boreholes to obtain the hydraulic flow parameter, transmissivity[9]. These tests consisted of a constant discharge test, on average 12-hour duration, followed by water level recovery measurements (recovery tests). The casing diameter was 114 mm (OD), restricting the pump diameter to 3 inches. The pump utilised by the mine obtained abstraction rates between 0.4 and 0.89 l/s. at the specific tested pump depths.

Pumping tests graphs are presented in APPENDIX 5-1. Borehole test water levels stabilised quickly with the low constant discharge rate, followed by quick water level recovery (7 to 30 minutes) once the pump was stopped. The tests provided limited opportunity to analyse the early test data of the constant discharge test data, using the Cooper-Jacob analytical method for analysing transmissivity. Recovery tests data was analysed by the Theis (Recovery) analytical method.

The results of the aquifer tests show a variation of 4 orders in terms of aquifer transmissivity values. This large range of transmissivity values is often encountered when testing secondary aquifers[10]. Estimations of the bulk, average hydraulic conductivity was also undertaken, using the calculated transmissivity values. The low-test pump-out rates also limit the overall characterisation of the aquifers and analysed transmissivities might not be fully representative of different aquifer features at depth.

Calculated transmissivities, based on early time drawdown data and recovery data vary between 0.06 and 10.2 m^2/d. Test boreholes MBH2 and MHB3 have low transmissivity values and were drilled in areas with relatively little weathering (<10 m deep), potentially suggesting more competent rock with few secondary aquifer features. The high transmissivity of borehole MBH1 is probably related to faulting/large fracturing associated with a

[9] Transmissivity is the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is expressed as the product of the average hydraulic conductivity and thickness of the saturated portion of an aquifer.

[10] An aquifer in which groundwater moves through secondary openings and interstices, which developed after the rocks were formed. The secondary opening form as a result of weathering, fracturing, faulting and dissolution.

northwest-southeast trending lineament identified from the aerial magnetic data or quartz veining structures associated with the ore body. Both MBH6 and MBH7 targeted younger dolerite dykes at with Matambo West, and it is likely that the dolerite intrusions resulted in fracturing along the contact of surrounding lithologies during intrusion.

TABLE 5-19: PUMPING TEST RESULTS

BOREHOLE ID	MAIN LITHOLOGY	BOREHOLE DEPTH	STATIC GROUNDWATER LEVEL (DEPTH)	DURATION OF CD TEST	CD ABSTRACTION RATE	MAXIMUM DRAWDOWN	TRANSMISSIVITY		HYDRAULIC CONDUCTIVITY [11]
		m	m	min	l/s	m	CD- m^2/d	RECOVERY - m^2/d	m/d
MB1	Granite-Gneiss (some quartz veining)	73	5.76	720	0.89	5.53	10.2	9.85	0.15
MB2	Amphibolite/Granite. Shallow weathering	111	5.18	840	0.67	6.43	0.06		0.0006
MB3	Granite-Gneiss (some amphibolite), Shallow weathering about 10 m	73	3.77	720	0.40	1.47		0.07	0.001
MB5	Granite-Gneiss (some amphibolite).	142	6.87	360	0.83	4.35	9.6	6.5	0.059
MB6	Granite-Gneis near dolerite dyke contact)	72	5.38	720	0.76	5.98	2.6	4.7	0.054
MB7	Granite/Gneiss/Ultramafic (near dolerite dyke contact)	100	5.07	720	0.41	5.59	2.3	2.5	0.025

CD - Constant discharge

[11] Hydraulic conductivity estimated from transmissivity by averaging over theoretical saturated zone.

5.4.2.5 Groundwater levels

The depth of groundwater levels, as measured end-2023, are listed in TABLE 5-17 and TABLE 5-18. The groundwater table in the general project area is shallow and measured depth of groundwater levels were between 2.4 and 7.7 metres below ground level (mbgl).

Shallow groundwater flow mimic topography. The pre-mining groundwater flow direction generally in a southwestern to southern direction. Groundwater outflow occurring at springs, dambo/wetland areas, and direct channel baseflow contribution.

The groundwater table is un-influenced by surrounding mining activities, with minimal, if any, permanent impact from community water abstraction.

5.4.2.6 General aquifer description

The baseline aquifer data were obtained from the MBH test boreholes, as well as similar studies at the New Liberty Gold Mine (NLGM) property. Different hydrogeological units and aquifers features are:

- **The weathered hydrogeological unit**, consisting of saprolite and saprock. Some shallow laterite formation and upper transported sediments are locally present. Groundwater is normally encountered on the contact with more competent rock as also seen from the site drilling, i.e. groundwater is often intersected in the transitional or saprock unit, especially the contact with the fractured slightly weathered to fresh rock. Information presented by Avesoro Resources suggests an average depth of about 21 m for the oxidised or saprolitic weathered zone.

  In general, it is expected that the hydraulic conductivity of the saprolite within the mafic/ultramafic and schist units are relatively low due to a high percentage of clay-rich alteration minerals. The saprolitic weathering associated with the gneiss and meta - granite, depending on the parent rock mineral composition, is expected to have a higher hydraulic conductivity compared to the mafic/ultramafic and schist units. Secondary features such as quartz veining also increases the permeability. Test work at New Liberty Work (Golder Associates, June 2012) also confirms the relatively high permeable nature of the saprock unit.

  The weathered unit has in general a higher aquifer storage potential compared to fresh rock.

- **Fractured rock hydrogeological unit**, associated with faulting, potential fracturing in the altered contact zone of dolerite dykes (northwest-southeast trending), potential fracturing associated with quartz veining in the ore zone. Available drill hole data is not sufficient to characterise or classify the hydraulic properties of the fractures according to depth and different lithological units. It is often observed that the frequency of groundwater intersection, in this type of geological environment, decreases with depth.

  Airborne geophysical, satellite imaging and topographic data of the area indicate several predominantly northwest-southeast dolerite dykes and other lineaments. It is anticipated that the altered contact zone of these dykes could potentially host groundwater. The dolerite dykes itself often form topographic highs, impacting surface drainage. These dykes, below the weathered zone (and if not impacted by younger cross-fracturing), could act as a partial groundwater flow barrier or aquitard for transverse flow across the dyke.

The conceptual model for the open pit/underground mining area could be summarised as follows:

- Pre – mining groundwater levels and the upper groundwater intersections during drilling were found to be relatively shallow. Groundwater intersections or strikes encountered during drilling of the MBH boreholes was mostly around 10 m and even shallower. Measured groundwater levels in the area were 2.4 and 7.7 metres below ground level.
- Groundwater flow in the area is mainly towards the southwest and south, with groundwater contributing to the Matambo River flow via springs, dambo/wetland and stream channel seeps. Dolerite dykes could potentially limit groundwater flow across these younger intrusive rock features.
- The groundwater intersections are most frequent in the weathered material (saprolite) and contact with more competent rock (saprock and fractured slightly weathered rock). Saprolitic weathering is on average 21 m deep, however, this is often less at the proposed Matambo 1 Center pit due to historical mining of the upper soft material. More discreate groundwater flow occurs at depth associated with open fracture features, such as flow along faults and dolerite dyke contacts. These features often have a northwest – southeast trend.

- Groundwater recharge rates of between 100 to 170 mm/a (3 to 5 % of MAP) are expected for the area, based on previous studies at New Liberty Gold Mine (NLGM) property (Geostratum, 2023). Areas with more permeable soil such as quartz vein zones or more silty sand areas (potentially associated with meta-granite/gneiss) have potentially a higher infiltration rate. Less recharge is expected on the heavily treed and steeply sloping hillsides since most rainfall will be subject to evapotranspiration and runoff rather than infiltration.
- Mining will take place via three open pits:
  - Matambo Pit 1 (final vertical depth about 140 m) – Matambo Center ore zone
  - Matambo Pit 2 (final vertical depth about 70 m) – Matambo Center ore zone
  - Matambo Pit 3 (final vertical depth about 100 m) – Matambo West ore zone.
- All three pits will intersect aquifer features and will require in-pit groundwater dewatering. Most groundwater intersections, in terms of mining, are expected in the saprolite, saprock and upper fractured rock units. Borehole information suggests that the first substantial groundwater intersections could be expected at depths of around 10 m. The saprock and upper fractured rock units are likely to hosts the most productive aquifer features. Deeper, groundwater associated with discreet open fracturing, are likely to occur and individual water strikes could often be high, however, on average less frequent than those in the oxidised zone (including the slightly weathered fractured zone). Previous studies at the New Liberty Gold Mine (NLGM) property suggest low to moderate groundwater flows (less than 3 000 m3/d) into the mine workings could be expected, however, this must be confirmed by numerical groundwater model simulations of pit dewatering.
- Mine groundwater flow could also be enhanced by leakage from surface water features such as the adjacent Matambo River, the planned stream diversion and where surface water is temporary or permanently dammed-up, e.g, at the main road of Bangoma village. This surface water leakage towards the open pit voids is likely at Matambo Pit 1 and to a lesser degree at Matambo Pit 2.
- Mine dewatering is likely to induce a drawdown cone around the open pit areas. This dewatering cone extending from the open pit will be calculated by numerical groundwater modelling, which is currently being undertaken. Groundwater dewatering could potentially impact surrounding community wells, specifically at the Bangoma village next to the proposed Matambo Pit 1. Community wells could be partially dewatered, however, the shallow nature of many wells, coupled with high rainfall conditions and low abstraction rates could make the potential impact less severe. The current mine schedule suggests a 3 year life-of-mine, which is short, and would furthermore reduce the likely impact. Note that the Bangoma community will be relocated to a different locality during the commencement of mining at Matambo Pit 1 z.
- Rainfall infiltration of waste rock material and ore stockpiles could potentially leach soluble chemical constituents from these materials, due to the exposed and larger surface contact areas of the material. Sulphide minerals associated with the ore material below the weathered zone could oxidise when exposed to atmospheric conditions. Subsurface infiltration below the water rock and ore stockpiles could alter the groundwater quality compared to pre-mining conditions.

5.5 WATER QUALITY

5.5.1 GROUNDWATER QUALITY

Groundwater quality samples were obtained from:

- The July 2021 monitoring programme which included hydrocensus boreholes MTB-15, MTB-16 and MTB-17 located at the Bangorma village (Samples analysed at an ISO17025 certified laboratory in South Africa)
- Monitoring results of selective parameters as presented by Petra Resources and Avesoro Resources for November and December 2023 for groundwater samples at MTB-10 (Saano community), MTB-15, MTB-16 and MTB-17.
- Samples was analysed at Liberlab and Rayan Laboratory Services in 2021 and 2023 respectively.

Shown in TABLE 5-20 are Liberian water quality standards for domestic use and the mining sector (Environment Protection Agency, 2018), IFC Mining Effluent Guidelines (2007) and the World Health Organization (WHO)

Guidelines for Drinking-water (2022). Groundwater quality is generally good, however, the pH of especially MTB-17 was relatively low. Higher iron (Fe) concentrations were analysed for December 2023, compared to previous results. This higher iron concentrations could originate from the suspended particles which was also analysed as part of the analysis, i.e. it is related to the sampling and laboratory analytical processes. The total suspended solids (TSS) for December 2023 were higher compared to the analysis of July 2021.

The water has generally low dissolved constituents (low total dissolved solids – TDS) in this high rainfall environment. The groundwater varies from calcium – bicarbonate to calcium/magnesium/sodium – bicarbonate (chloride) to magnesium/sodium – chloride water. The sodium – chloride imprint could be related to sea spray from the coast that is about 30 km to the west.

TABLE 5-20: GROUNDWATER QUALITY RESULTS – HYDROCENSUS POINTS

ANALYSIS	UNIT	LIBERIAN FIRST SCHEDULE (EPA 2018)[12]	LIBERIAN THIRD SCHEDULE PART B (EPA 2018)[13]	IFC MINE EFFLUENT GUIDELINES (2007)	WHO GUIDELINES FOR DRINKING-WATER (2017/2022) GUIDELINE VALUES	JULY 2021			NOVEMBER 2023			DECEMBER 2023		
						MTB-15	MTB-16	MTB-17	MTB-15	MTB-16	MTB-17	MTB-10	MTB-15	MTB-17
pH	pH	6.5 - 8.5	6.5 - 8.5	6-9	*6.5 -8.5s*	5.95	6.14	**4.9**	6.2	6.36	**4.82**	6.93	6.5	6.71
EC	mS/m					7.1	12.6	8.88				9.2	9.049	9.284
TDS	mg/l	≤ 1000	≤ 1000		*1000a*	44	102	57				19.73	20.84	21.93
Alkalinity	mg/l $CaCO_e$	≤ 400				26.7	33	2.32				5.93	4.53	5.7
Hardness	mg/l $CaCO_e$	≤ 150				30	46	16						
Total Acidity	mg/l $CaCO_e$											14.82	11.83	13.22
TSS	mg/l	≤ 30.0	≤ 30.0	50		4.5	4.5	4.5				10.83	11.8	11.05
Turbidity	NTU											0.33	0.98	0.28
Cl	mg/l	≤ 250	≤ 250		*250a*	1.57	5.13	6.55	<2	6.7	6			
SO_4	mg/l	≤ 250	≤ 250		*250a*	0.408	4.02	0.217	<2	2.8	<2			
NO_3 as N	mg/l	≤ 10	≤ 10		11.31	0.333	3.19	5.47	0.72	3.98	6.20	1.59	2.07	1.66
NO_2 as N	mg/l	≤ 3			0.91	0.066	0.067	0.066						
NH_4 as N	mg/l	≤ 0.5	≤ 0.4			0.014	0.016	0.019				<0.005	0.005	<0.005
PO_4 as P	mg/l	≤ 5	≤ 5			<0.005	<0.005	<0.005				0.02	0.04	0.02
F	mg/l	≤ 2	≤ 2		1.5	<0.263	<0.263	<0.263						
Ca	mg/l	≤ 75			*300a*	11.4	7.42	3.76						
Mg	mg/l	≤ 30				0.383	6.66	1.72						
Na	mg/l	≤ 20			*200a*	1.03	6.18	6.49						
K	mg/l					0.302	0.896	2.44						

[12] Water Quality Standards for sources of domestic use

[13] Standards for Effluents discharged into the Environment (applicable to mining companies)

ANALYSIS	UNIT	LIBERIAN FIRST SCHEDULE (EPA 2018)[12]	LIBERIAN THIRD SCHEDULE PART B (EPA 2018)[13]	IFC MINE EFFLUENT GUIDELINES (2007)	WHO GUIDELINES FOR DRINKING-WATER (2017/2022) GUIDELINE VALUES	JULY 2021			NOVEMBER 2023			DECEMBER 2023		
						MTB-15	MTB-16	MTB-17	MTB-15	MTB-16	MTB-17	MTB-10	MTB-15	MTB-17
Al Total	mg/l					0.008	0.012	0.091						
Al	mg/l				*0.9h*	<0.002	<0.002	<0.002						
Fe Total	mg/l	≤ 0.3	≤ 10	2	*0.3a 2h*	0.168	0.091	0.247	<0.019	<0.019	0.0222	0.98	1.28	1.07
Mn	mg/l	≤ 0.05	≤ 10		0.08	<0,001	<0,001	<0,001				<0,002	<0,002	<0,002
Cr Total	mg/l	≤ 0.1	≤ 2		0.05	<0.01	<0.01	<0.01						
Cr^{6+}	mg/l	≤ 0.1	≤ 0.	0.1		<0.002	<0.002	<0.002				0.003	0.005	0.005
Cu	mg/l	≤ 1	≤ 1	0.3	*2*	0.023	<0.002	0.006	0.047	0.003	0.024	0.005	0.007	0.003
Ni	mg/l	≤ 0.1	≤ 0.3	0.5	0.07	<0.002	0.002	<0.002						
Zn	mg/l	≤ 1		0.5	3a	<0.002	<0.002	<0.002				0.013	0.04	0.015
Co	mg/l					<0.003	<0.003	<0.003						
Cd	mg/l	≤ 0.005	≤ 0.01	0.05	0.003	<0.002	<0.002	<0.002				<0.001	<0.001	<0.001
Pb	mg/l	≤ 0.01	≤ 0.01	0.2	0.01	<0.004	<0.004	<0.004	0.001	0.0003	0.002	<0.001	<0.001	<0.001
As	mg/l	≤ 0.01	≤ 0.05	0.1	0.01	<0.006	<0.006	<0.006				0.006	0.009	0.005
Se	mg/l	≤ 0.05	≤ 0.01	≤ 0.05	0.04	<0.002	<0.002	<0.002						
Hg	mg/l	≤ 0.002	≤ 0.01	0.002	0.006	<0.004	<0.004	<0.004						
Ag	mg/l					<0.001	<0.001	<0.001						
B	mg/l		≤ 1		2.4	<0.013	<0.013	<0.013						
Ba	mg/l	≤ 2			1.3	<0.002	<0.002	0.028						
Be	mg/l	≤ 0.004				<0.005	<0.005	<0.005						
Li	mg/l					<0.001	<0.001	<0.001						
Mo	mg/l					0.004	0.004	<0.004						
Cyanide Total/ Screening	mg/l		≤ 1	1	*0.17a 0.5h*	Absent	Absent	Absent	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001
Cyanide WAD	mg/l		≤ 0.5	0.5								<0.001	<0.001	<0.001

ANALYSIS	UNIT	LIBERIAN FIRST SCHEDULE (EPA 2018)[12]	LIBERIAN THIRD SCHEDULE PART B (EPA 2018)[13]	IFC MINE EFFLUENT GUIDELINES (2007)	WHO GUIDELINES FOR DRINKING-WATER (2017/2022) GUIDELINE VALUES	JULY 2021			NOVEMBER 2023			DECEMBER 2023		
						MTB-15	MTB-16	MTB-17	MTB-15	MTB-16	MTB-17	MTB-10	MTB-15	MTB-17
Free Cyanide	mg/l	0	≤ 0.02	0.1					<0.05	<0.05	<0.05	<0.001	<0.001	<0.001
Sr Total	mg/l					0.027	0.03	0.032						
Tl	mg/l					<0.037	<0.037	<0.037						
V	mg/l					<0.001	<0.001	<0.001						
Sb	mg/l					<0.001	<0.001	<0.001						
Oil & Grease	mg/l		0	10								<1	<1	<1

Exceeds the Liberian First Schedule (2018): Water Quality Standards for sources of domestic use
Exceeds all above guidelines/standards

WHO Guidelines for Drinking-water:

s best range for water supply system

a aesthetic concerns

h health concerns or provisional maximum tolerable daily intake

5.5.2 SURFACE WATER QUALITY ANALYSIS

Quality analysis

Surface water quality samples were obtained by Petra Resources in November and December 2023 (MAP 5-2). The samples were submitted to and analysed at Rayan Laboratory Services. The analysis results are presented in TABLE 5-21.

pH

The pH values for the sites assessed ranged between 6.29 (SW-06) to 6.71 (SW-05), which fall within expected standard values. This suggests that the pH levels would not have had a limiting effect on local aquatic biota during the time of the surveys.

Electrical conductivity (EC)

Conductivity levels at the sites ranged from 90.38 µS/cm at SW-02 to 110.28 µS/cm at SW-04. This indicates that dissolved salts within the river systems associated with the Matambo Site are high, suggesting a low dilution capacity. The high conductivity levels further indicate that current surrounding activities (including anthropogenic) are contributing a significant number of solutes to these systems.

Dissolved oxygen

Dissolved Oxygen (DO) ranged from 5.19 at SW-01 and SW-05 to 5.92 at SW-02. All the sampling sites was considered adequate to support local aquatic biota.

Aluminium

Aluminium levels at the sites ranged from 0.04 at SW-05 to 0.10 at SW-05. All the sites presented aluminium levels well within the Liberian standards for surface water.

Ammonia

Ammonia levels at the sites ranged from 0.31 at SW-06 to 0.84 at SW-01. These levels fall well within the Liberian standards for surface water.

Chloride

Low chloride levels were observed at all sites assessed ranging from 5.50 at SW-06 to7.88 at SW-04.

Phosphate

Phosphate was the only element found in the samples (MTB-01 and MTB-11, MAP 5-2) to exceed the Liberian standards for surface water. According to the United States- Environmental Protection Agency (US-EPA), elevated phosphorus levels can cause an increase in algae and large aquatic plants growth, which can result in decreased levels of dissolved oxygen– a process called eutrophication. High levels of phosphorus can also lead to algae blooms that produce algal toxins which can be harmful to human and animal health[14].

[14] https://www.epa.gov/national-aquatic-resource-surveys/indicators-phosphorus#:~:text=Too%20much%20phosphorus%20can%20cause,to%20human%20and%20animal%20health.

MAP 5-2

ANALYSIS	UNIT	LIBERIAN SECOND SCHEDULE (EPA 2018)	MTB-01	MTB-02	MTB-08	MTB-09	MTB-11	MTB-16
pH	pH	6.0-9.0	6.47	6.59	6.33	6.41	6.71	6.29
EC	µS/cm		101.30	90.38	101.83	110.28	94.82	99.10
TDS	mg/l	≤ 1000	18.93	20.04	17.39	16.92	19.82	17.22
Total Alkalinity	mg/l $CaCO_e$		6.93	8.62	9.10	8.74	6.82	8.82
Total Acidity	mg/l $CaCO_e$		12.93	10.93	9.84	10.29	11.83	9.94
TSS	mg/l	≤ 30	10.33	10.83	11.28	9.73	9.17	10.82
Turbidity	NTU	≤ 10	0.70	0.73	0.80	0.71	0.79	0.81
Cl	mg/l	≤ 250.0	5.93	6.90	7.03	7.88	7.29	5.50
SO_4	mg/l	≤ 150.0	0.08	0.04	0.03	0.04	0.04	0.06
NO_3 as N	mg/l	≤ 60	3.16	4.05	10.83	6.29	6.09	7.02
NH_4 as N	mg/l	≤ 3.0	0.84	0.77	0.38	0.40	0.48	0.31
PO_4 as P	mg/l	≤ 0.02	**0.03**	0.009	0.005	0.007	**0.05**	0.009
F	mg/l	≤ 1.5	0.009	0.011	0.007	0.005	0.008	0.007
Ca	mg/l	≤ 500	2.89	2.22	1.97	1.94	2.01	2.88
Mg	mg/l	≤ 30	0.58	0.50	0.55	0.43	0.51	0.61
Na	mg/l	≤ 200	2.22	2.30	2.33	2.29	2.37	1.99
K	mg/l	≤ 3000	1.78	1.59	1.64	1.70	1.22	1.83
Al	mg/l	≤ 0.2	0.09	0.07	0.08	0.05	0.04	0.10
Fe	mg/l	≤ 1.50	0.63	0.53	0.55	0.71	0.62	0.50
Mn	mg/l	≤ 0.3	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Cr Total	mg/l	≤ 0.2	0.075	0.028	0.043	0.026	0.011	0.020
Cr^{6+}	mg/l	≤ 0.1	0.004	0.013	0.017	0.011	0.006	0.005
Cu	mg/l	≤ 0.01	0.003	0.005	0.005	0.009	0.005	0.005
Zn	mg/l	≤ 2.0	0.15	0.11	0.18	0.09	0.10	0.07
Cd	mg/l	≤ 0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

ANALYSIS	UNIT	LIBERIAN SECOND SCHEDULE (EPA 2018)	MTB-01	MTB-02	MTB-08	MTB-09	MTB-11	MTB-16
Pb	mg/l	≤ 0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
As	mg/l	≤ 0.05	0.005	0.019	0.008	0.014	0.011	0.007
Se	mg/l		<0.005	<0.005	0.007	<0.005	0.008	0.005
Hg	mg/l	≤ 0.005	0.005	0.005	0.004	0.005	0.00	0.005
B	mg/l	≤ 1.0	0.017	0.009	0.015	0.008	0.005	0.011
Ba	mg/l		0.003	0.001	<0.001	0.001	0.003	0.001
Cyanide Total/ Screening	mg/l	≤ 0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide WAD	mg/l		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Free Cyanide	mg/l		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
HCO_3^-	mg/l	≤ 500	1.49	1.18	1.06	1.30	1.29	1.51
U	mg/l		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
COD	PPM	≤ 500	91.83	90.84	91.22	90.98	89.39	90.83
BOD	PPM	≤ 250	54.96	50.92	60.82	60.82	59.23	58.29
DO	PPM	≥ 5.0	5.19	5.92	5.81	5.29	5.19	5.28
Oil & Grease	mg/l		<0.001	<0.001	0.001	0.003	0.001	<0.001

Exceeds the Liberian Standards (2018)

5.6 SOILS AND LAND CAPABILITY

5.6.1 SOIL SAMPLING ANALYSIS

The 2023 sampling data was augmented with nine (9) soil samples collected for analysis at Rayan Laboratory Services (an EPA accredited laboratory).

Laboratory analytical parameters included:

- Determination of pH;
- Exchangeable bases;
- Cation exchange capacity (CEC);
- Texture (% clay); and
- Nutrient status.

TABLE 5-21 provides the results of the laboratory analyses. The norms and standards used are taken from the EPA Soil Standards and Agricultural Standards for Arable Soils as defined by the Agricultural Research Council (ARC).

5.6.2 LAND CAPABILITY CLASSIFICATION AND RATING

Classifying and rating land capability requires an approach and system that is adaptable and versatile. In achieving this versatility, a combination of the CLI system, British Land Capability Classification System and the South African Chamber of Mines Land Classification Rating System was used in combination with the overall geomorphology of the site (soils, geology topography, ground roughness, climate etc.).

The variability in topography and landform, and the change in the geology across the landscape result in a complex of in-situ soils and colluvial derived materials across the catena. The depth of the soils and their changing structure and texture are inherently linked to the lithologies from which they are derived and the climatic conditions.

In addition to the soils, geology and topographic variables, other geomorphological (e.g. ground roughness) and environmental (e.g. climate) aspects were noted from the information available and used in the desktop assessment and understanding of the site sensitivities, land capability rating and ultimately an interpretation and assessment of the impact significance of the activities that are being proposed as part of the mine plan and its associated support infrastructure.

The classifications of land capability Class 1 and 2 as defined in the system have been combined as “Arable”, while Classes 3 and 4 are considered of a “Palatable Grazing” land capability and Classes 5, 6 and 7 as “Rough Grazing or Wilderness” status. The final class classifies the areas with wetland (Ramsar) status.

5.6.3 BASELINE SOILS AND SURVEY RESULTS

The spatial variability observed in natural systems are sometimes complex, the topographic and geomorphological variation combined with the geological and lithological changes resulting in a natural variation in the pedogenetic process and resultant soil forms mapped. The complex of soils and resultant land capabilities that occur across the study area are strongly influenced by the underlying lithologies from which they are formed, the tropical climate (high rainfall, moderate evaporation, temperatures and high humidity) and to a lesser extent the topography.

Soil groups have similar physical and chemical characteristics and will react in a similar manner to being disturbed, while the landform units have similar topographic character, erosion indices, ground roughness geomorphological characteristics.

The four dominant soils (FIGURE 5-13) identified within the project area include:

- **Leptosols** - Soils of the lithic Leptosols and Rudic form are characterised by shallow to very shallow rooting depths (<20cm to 40cm), with significant gravel to cobble size fragments of rock and rock shards, and a ground roughness that exhibits 20% to 60% cover of rocky scree. These soils are mainly associated with the steeper landforms and steeply dipping lithologies that form the mountainous terrain (25% to 60% slopes) that host the mineralised zone. The soil physical properties are characterised by very shallow to shallow, dark brown sandy loams and sandy clay loams, single grain to apedel structure, better than average drainage, and are generally loose to friable when dry, and non-sticky and non-plastic in the wetted state.

- **Cambisol** - These soils occur on the moderate slopes and hilly topography that form the midslopes and upper midslopes, reflecting a change in geomorphology and geology.

  They are characterized by the presence of stones and gravels on the surface and in the profile and are more often than not underlain by a ferruginous sub-base. The land cover is densely wood bush land, with a topographic/surface gradient ranging from 12% to 20%. Generally, their depth is categorised as moderately deep to deep, generally well drained, dark brown to red and red/orange over dark brown to red subsoil with a sandy clay to sandy clay loam texture. The topsoil structure is apedel to single grain, consistency is loose or friable.

- **Ferralsols** - Ferralsols represent the classical, deeply weathered, red or yellow soils, have diffuse horizon boundaries, a clay assemblage dominated by low-activity clays (mainly kaolinite) and a high content of sesquioxides.

  These soils are often associated with strongly weathered material on old, stable geomorphic surfaces, the deep and intensive weathering resulting in a residual concentration of resistant primary minerals (e.g. quartz) along with sesquioxides and kaolinite. This mineralogy and the relatively low pH explain the stable microstructure (pseudo-sand) and yellowish (goethite) or reddish (hematite) soil colours. The Ferralsols have good physical properties, good soil rooting depth, moderate water holding capability, better than average permeability and stable microstructure.

- **Luvisols/Fluvisols**- The soils of the Alisol form are associated with the flat to rolling plain landforms and are by definition soils associated with the lower lying areas and alluvial/colluvial deposits of transported materials. These soils are variable in both depth as well as texture, varying from deep to shallow rooting depths with a sandy clay texture to well washed and sorted medium and coarse-grained sands in the river channels. Physically, these soils are well drained, light brown to white on a rocky stream/riverbed.

  In contrast, but part of a similar topographic environment comprises colluvial derived materials that are more commonly associated with the wetland river banks and river tributaries. These soils comprise fine to medium grained sandy clay loams over clay loam, the clay content increasing with depth. The topsoil structure is granular over sub-angular moderate blocky structure, and is hard when dry and friable, moist, sticky and plastic when wetz.

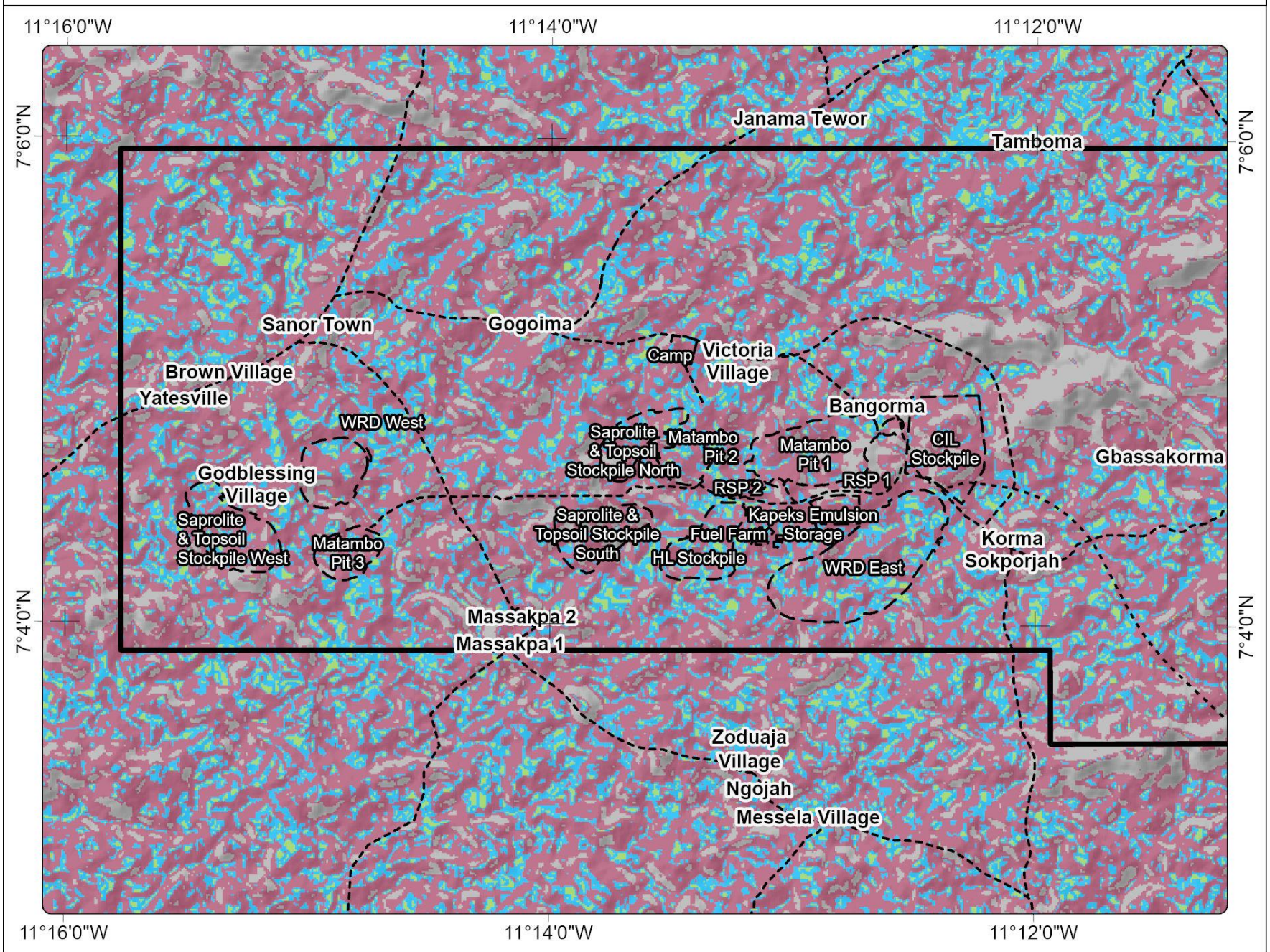
  Most Alisols have a higher clay content in the subsoil than in the topsoil as a result of pedogenetic process particularly clay migration leading to an argic subsoil horizon.

The four Landform Units (LFU) identified include:

- Ms - Mountains and steep slopes (25% to 60%),
- Uh - Undulating to hilly slopes (12% to 25%),
- Fu - Flat to undulating terrain (<12%), and
- Dvr - Dissected valleys and rolling terrain.

Matambo

Dominant Soil Units



WRB Naming	Slope %	Soil Resource	Soil Description
Luvisols/Fluvisols	0-2%	Fluvic (fu), Luvic (lv) or Colluvic (co)	Well sorted rivirine or stream deposits and mixed materials that have been transported by wind or water
		Arenic (ar)	Sand to sandy loam texture underlain by hard rock or indurated layer
		Aeolic (ay)	Material deposited by wind (<0.6% soil organic carbon), locally associated with crest slope plains
Calcisols	2-5%	Alcalic (ax)	Lime/Calc pH>8.5 - Dolomite and Limestone derived
		Calcaric (ca) / Hypercalcic (jc)	Contaning Lime - Limestone/Dolomite on hard rock
Cambisols	5-15%	Cambic (cm) or Cambisols	In-situ derived materials, are characterised by presence of stones and gravel on surface and within the soil profile
			Often associated with the change in geology and more often with the change in terrain unit - undulating to
			steep lower midslope to midslope positions
Leptosols	15-30%	Haplic (ha)	Simple soil profile - Soils of varying depth on hard saprolite or hard rock layer (transported material in some cases in study area)
	30-70%	Dolomitic (do)	Dolomitic material on hard rock (often red in colour)
		Duric (du)	Hard surfaces or rock
	70-100%	Leptic (le)	Thin layer of soil and rock
		Petric (pt)	Cemented or indurated layer at surface
	100%+	Lithic Liptosol (li)	Stoney ground
		Lapiadic (ld)	Continious rock

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LEGEND

Roads
Layout
BMMC MDA Boundary

Soils
Luvisols/Fluvisols
Calcisols
Cambisols
Leptosols

N
W E
S

0 500 1 000 1 500
Meters

Scale: 1:60 000
WGS 1984 UTM Zone 29N

Date: 2024/02/01

Map ID: 123-007-09-v2

FIGURE 5-13: DOMINANT SOILS MAP

5.6.3.1 Chemical Characterisation

The soil chemistry is based on a combination of the laboratory results obtained during the baseline study and extrapolated where possible to the Matambo Mine area, the landform, soils and geology used as the basis for comparison along the strike of the mining area (TABLE 5-21).

The criteria used for interpretation is adapted from the World Reference Base for Soil Naming (WRB) and the Booker Tropical Soil Manual.

In most cases, the chemistry is reflective of the weathered products of the underlying (in-situ) geology, the impacts of erosion and man induced variables (artisanal mining etc.) having an over shadowing effect where these impacts are present.

The soil chemistry for the *in-situ* materials is relatively homogeneous across the study area with no obvious differences in the physical and chemical characteristics and have therefore been assessed holistically. The alluvial and to some extent the colluvial derived materials are however distinguishable by their differences in both physical as well as chemical signature.

Cation Exchange Capacity

Important to understanding the land capability associated with the soils is the Cation Exchange Capacity or CEC of a soil. The CEC value is a measure of the potential for a soil to retain and supply nutrients to plants. From the baseline information gathered the CEC values in the area are moderate to low.

pH Rating

The preferred range for pH in good plant growth soils is between 5.5 and 7.0.

The range in pH of the soils of the study area are typically between 3.80 to 4.97. These acidic conditions are observed across the range of soil forms mapped and are associated with aluminium toxicity and excess cobalt, copper, iron, manganese, zinc and deficiencies in calcium, potassium, sodium, molybdenum, phosphorus and sulphur. The Fluvisols and colluvial derived materials returned slightly lower than average pH from the *in-situ* derived soils.

Available Phosphorus

Available P has been determined by the Olsen method of bicarbonate extraction and is rated in ppm available. Greater than 80mg/kg is considered high and fertiliser response is unlikely, while less than 20mg/kg will likely see a good response to fertilization.

The Available Phosphorus content of soils of the study area is very low.

TABLE 5-21: ANALYTICAL RESULTS

Soil Analytical Results									
Parameters (Unit)	**SL1**	**SL2**	**SL3**	**SL4**	**SL5**	**SL6**	**SL7**	**SL8**	**SL9**
Aluminum (mg/Kg)	7.77	11.35	12.18	7.94	11.05	10.05	8.15	7.76	11.08
Arsenic (mg/Kg)	0.051	0.048	0.041	0.055	0.051	0.040	0.048	0.044	0.051
Boron (mg/Kg)	<0.050	0.057	0.071	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Barium (mg/Kg)	0.018	0.009	0.011	0.007	0.028	0.131	0.091	0.007	0.005
Calcium (mg/Kg)	18.33	20.91	33.49	20.73	37.72	40.98	29.78	29.69	31.07
Cadmium (mg/Kg)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlorine (mg/Kg)	0.004	0.009	0.003	0.005	0.003	0.005	0.003	0.006	0.004
Cobalt (mg/Kg)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium (mg/Kg)	0.108	0.212	0.105	0.102	0.075	0.065	0.039	0.047	0.055
Copper (mg/Kg)	0.828	0.766	1.051	1.107	2.082	1.048	1.044	2.071	0.939
Iron (mg/Kg)	8.637	6.418	9.619	11.438	10.582	9.608	7.472	6.441	9.409
Mercury (mg/Kg)	0.005	<0.001	0.007	<0.001	<0.001	0.005	0.005	0.001	<0.001
Magnesium (mg/Kg)	10.77	12.07	9.93	11.24	10.18	9.06	10.07	9.99	9.64
Potassium (mg/Kg)	1.093	0.798	1.005	1.068	0.973	0.883	0.972	0.781	0.712
Manganese (mg/Kg)	0.973	1.08	1.007	0.909	0.707	0.805	0.709	0.816	0.707
Molybdenum (mg/Kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium (mg/Kg)	0.109	0.117	0.216	0.107	0.115	0.107	0.091	0.093	0.121
Nickel (mg/Kg)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Phosphorus (mg/Kg)	5.128	4.917	4.085	5.297	5.163	4.972	4.863	5.073	4.782
Lead (mg/Kg)	<0.001	<0.001	0.005	0.006	0.005	<0.001	<0.001	0.006	0.001
Sulfur (mg/Kg)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin (mg/Kg)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium (mg/Kg)	0.007	0.011	0.005	0.008	0.005	0.013	0.007	0.005	0.005
Silicon (mg/Kg)	1.431	1.382	1.742	1.073	1.063	1.004	1.297	1.063	1.082
Vanadium (mg/Kg)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (mg/Kg)	0.749	1.047	0.952	0.855	0.974	0.753	0.983	0.991	0.868
Organic Carbon (%)	1.05	0.74	0.41	0.86	0.66	0.81	0.77	0.80	0.71

Soil Analytical Results (Cont'd)			
	Parameters		
Sample Code	**% Clay**	**% Silt**	**% Sand**
SL01	55	8	37
SL02	43	8	49
SL03	49	15	36
SL04	60	11	29
SL05	45	17	38
SL06	39	19	42
SL07	44	16	40
SL08	61	12	27
SL09	40	9	51

5.6.3.2 *Physical Characterisation*

Soil Texture

Soil texture is defined by the relative proportion of sand, silt and clay particles present.

Soil texture can influence nutrient and soil water holding capacities, aeration, drainage, and the workability of materials.

Soils with high clay content have high absorption and moisture retention capacities and tend to retain nutrients better. In contrast, coarse textured soils have low water holding capacities, high infiltration rates, and very rapid hydraulic conductivity (the ability of a fluid to move through pore spaces).

Both field and laboratory texture assessments indicated that the in-situ derived soils of the study area are categorized as sandy clay to silt clay loams.

Soil Erosion and Compaction

Erodibility is defined as the vulnerability or susceptibility of a soil to erosion. It is a function of both the physical characteristics and the treatment of a soil.

The resistance to or ease of erosion of a soil is expressed by an erodibility factor ("K"), which is determined from soil texture/clay content, permeability, organic matter content and soil structure. The Soil Erodibility Nomograph (Wischmeier et al, 1971) was used to calculate the "K" values.

The Index of Erosion (IOE) is determined by multiplying the "K" value by the "slope" (measured as a percentage). Erosion problems may be experienced when the IOE is greater than 2.

The IOE for the dominant soil forms that occur in the study area falls within the moderate to erodible category. This is based primarily on the steepness of the slopes, the IOE being tempered somewhat by the better than average clay content moderate organic carbon content and moderate structure for all but the river sediments.

However, the vulnerability of the "B" horizon to erosion once the topsoil and/or vegetation will be enhanced if undertaking activities likely to disturb these soils.

The transported colluvium and depositional environments of the lower midslopes are characterised by a regolith or scree, through to the bottom slopes of alluvial derived materials.

5.6.4 LAND USE AND LAND CAPABILITY

The land capability rating ranges from moderate to low palatable grazing lands on the lower lying gently undulating to hilly landforms Haplic Alisols and Cambisols, to rough grazing and/or wilderness land on all of the steeper and shallow rooting soils associated with the Lithic Leptosols and Regosols (FIGURE 5-14).

In general, the soils associated with the more hilly terrain and metasediments are too shallow and the slopes overly steep for any form of arable cultivation other than possibly commercial forestry. Soils with greater than 400 mm of rooting depth are for the most part restrictive to cultivation due to soil water holding capability and effective rooting depth, while any slope over 12% is considered too steep for any form of cultivation.

5.6.4.1 *Arable land*

There are no sites within the area of study that classify/rate as Arable Land. The potential for any form of commercial agriculture is restricted to the valley floodplains all of which classify as highly sensitive wetland environments and should not be impacted.

5.6.4.2 *Palatable Grazing Land*

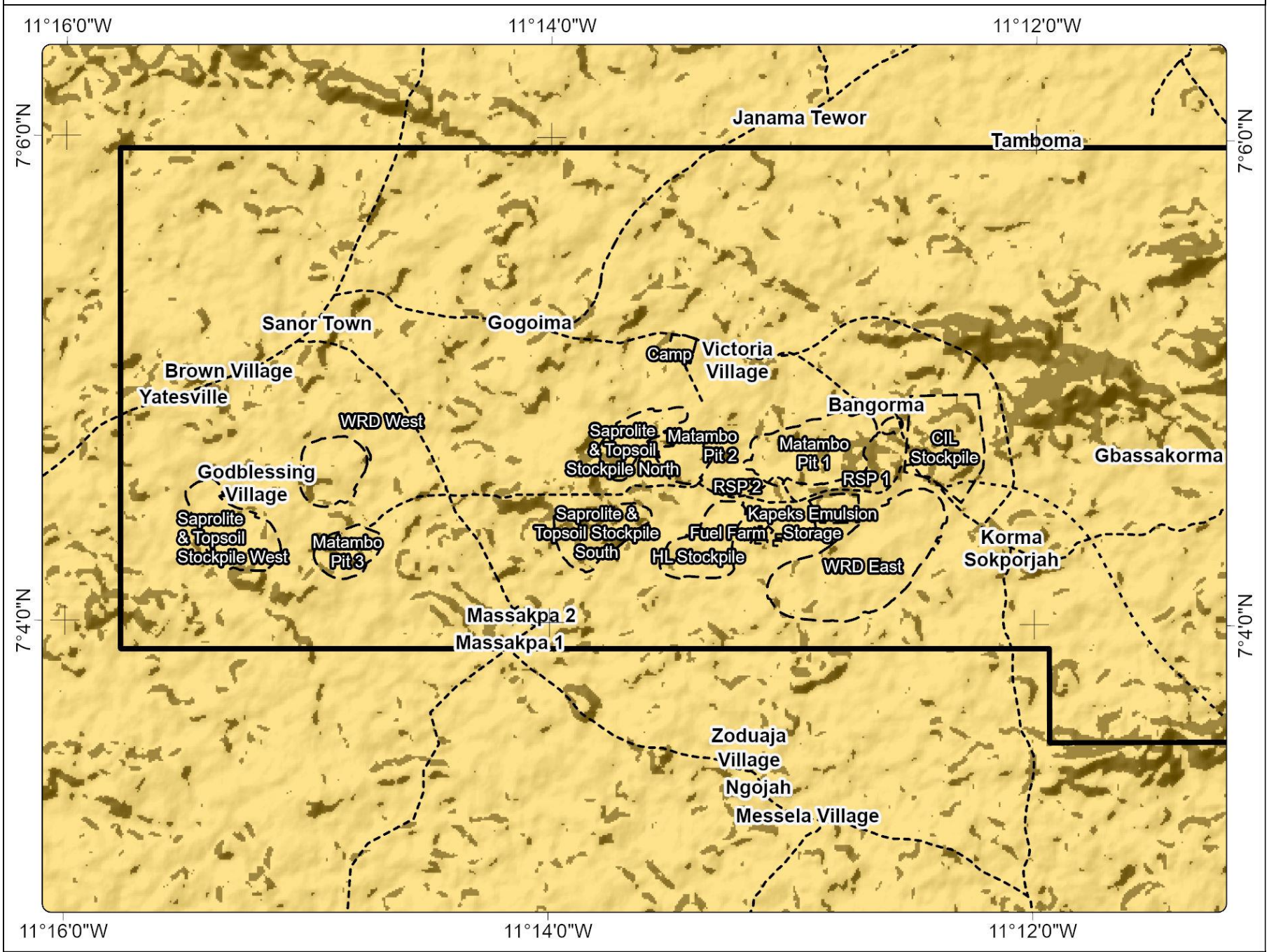
The areas classified as palatable grazing land are generally associated with the deeper sandy clay loams that occur as transitional to the wetland zones, while the hilly and undulating landforms downslope of more mountainous terrain that comprise for the most part the Haplic Alisols and Cambisols are considered rough grazing lands.

5.6.4.3 *Rough Grazing or Wilderness / Conservation Land*

The areas classified as rough grazing or wilderness/conservation status include all of the steeper landforms associated with Lithic Leptosols and some of the Haplic Alisols. The extremes of steepness of the terrain combined with the shallowness of the soil rooting render these sites to have poor grazing potential.

Matambo

Land Capability Rating



WRB Naming	Slope %	Soil Resource	Land Capability Rating
Luvisols/Fluvisols	0-2%	Fluvic (fu), Luvic (lv) or Colluvic (co)	Rough/natural Grazing or Wilderness rating.
		Arenic (ar)	
		Aeolic (ay)	
Calcisols	2-5%	Alcalic (ax)	Rough/natural Grazing or Wilderness rating.
		Calcaric (ca) / Hypercalcic (jc)	
Cambisols	5-15%	Cambic (cm) or Cambisols	Rough/natural Grazing or Wilderness rating.
Leptosols	15-30%	Haplic (ha)	Too steep for any form of cultivation
	30-70%	Dolomitic (do)	
		Duric (du)	
	70-100%	Leptic (le)	
		Petric (pt)	
	100%+	Lithic Liptosol (li)	
		Lapiadic (ld)	

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Reviewed by:
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Environmental Scientist

Drawn by:
L van Zyl
GIS Consultant

LEGEND

- Roads
- Layout
- BMMC MDA Boundary

Land Capability

- Grazing/Wilderness
- Too steep for any Cultivation

N
W E
S

0 500 1 000 1 500
Meters

Scale: 1:60 000
WGS 1984 UTM Zone 29N

Date: 2024/02/01

Map ID: 123-007-10-v2

FIGURE 5-14: PRE-CONSTRUCTION LAND CAPABILITY

5.6.5 SITE SENSITIVITY

The sensitivity or vulnerability of a soil is an estimate of the ability of the materials under consideration to maintain their inherent strength.

Factors that effect a soils sensitivity or vulnerability include:

- soil depth,
- soil texture (clay content and types),
- soil structure (particularly the shrink/swell properties);,
- permeability,
- absorption and
- moisture retention.

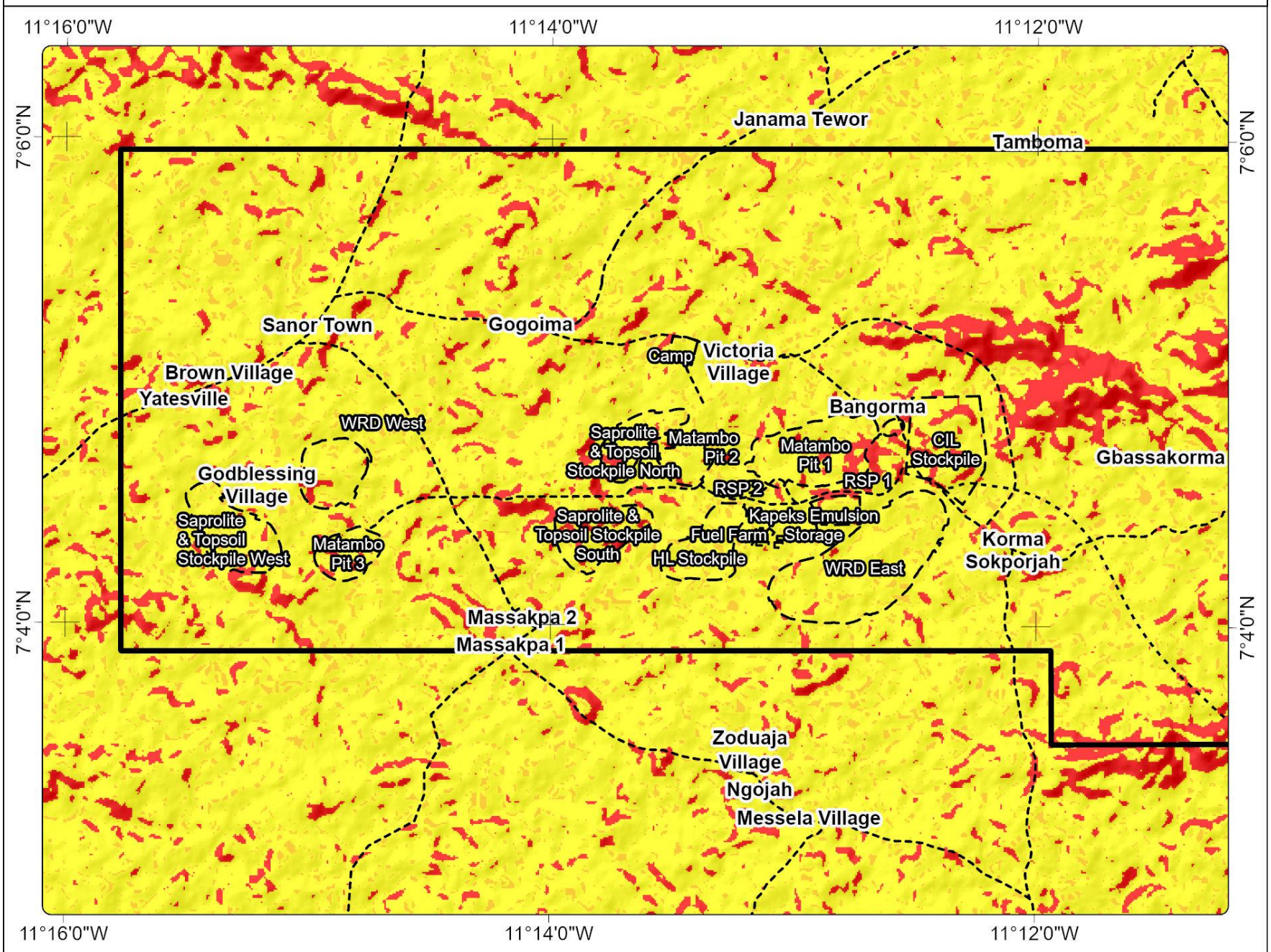
All of these factors combine in forming the character of a soil and determine how robust or weak a soil is in terms of reacting to change.

The area of study exhibits all of these variations in site sensitivity to varying degrees.

The variation in soil depth from moderately shallow soils on a hard rock substrate to the deeply weathered materials on highly weathered saprolite mapped on the crest and upper midslopes contrast with the shallower soils of the lower and lower midslopes and valley flood plains, the steepness of the mountainous terrain all contribute to the variation in site sensitivity (FIGURE 5-15).

Matambo

Soil & Agriculture Site Sensitivity



WRB Naming	Slope %	Soil Resource	Site Sensitivity
Luvisols/Fluvisols	0-2%	Fluvic (fu), Luvic (lv) or Colluvic (co)	Sensitive to Moderately sensitive sites
		Arenic (ar)	
		Aeolic (ay)	
Calcisols	2-5%	Alcalic (ax)	Moderately sensitive
		Calcaric (ca) / Hypercalcic (jc)	
Cambisols	5-15%	Cambic (cm) or Cambisols	Moderately sensitive
Leptosols	15-30%	Haplic (ha)	Highly sensitive to sensitive, steep slopes and poor soil cover. Vegetation cover limited and erosion potential is high
	30-70%	Dolomitic (do)	
		Duric (du)	
	70-100%	Leptic (le)	
		Petric (pt)	
	100%+	Lithic Liptosol (li)	
		Lapiadic (ld)	

ABS Africa Sustainability Advisors

Reviewed by:
P Furniss / F Coetzee
Environmental Scientist

Drawn by:
L van Zyl
GIS Consultant

LEGEND

- Roads
- Layout
- BMMC MDA Boundary

Sensitivity

- High
- Moderate to High
- Moderate

N
W E
S

0 500 1 000 1 500
Meters

Scale: 1:60 000
WGS 1984 UTM Zone 29N

Date: 2024/02/01

Map ID: 123-007-11-v2

FIGURE 5-15: SITE SOIL SENSITIVITY MAP

5.7 AIR QUALITY

5.7.1 SENSITIVE RECEPTORS

The Matambo Mine area is situated approximately 12 km northwest from the current New Liberty Gold Mine (NLGM) which is the closest large-scale activity in the area. The proposed development site is situated in a forested area, with nearby activities including logging and small-scale informal gold mining. Sensitive receptors (FIGURE 5-16) in the vicinity of the site include the villages of Bangorma (< 100 m northeast of Matambo 1), Korma Sorkpoja (1 km southeast of Matambo 1), Zoduaja (2 km south of Matambo 1&2), Masakpolor (1 km southeast of Matambo 3 and 1.5 km southwest of Matambo 2), Gogoma (1.2 km northwest of Matambo 2 and 1.7 km northeast of Matambo 3), Sanor (1.5 km north of Matambo 3), Brownsville (1.4 km northwest of Matambo 3) as well as the accommodation camp, located approximately 500 m north of the Matambo 1 & 2.

There is very little vehicle traffic and no industrial activity in the study area, the closest being the processing plant at NLGM. Ore will be transported to NLGM for processing.

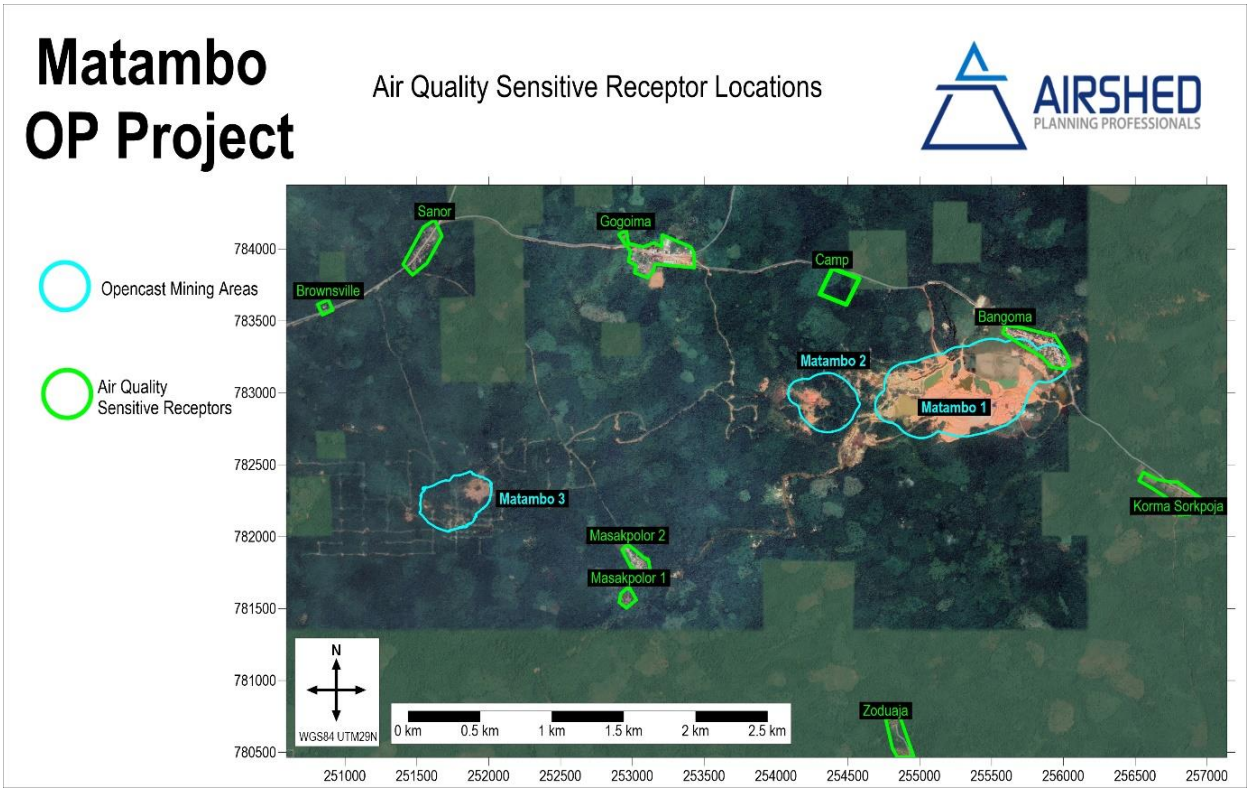


FIGURE 5-16: AIR QUALITY SENSITIVE RECEPTOR LOCATIONS

5.7.1.1 Existing sources of emissions in the study area

There are limited local sources that are expected to contribute to pollutant concentrations in the region. Local sources of fugitive dust and gaseous emissions include chainsaw logging activities, bush clearing (burning), subsistence farming, charcoal making, small-scale livestock farming, wildfires, vehicle activity on unpaved roads and small-scale artisanal mining activities. Household fuel burning and possibly refuse burning also constitutes a significant local source of low-level emissions. The pollutants released by local sources are discussed in more detail below.

Household Fuel Burning

Fuel sources generally used for household fuel burning purposes include mainly wood, but also charcoal, coal, and paraffin. Based on the findings of the social impact assessment baseline report wood and charcoal are the main household fuel sources. Petrol and diesel are readily available but are mainly used in the mining areas for equipment such as water pumps and mini crushers. Pollutants arising due to the combustion of wood and charcoal

include PM_{10}, NO_2, CO, polycyclic aromatic hydrocarbons (PAHs), particulate benzo(a)pyrene and formaldehyde. Polyaromatic hydrocarbons are recognised as carcinogens.

Burning of Refuse

Another common source of emissions in residential areas is the burning of refuse. These surface fires are most commonly low temperature burning of general refuse and are typified by the emission of dense white smoke and the products of incomplete combustion. This smoke will also include irritating and odorous aldehydes and organic acids. During this process moisture in the refuse is driven off as steam, and other volatiles are lost by distillation. Temperatures may be high enough to release contaminants, such as arsenic from treated timber wastes. Where fires burn quantities of flammable organic materials, such as tyres or plastics, temperatures may be very high in the burning zone. Combustion of the volatiles will not be complete because of insufficient oxygen. High temperatures can break down volatile compounds, resulting in the emission of dense black smoke. Contaminants released are likely to include carcinogens such as PAHs, dioxins, furans and volatilised heavy metals.

Biomass Burning (Wildfires)

Biomass burning includes the burning of woodlands, grasslands, and agricultural lands. Within the study area wildfires represent a source of combustion-related emissions. Wildfires in the study area occur during the dry season, and fires can be fanned by dry and warm Harmattan winds.

Biomass burning is an incomplete combustion process, with CO, methane and NO2 gases being emitted. Approximately 40% of the nitrogen in biomass is emitted as nitrogen, 10% is left is the ashes, and it may be assumed that 20% of the nitrogen is emitted as higher molecular weight nitrogen compounds. The visibility of the smoke plumes is attributed to the aerosol (particulate matter) content. In addition to the impact of biomass burning within the vicinity of the project, long-range transported emissions from this source can further be expected to impact on the air quality. It is impossible to control this source of atmospheric pollution loading; however, it should be noted as part of the background or baseline condition before considering the impacts of other local sources.

Artisanal Mining Activities

Small scale artisanal mining activities in the study area are expected to result in fugitive dust emissions from mining activities, vehicle entrainment on unpaved roads and wind erosion emissions from exposed areas. Gaseous emissions are expected from combustion processes (such as small generators, water pumps and crushers) and vehicle exhaust as well as from collecting panned gold from concentrates using mercury over a flame.

Fugitive Dust and Gaseous Emissions from Small-Scale Farming

Local families are involved in subsistence farming, which could lead to fugitive dust emissions. Preparing soils for crops, planting and tilling raises dust as a fugitive emission and these activities can be responsible for the emission of large quantities of particulates. Fields are fallow during the dry winter months resulting in the potential for fugitive dust due to wind entrainment.

Small-scale livestock farming is also prevalent in the study area. Agriculture is the dominant anthropogenic source of ammonia and livestock account for about 40% of global emissions of ammonia. Agriculture is also responsible for up to 50% of all methane emissions worldwide – livestock alone account for about a quarter of methane emissions, by way of gut fermentation and the decay of excreta. Another important greenhouse gas (nitrous oxide) is generated by natural processes but is boosted by the breakdown of crop residues and animal wastes (FAO Corporate Document Repository, 2004).

Bush clearing and burning to make room for agricultural activities result in high particulate emissions over a short period.

Vehicle Entrainment of Dust and Vehicle Exhaust Emissions

Vehicle entrainment of dust on unpaved roads occurs when the force of the wheels of vehicles travelling causes pulverisation of surface material. The extent of particulate emissions from the unpaved roads depends on the number of vehicles using the roads and, on the silt, loading on the roadways.

Gaseous emissions from vehicle tailpipes may be grouped into primary and secondary pollutants. Primary pollutants are those emitted directly into the atmosphere, and secondary pollutants are those formed in the atmosphere because of chemical reactions, such as hydrolysis, oxidation, or photochemical reactions. The

significant primary pollutants emitted by motor vehicles include CO_2, CO, hydrocarbon compounds (HC), SO_2 and NO_x. Secondary pollutants include NO_2, photochemical oxidants (e.g. ozone), sulfuric acid, sulphates, nitric acid, and nitrate aerosols. Agricultural and farming equipment with diesel engines are sources of hydrocarbon emissions.

Logging Activities

Small scale logging activities are prevalent throughout the study area. Logging activities are expected to result in fugitive wood dust emissions released during sawing. Discarded decomposing biomass (such as leaves) could lead to VOC emissions, while burning of the above-mentioned biomass would lead to combustion emissions. Generator and chainsaw exhaust result in gaseous and particulate combustion emissions, while transport of wood products would lead vehicle entrainment emissions as described in the section above.

Further ambient air quality

Periodic ambient air quality sampling is currently conducted at four sampling locations surrounding the Matambo Project site (MAP 5-2). Preliminary short-term sampling conducted during December 2023 (FIGURE 5-17 to FIGURE 5-20) indicate very low particulate (PM) concentrations at Massakpa and Kumah Sorkojah, with slightly higher concentrations at Gogoima, and the highest PM concentrations sampled at Bangorma. In addition, sampling is also conducted for CO_2, the trend for which is mostly the same as for PM, with the highest concentrations (>500 ppm) recorded at Bangorma, while CO_2 concentrations at the other three sampling concentrations and more in line with natural background CO_2 levels (400 to 450 ppm). Formaldehyde (HCHO), in very low concentrations (<10 ppb), was detected at Kumah Sorkorja, Massakpa and Gogoima, but not at Bangorma. Total volatile organic compound (TVOC) concentrations were below 1 ppm at all four sampling locations. Major VOC and HCHO sources in the area are likely to be because of natural biogenic sources rather than anthropomorphic sources. Ambient air quality in the area is good, and highly influenced by localised sources, such as vehicles travelling on unpaved roads, domestic fuel burning for cooking, and pre-mining related activities.

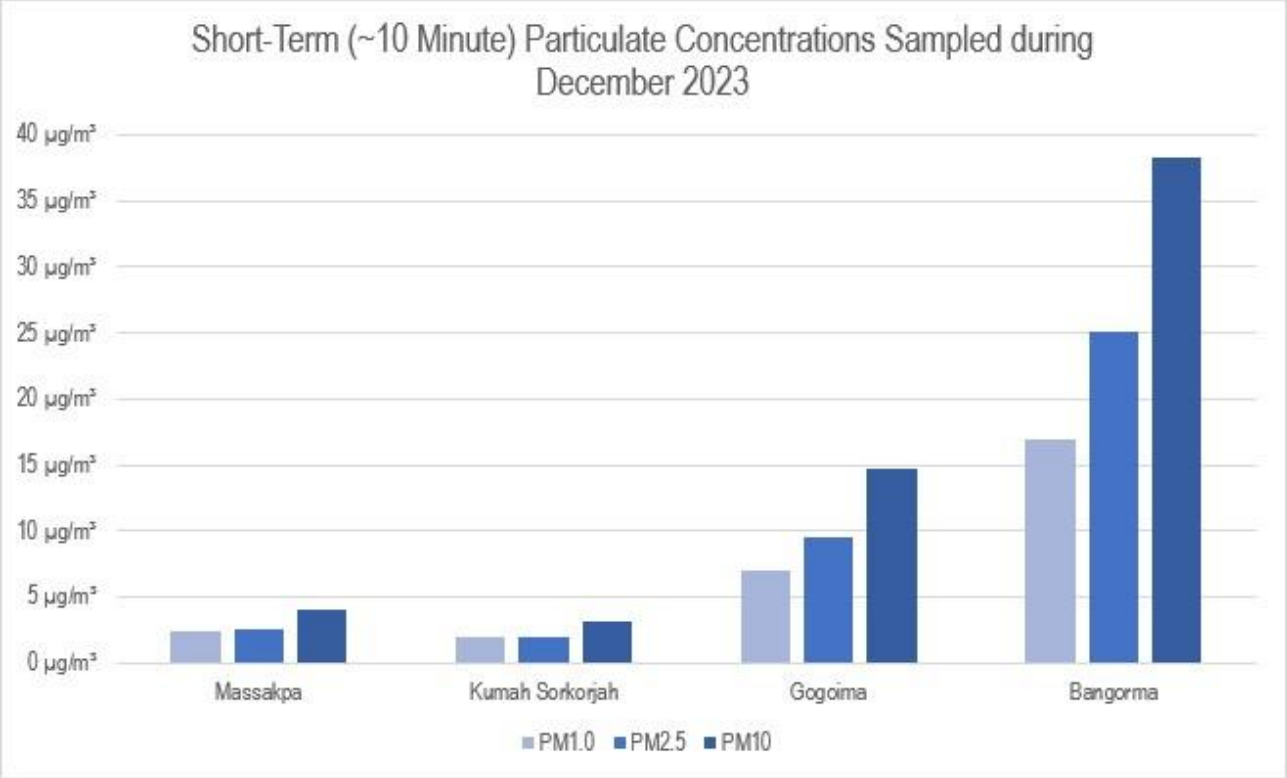


FIGURE 5-17: PARTICULATE CONCENTRATIONS SAMPLED DURING DECEMBER 2023

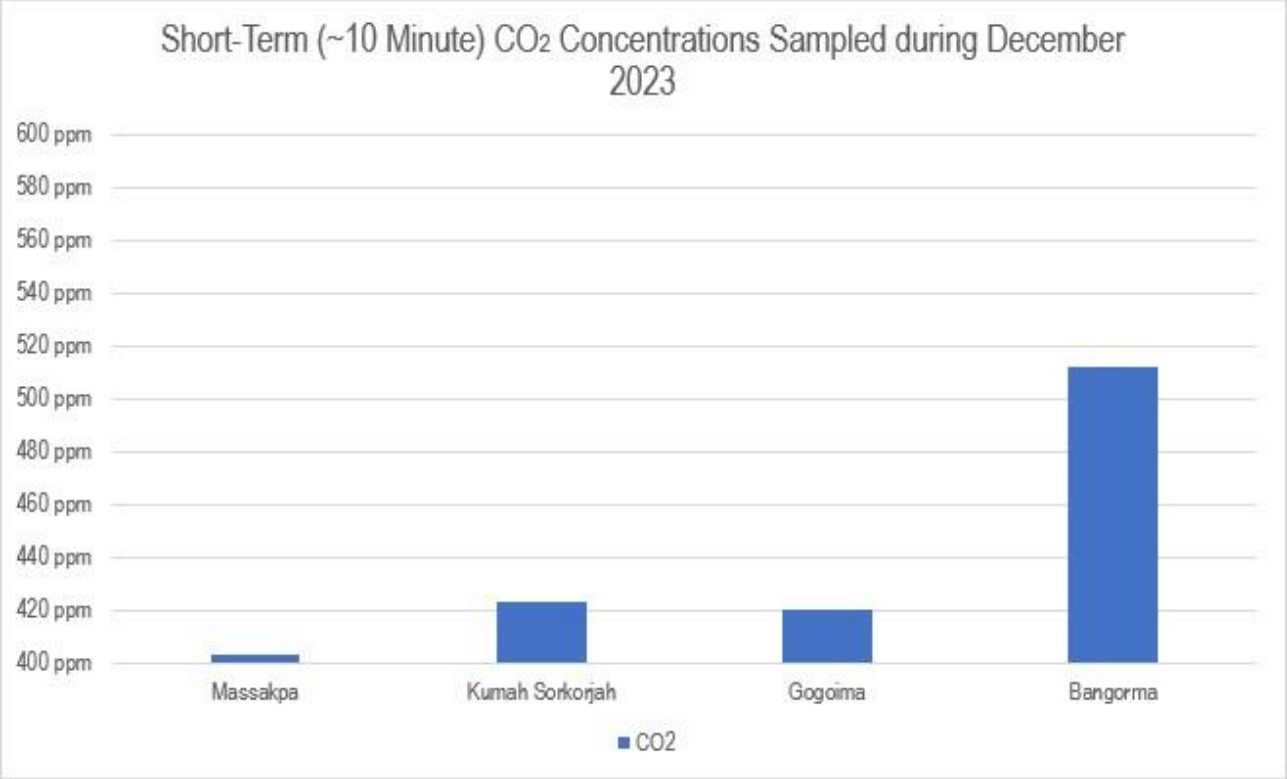


FIGURE 5-18: CO_2 CONCENTRATIONS SAMPLED DURING DECEMBER 2023

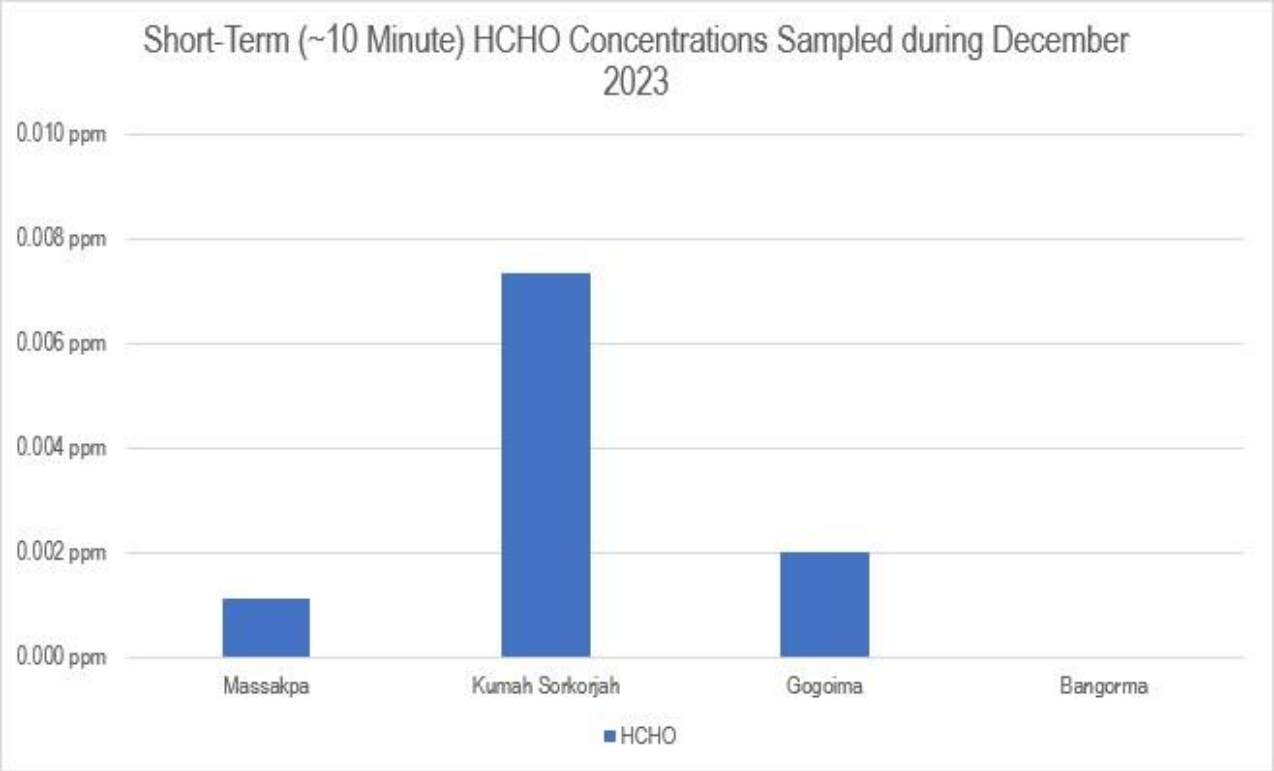


FIGURE 5-19: HCHO CONCENTRATIONS SAMPLED DURING DECEMBER 2023

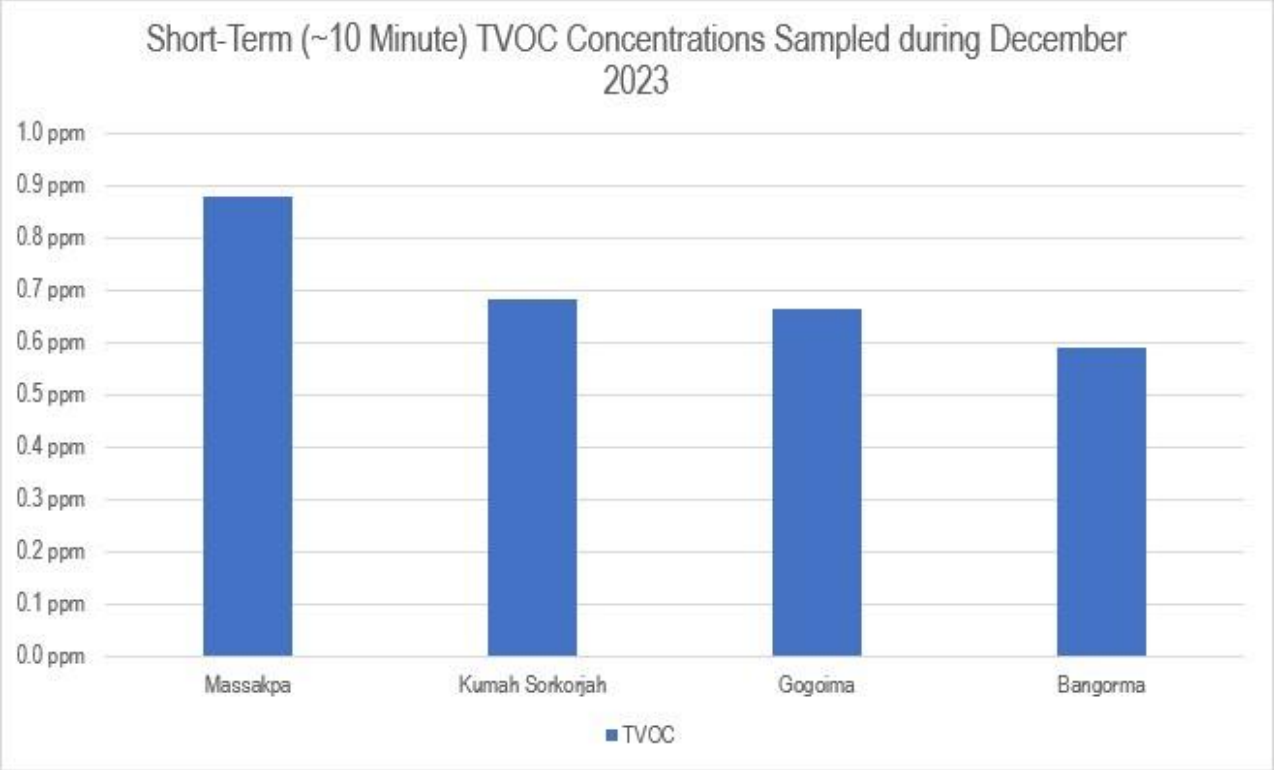


FIGURE 5-20: TVOC CONCENTRATIONS SAMPLED DURING DECEMBER 2023

5.8 NOISE

5.8.1 DESCRIPTION OF RECEIVING ENVIRONMENT

This section provides details of the receiving acoustic environment which is described in terms of:

- Local NRs;
- The local environmental noise propagation and attenuation potential; and
- Current noise levels and the existing acoustic climate.

5.8.1.1 Noise sensitive receptors

NSRs generally include places of residence and areas where members of the public may be affected by noise generated by proposed activities. Generally, only those within a 3 km radius of activities could be affected by noise generated by the activities. This does not necessarily mean that these receptors will be negatively impacted by the project, only that further receptors are very unlikely to be affected.

Sensitive noise receptors (FIGURE 5-21) in the vicinity of the Matambo mine activities include the villages of Bangorma (< 100 m northeast of Matambo 1), Korma Sorkpoja (1 km southeast of Matambo 1), Zoduaja (2 km south of Matambo 1&2), Masakpolor (1 km southeast of Matambo 3 and 1.5 km southwest of Matambo 2), Gogoma (1.2 km northwest of Matambo 2 and 1.7 km northeast of Matambo 3), Sanor (1.5 km north of Matambo 3), Brownsville (1.4 km northwest of Matambo 3) as well as the accommodation camp, located approximately 500 m north of the Matambo 1 & 2.

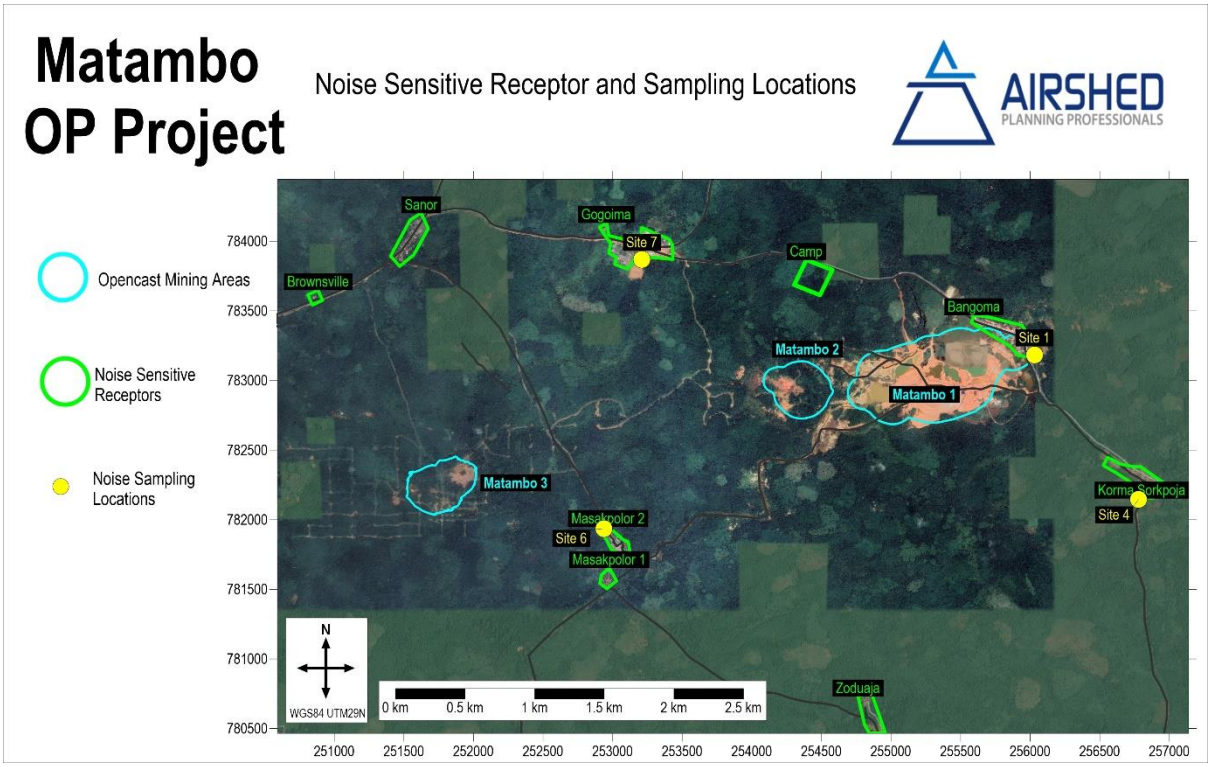


FIGURE 5-21: NOISE SENSITIVE RECEPTOR LOCATIONS AND NOISE SAMPLING LOCATIONS

5.8.2 NOISE SURVEY AND RESULTS

Day- and night-time baseline (pre-mining) noise measurements were conducted in August 2021 (Grobler, 2021) at four villages (Bangorma, Korma Sorkpoja, Masakpalor and Gogoima). Survey sites were selected taking into consideration existing and proposed activities, NRs, accessibility and safety.

Acoustic observations made during the 2021 survey are summarised in TABLE 5-22 and TABLE 5-23. The acoustic climate at NRs is currently affected by community activities, generators, vehicle traffic, domesticated animals as well as natural noises such as birds and insects.

Recorded LAeq,d were below the Liberian noise limits at sites 1, 6 and 7, and slightly exceeded the 55 dBA level at site 4 (Korma Sorkpoja), mainly due to natural and community noise. Because of community and natural noise (such as birds and insects), night-time noise levels were significantly higher than the Liberian limit for residential locations (35 dBA), and slightly higher than the limit for mixed-use residential areas (45 dBA).

TABLE 5-22: BASELINE NOISE MEASUREMENT SURVEY RESULTS

SITE	DESCRIPTION	DAY TIME	NIGHT-TIME
		$L_{aeq,d}$ (dBA)	$L_{aeq,n}$ (dBA)
Site 1	East of Matambo-Bangorma Village	42.5	47.1
Site 2	Southeast of Matambo-Korma Sorkpoja Village	57.6	47.6
Site 3	Southwest of Matambo-Massakpolor #1	47.7	47.7
Site 4	Northwest of Matambo-Gogoima	51.2	46.0

TABLE 5-23: BASELINE NOISE MEASUREMENT SURVEY DETAILS AND BROADBAND RESULTS

SITE	COORDINATES	SAMPLING DATE	NOISE CLIMATE	L_{AFMAX} (dBA)	L_{aeq} (dBA)	L_{A90} (dBA)
DAYTIME						
Site 1 - Bangorma	7° 4'48.37"N 11°12'31.28"W	07-Aug-21	Generator (artisanal mining), Road Traffic, Birds, Construction, Music	59.3	**42.5**	38.5
Site 4 – Korma Sorkpoja	7° 4'14.69"N 11°12'6.74"W	07-Aug-21	Chickens, Birds, Community Noise, Birds, Road Traffic	79.0	**57.6**	36.3
Site 6 - Massakpolor	7° 4'7.29"N 11°14'11.90"W	08-Aug-21	Community Noise, Children Playing, Road Traffic, Music, Birds	64.9	**47.7**	38.9
Site 7 - Gogoima	7° 5'10.23"N 11°14'3.27"W	08-Aug-21	Community Noise, Sheep, Chickens, Road Traffic, Birds, Insects	59.3	**42.5**	38.5
NIGHT-TIME						
Site 1 - Bangorma	7° 4'48.37"N 11°12'31.28"W	07-Aug-21	Music, Insects, Community Noise	49.6	**47.1**	46.1
Site 4 – Korma Sorkpoja	7° 4'14.69"N 11°12'6.74"W	07-Aug-21	Insects, Community Noise, Dogs, Birds	53.4	**47.6**	45.2
Site 6 - Massakpolor	7° 4'7.29"N 11°14'11.90"W	08-Aug-21	Community Noise, Music, Road Traffic, Insects	74.9	**47.7**	30.1
Site 7 - Gogoima	7° 5'10.23"N 11°14'3.27"W	08-Aug-21	Community Noise, Music, Generator, Road Traffic, Insects	55.8	**46.0**	42.8

Periodic ambient Noise sampling is currently conducted at four sampling locations surrounding the Matambo Project site (MAP 5-2). Preliminary short-term sampling conducted during December 2023 (TABLE 5-24 and FIGURE 5-22) indicate that the average day-time noise falls well within the EPA draft guideline noise levels for construction (75db).

TABLE 5-24: PRELIMINARY SHORT-TERM NOISE SAMPLING RESULTS

SAMPLE ID	MAX	MIN	AVERAGE	EPA DRAFT GUIDELINE NOISE

				LEVELS FOR CONSTRUCTION
MTB_NEW_NL_01	65.0	49.9	57.5	75.0
MTB_NEW_NL_02	62.4	57.5	60.0	75.0
MTB_NEW_NL_03	65.0	57.2	61.1	75.0
MTB_NEW_NL_04	63.3	57.9	60.6	75.0
MTB_NEW_NL_05	69.4	55.6	62.5	75.0
MTB_NEW_NL_06	76.6	58.3	67.5	75.0
MTB_NEW_NL_07	65.9	61.4	63.7	75.0
MTB_NEW_NL_08	52.3	43.5	47.9	75.0
MTB_NEW_NL_09	43.0	38.1	40.6	75.0
MTB_NEW_NL_10	50.8	40.0	45.4	75.0
MTB_NEW_NL_11	54.7	47.4	51.1	75.0
MTB_NEW_NL_12	57.3	48.8	53.1	75.0

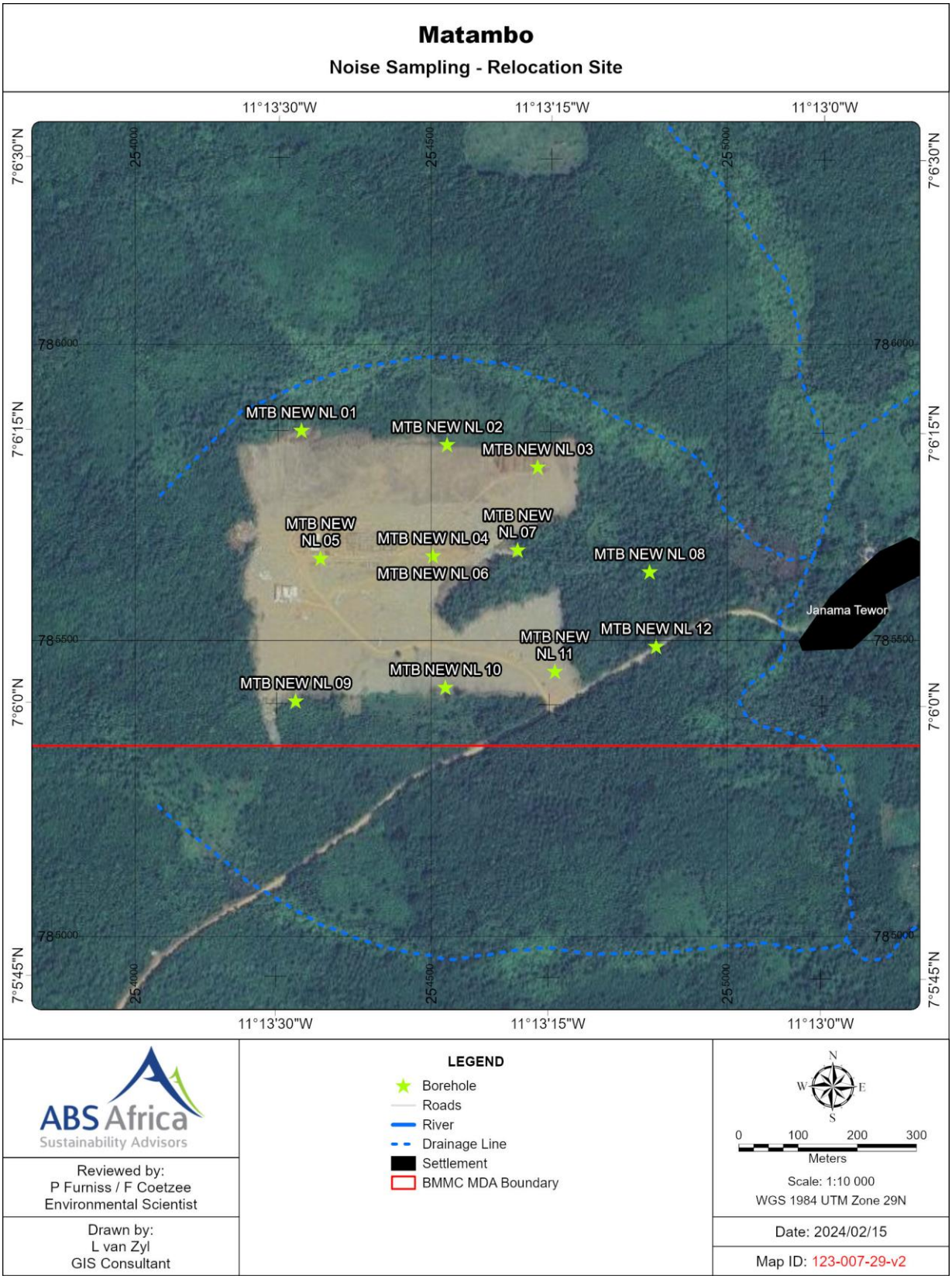


FIGURE 5-22: LOCATIONS OF PRELIMINARY SHORT-TERM NOISE SAMPLING

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5.9 ECOLOGICAL OVERVIEW[15]

A rapid baseline verification study was conducted in 2023 by Enviro-Insight (APPENDIX 5-2). The purpose of the study was to verify the status of the baseline assessed in the 2021 fieldwork. The sections below provide an overview of the updated ecological baseline (pre-mining) environment of the Matambo Mine area.

5.9.1 GLOBAL PERSPECTIVE

The Upper Guinean forests extend from Senegal to Togo and are regarded as one of the biodiversity hotspots of the world. Woodland savanna stretching from the Sahel to the Gulf of Guinea, known as the Dahomey gap, separates the Upper Guinean forests from the rest of the African forests and consequently, the Upper Guinean forests have a high degree of plant and animal endemism.

5.9.2 REGIONAL PERSPECTIVE

5.9.2.1 Land cover

The following sub-sections aim to provide context of the Matambo Site in relation to the typical regional ecosystems. The Matambo Site is located within one of the World-Wide Fund for Nature's (WWF) Global 200 Ecoregions, which represents 238 global Ecoregions selected for their "exceptional levels of biodiversity, such as high species richness or endemism, or those with unusual ecological or evolutionary phenomena" (WWF, 2016).

Approximately half of the remaining West African forests are in Liberia. Land cover statistics published in 2015 by Joint Venture Metria AB and GeoVille GmbH for the FDA of Liberia indicated that approximately 45% of Liberia's land cover consists of patches with more than 80% forest cover (TABLE 5-25). However, during 1990 and 2010, Liberia lost between 12% and 22% of this forest cover (FDA, REDD+ Infobooklet, 2016). Currently, the UGF is highly fragmented, and deforestation continues to occur due to unregulated logging and slash and burn agriculture (FIGURE 5-23).

TABLE 5-25: LAND COVER STATISTICS FOR LIBERIA 2014/2015[16]

LAND COVER CLASS	AREA (ha)	% OF MAPPED AREA
Forest >80%	4,389,270	45.46
Forest 30 - 80%	2,186,495	22.64
Forest <30%	1,529,949	15.84
Mangrove and Swamps	37,158	0.38
Settlements	44,595	0.46
Surface Water Bodies	60,374	0.63
Grassland	625,332	6.48
Shrub	606,928	6.29
Bare Soil	173,690	1.80
Ecosystem complex (rocks & sand)	2,271	0.02
Cloud covered (unmapped)	14,336	0.15
Total mapped area (land and inland water)	9,656,062	100.00

[15] Summarised from Rapid Baseline Verification Study (Enviro-Insight, 2023). See Appendix 5-2.
[16] (FDA, 2015)

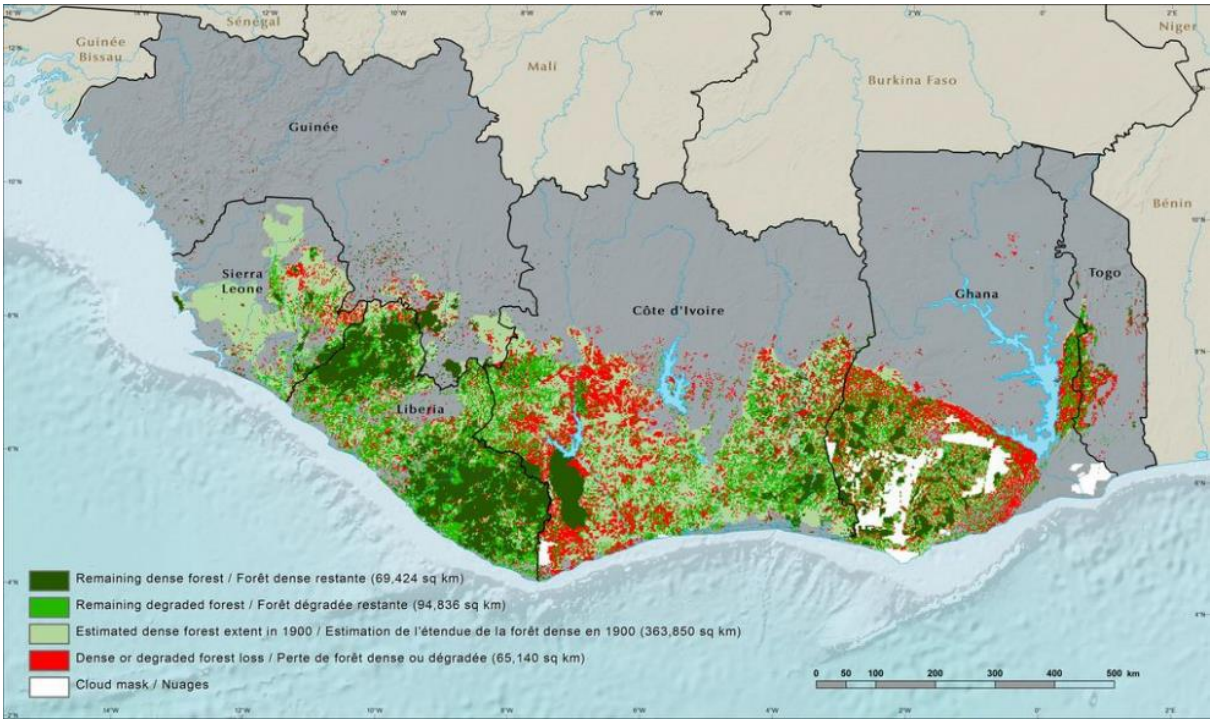


FIGURE 5-23: REMAINING UPPER GUINEA FOREST EXTENT[17]

Fauna and Flora of Liberia

The Liberian forests provide habitat for approximately 125 mammal species, 1000 insects, 162 fish, 590 birds, 125 reptiles and amphibians, 2000 flowering plants and 240 tree types (FDA, REDD+ Infobooklet, 2016). These fauna and flora species within their forest ecosystems provide essential ecosystem services e.g.

- Fertile soil;
- Climate stabilisation;
- Flood control;
- Medicinal plants;
- Stable and consistent supply of water; and
- Reduced risk for tropical diseases.

Physiography

Liberia is divided into two major topographical regions based on the height above sea level and physical features namely the 'belt of the rolling hills' and the 'belt of the dissected table lands' (Voorhoeve, 1965). The former stretches from the coast to between 80 and 130 km inland and is characterised by a relatively uniform pattern broken by the occasional rocky outcrop and hilly range. A steep and hilly escarpment marks the transition into the latter belt, which is characterised by a number of steep mountain ranges with a general south-west to north-east direction. The Matambo Site falls within the 'belt of the rolling hills'.

Hydrography

Approximately 14% of the total land area of Liberia consists of freshwater bodies in the form of rivers, lakes and wetlands (Nketia, Larmie, & Otu Ansah, 2016). The country is drained by six major river systems, draining south-west through Liberia towards the coast (FFL, 2016; Nketia, Larmie, & Otu Ansah, 2016). These include the Mano, Lofa, St. Paul, St. John, Cestos and Cavalla and collectively drain 66% of the country (Nketia, Larmie, & Otu Ansah, 2016).

[17] https://eros.usgs.gov/westafrica/land-cover/deforestation-upper-guinean-forest

5.9.3 LOCAL PERSPECTIVE

The general climatic conditions during a survey are of great importance to the observation success of faunal surveys because animals are greatly affected by temperature, humidity and precipitation. The climate at NLGM is expected to represent that of Matambo (being within 50 km) and is characterised by a warm and wet climate with mild seasonality.

This assessment was conducted over two-seasons (wet and dry) in 2021 in order to inform and guide the development of the gold resources within targeted areas within the Avesoro MDA, Grand Cape Mount County, Liberia.

The verification survey in 2023 was undertaken in the wet season.

5.9.4 GENERAL RESULTS AND SURVEY COVERAGE

5.9.4.1 Wet season

During the wet season, many Liberian forest species are either dispersed (fauna only), senescent (plants only) or dormant. This explains the relative low richness values for fauna observed (mainly birds and mammals) during the wet season since it is also the time of the year when the majority of tree species are not in flower or fruit (FIGURE 5-24). This also explains why many bird taxa are not breeding (FIGURE 5-24) and are scattered ("thinly" distributed) across the landscape, thereby complicating predictions regarding their occurrence in a particular patch of forest. These wet season specific limitations highlight the necessity for dual season surveys in forested environments.

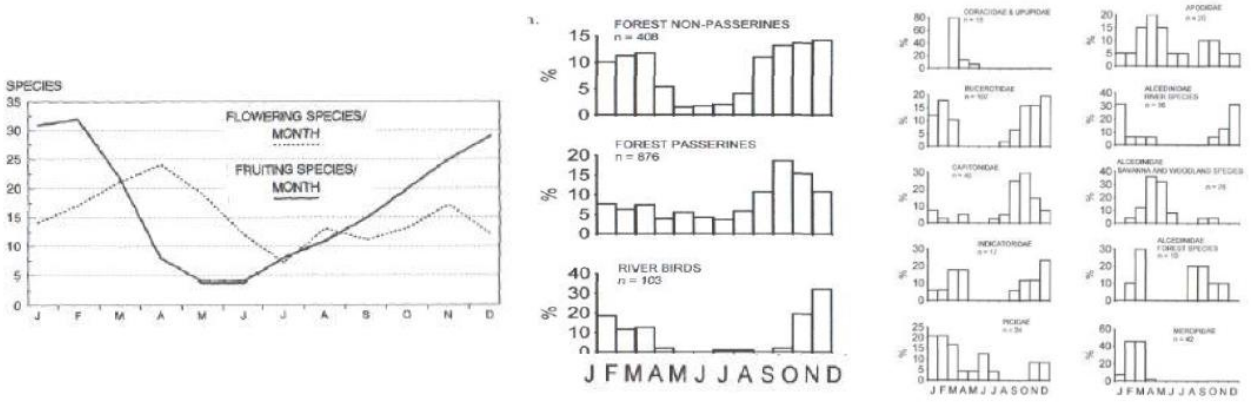


FIGURE 5-24: FROM LEFT TO RIGHT: THE SEASONAL PHENOLOGY OF FOREST TREES, THE MONTHLY BREEDING INTENSITY FOR FOREST BIRDS (NON-PASSERINE, PASSERINE AND RIVER BIRDS), AND SELECTED NON-PASSERINE BIRD FAMILIES (GATTER, 1997)

5.9.4.2 Dry season

During the dry season, many Liberian forest species are active and concentrated near water (fauna only) or in growth (plants only). This explains the high richness values for birds and mammals during the dry season since it is also the time of the year when various tree species are in flower (FIGURE 5-24). Amphibian activity is reduced due to the lack of suitable water bodies for the breeding of some species and snakes were found to be very scarce during this period. However, certain amphibian species that breed in flowing water choose the dry season for breeding purposes due to the reduced flows which are more conducive to breeding requirements, and observations of these species was improved during the dry season. This dry season survey complimented the wet season due to season specific limitations in this forested environment.

5.9.5 HABITAT AND PLANT SPECIES

Combined wet and dry season fieldwork (3 transects) produced a total of 226 plant species in the Matambo Area. Although this is an underrepresentation of true species richness for the Matambo Area, since fieldwork coverage focused on areas of intact forest, it does nonetheless give an indication of how high species richness is in the intact forests. Transects comprised on average 58% of the entire plant list for the area, indicating relatively high species turnover between sites. Five main habitat types were delineated for the pre-developed Matambo Open Pit Sites (TABLE 5-26).

TABLE 5-26: HABITAT TYPES OF THE MATAMBO AREA

NAME	DESCRIPTION
Hillslope Forest	Hillslope Forest (HF) is closely associated with steeper mid to upper slopes and crests of all the hills in the study area (FIGURE 5-25 and FIGURE 5-26). HF is a tall forest type with a canopy height of over 30 m on hillslopes, particularly more level terraces on the hillslopes, whereas canopy height tends to be much lower on hillcrests and with a more open understory of sub-canopy strata. No tree species are clearly dominant in the canopy, although species found regularly throughout this forest type include *Irvingia gabonensis, Klainedoxa gabonensis, Lophira alata, Sacoglottis gabonensis, Aphanocalyx pteridophyllus, Parinari excelsa, Pentaclethra macrophylla* and *Piptadeniastrum africanum*. Common mid-stratum trees and shrubs include several Diospyros species, such as *D. sanza-minika* and *D. gabunensis, Calpocalyx brevibracteatus, Placodiscus pseudostipularis, Heisteria parvifolia* and *Friesodielsia enghiana*. Epiphytes are very prominent in HF and include ferns such as *Aglaomorpha laurentii* and *Pleopeltis macrocarpa*, and orchids such as *Angraecum bancoense* and several *Bulbophyllum* species. The herbaceous undergrowth is characterised by geophytes such as *Nephthytis afzelii*, several *Hypselodelphys* species and sedges (*Mapania* species). IUCN Red-listed species are moderately represented in this forest type, with three out of the six threatened species in the study area, as well as one NT species (*Didelotia idae*), being recorded (FIGURE 5-28). One of these, *Placodiscus pseudostipularis*, is classified as Endangered (EN), while the other two threatened species are classified as Vulnerable (VU), namely *Heritiera utilis* and *Entandrophragma angolense*. Upper Guinea Endemic (UGE) and Liberian endemics are also prominent, including trees such as *Afzelia parviflora, Calpocalyx brevibracteatus* and *Maranthes aubrevillei*, understory shrubs such as *Myrianthus libericus* and *Cnestis bomiensis*, as well herbaceous forest floor species such as *Nephthytis afzelii, Mapania linderi* and *Stenandriopsis buntingii*.
Lowland Forest	Lowland Forest (LF) and HF are representative of "closed evergreen lowland forest" (Mayaux, et al. 2004) and "wet evergreen forest" (Poorter, et al. 2004), and represent most of the intact forest cover in the study area (FIGURE 5-26). While these two forest types occupy distinct positions in the landscape, they can be very similar on footslopes, where LF merges with HF. Canopy height is 20-30 metres, although sometimes higher than 30 metres. The woody sub-canopy strata are diverse and generally denser than in HF. Prominent large canopy trees, some of which can be emergents, include *Cleistopholis patens, Entandrophragma angolense, Erythrophleum ivorense, Klainedoxa gabonensis, Milicia excelsa, Parinari excelsa, Piptadeniastrum africanum, Sacoglottis gabonensis, Pentadesma butyracea* and *Pycnanthus angolensis*. A diverse range of trees and large shrubs in the understory includes common species such as *Alstonia boonei, Anthonotha macrophylla, Dialium aubrevillei, Didelotia idae, Diospyros gabunensis, Newtonia duparquetiana, Friesodielsia enghiana* and *Protomegabaria stapfiana*. The low forest understory is very diverse, comprising low shrubs, some of which are leaf-litter collectors such as *Campylospermum duparquetianum, Psychotria rufipilis, P.micheliae* and *Pycnocoma angustifolia*, numerous large-leaved Dracaena species and Marantaceae species such as *Hypselodelphys poggeana*, H. violacea and *Sarcophrynium brachystachyum*, and dense carpets of herbs such as *Geophila afzellii* and *Hymenocoleus hirsutus*. Epiphytes are also a prominent life form in LF, and most large trees are covered in climbing Araceae species such as *Culcasia angolensis* and *C. glandulosa*, while the epiphytic fern, *Aglaomorpha laurentii*, is particularly prominent in taller parts of the forest. SCC are more well represented in LF than in HF. Five VU tree species and one EN species (*Placodiscus pseudostipularis*) were confirmed to occur, as well as one NT species (*Didelotia idae*) (FIGURE 5-28). A similar selection of Upper Guinea Endemic (UGE) and Liberian endemics that occur in HF are present in LF, with some species such as *Hunteria simii, Myrianthus libericus* and *Sabicea discolor* being noticeably more common in LF.
Secondary and Pioneer Forest / Thicket	This is a vegetation community that represents mostly Modified Habitat derived from forest that has recently been cleared for activities such as slash-and-burn cultivation, or recently degraded through commercial logging or artisanal mining. Consequently, it is a vegetation community found closest to areas of human habitation or along access routes into the forests such as logging roads. Vegetation structure is low forest or thicket to dense shrubland, depending on how recently the degradation occurred. Species composition is dominated by pioneer species and other species typical of secondary habitats, such as *Musanga cecropioides, Anthocleista nobilis, Trema orientalis, Alchornea cordifolia, Sarcocephalus latifolius* and *Dichrostachys cinerea*. Invasive alien species are prominent, particularly *Chromolaena odorata* and *Allamanda cathartica*, which both form dense thickets on some recently abandoned fields and along roadsides. Other alien species recorded included *Mangifera indica, Bambusa vulgaris* and *Ageratum conyzoides*. While no threatened species were recorded in this community during fieldwork, a number of UGE species are pioneer species of secondary forest and some of these were confirmed to occur, e.g.

	Anthocleista nobilis, Myrianthus libericus, Mussaenda chippii and *Sabicea discolor*. However, the proportion of SCC was much lower than in the other vegetation communities in the study area.
Azonal Riparian Forest	Azonal Riparian Forest (ARF) is confined to narrow strips along perennial streams and rivers throughout the Matambo Area. It mostly represents Natural Habitat, even in areas that have been quite heavily cultivated, but is a mosaic of Natural and Modified Habitat in areas of artisanal mining activity. Species composition is similar to LF, although a few canopy tree species are either confined to ARF or most common in it, particularly *Aphanocalyx pteridophyllus, Bridelia micrantha, Carapa procera, Erythrophleum suaveolens, Parkia bicolor, Pterocarpus santalinoides* and *Xylopia cf. rubescens. Aphanocalyx pteridophyllus* and *Erythrophleum suaveolens* are often the dominant canopy species, while *Pterocarpus santalinoides* is the most prominent small tree on the banks of larger perennial rivers. The dense forest understory has diversity of LF shrubs such as *Campylospermum* species, *Cola heterophylla, Connarus africanus,* various *Psychotria* species and *Pycnocoma angustifolia,* while the climbing palms *Eremospatha macrocarpa* and *Laccosperma opacum* are common in places. Epiphytes are a prominent life form in the forest canopy, particularly ferns such as *Aglaomorpha laurentii* and *Pleopeltis macrocarpa*. SCC are not as well represented as in HF and LF. Only one VU tree species was confirmed to occur, namely *Heritiera utilis*, as well as a fair number of UGE and Liberian endemics, such as *Hunteria simii, Maranthes aubrevillei, Myrianthus libericus, Pycnocoma angustifolia* and *Sabicea discolor*.t
Azonal Swamp Vegetation	This vegetation community is associated with permanently wet swamps throughout the study area. Vegetation structure varies from tall thicket to low shrubland, depending on the structure of the wetland and the degree of disturbance and subsequent exposure of plants to sunlight. The palm *Raphia hookeri* is often the dominant species in the less degraded swamps, growing in dense stands, while *Elaeis guineensis* is the more prominent palm species in the degraded swamps within cultivated areas where it forms more open groves in standing water. Low shrubs such as *Alchornea cordifolia*, *Mimosa pudica* and *Clappertonia ficifolia* are prominent at the edges of the more open swamps, as well as the herbaceous *Lasimorpha senegalensis*. Narrow swamps within relatively undisturbed forest often support patches of low woodland or swamp forest that are characterised by tree species such as *Anthocleista vogelii, Mitragyna ledermannii, Nauclea diderichii, Uapaca guineensis, Voacanga africana* and *Xylopia cf. rubescens*. SCC are not well represented, with only two NT species confirmed to occur (*Nauclea diderrichii, Mitragyna ledermannii*), as well as a small number of UGE, such as *Raphia hookeri, Myrianthus libericus* and *Anthocleista nobilis*.

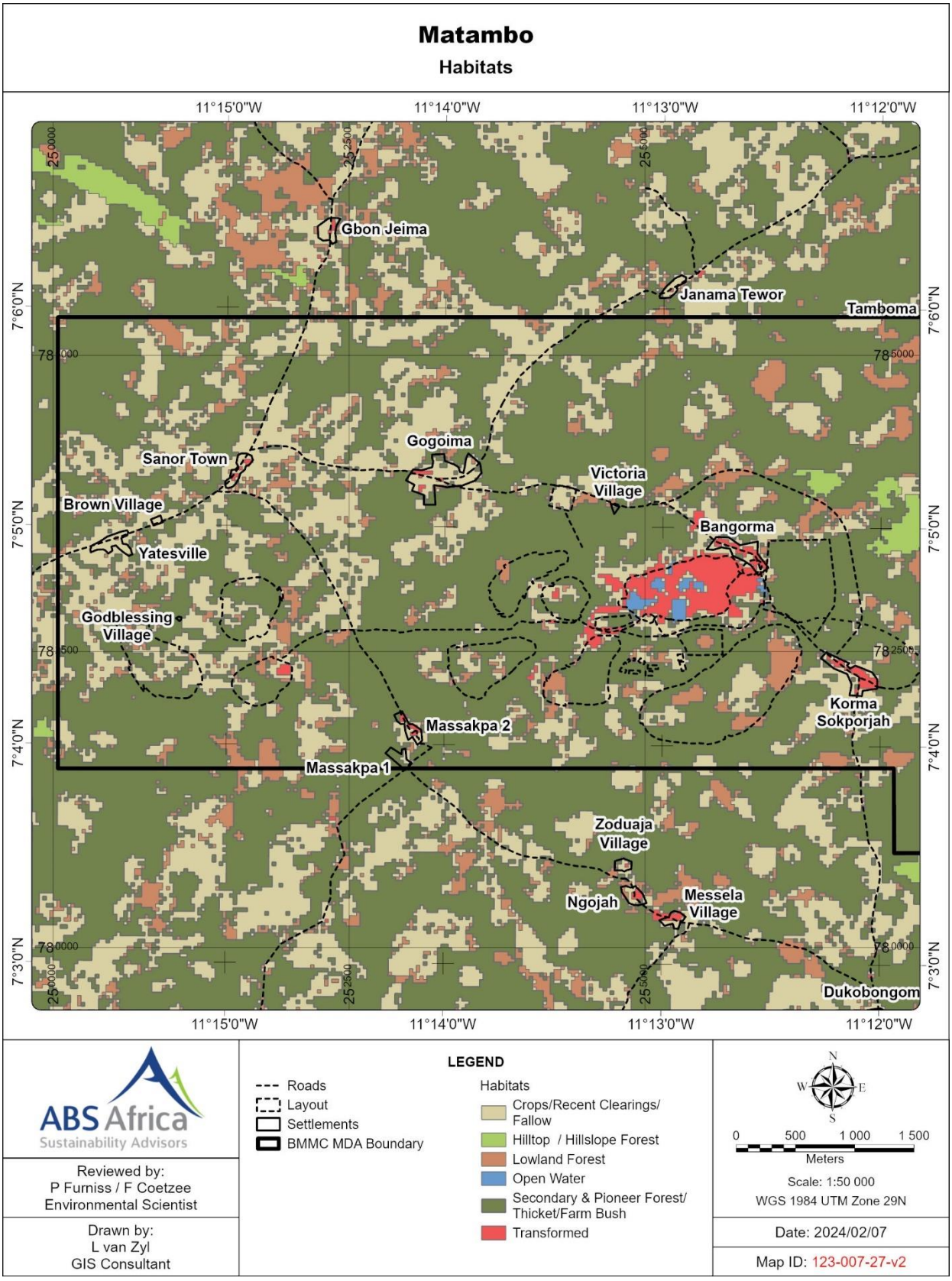


FIGURE 5-25: DISTRIBUTION OF HABITATS / VEGETATION COMMUNITIES WITHIN THE MATAMBO AREA

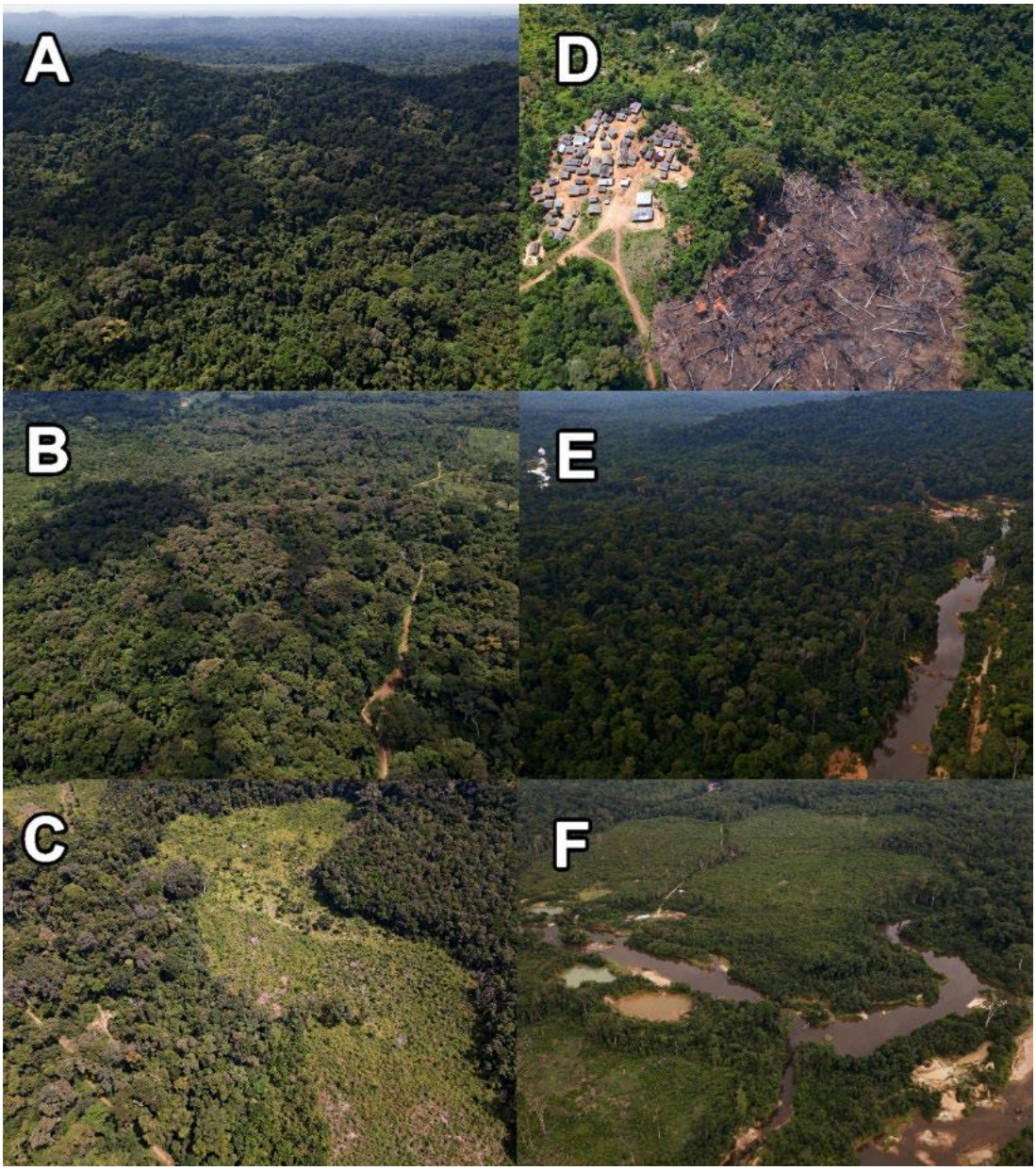


FIGURE 5-26: DRONE PHOTOS TAKEN IN 2021 OF SPECIFIC HABITATS IN THE EASTERN PORTION OF THE MATAMBO AREA[18]

[18] A: Hillslope Forest leading down into Lowland Forest on the flats, B: Lowland Forest patch surrounded by agriculture and secondary forest, C: cultivated land, D: village and recent slash and burn agriculture of Lowland Forest, E: Lowland and Hillslope Forest adjacent to the Mafa River showing artisanal mining disturbance along banks, F: Large disturbance from an abandoned Chinese gold mining area and agriculture along the Mafa River.



FIGURE 5-27: DRONE PHOTOS TAKEN IN 2023 OF THE MATAMBO AREA



FIGURE 5-28: A PHOTO OF *Didelotia idae* FOUND IN THE STUDY AREA

5.9.5.1 Endemics and Restricted-range Species

Another criterion for defining Critical Habitat (CH) as defined by the IFC in PS6 is Criterion 2: "habitat of significant importance to endemic and/or restricted-range species" (IFC, 2012). Restricted-range (Rr) species are defined as species with an Extent of Occurrence (EOO) of less than 50 000 km^2. The threshold for CH status is that an area should support at least 10% of the global population size and ≥10 reproductive units of a species".

The study area is located within a known floristic centre of endemism, defined by White (1983) as the Upper Guinea subcentre of the Guinea Congolian Regional Centre of Endemism. This is similar to the concept of the Upper Guinea Forests terrestrial ecoregion.

The Upper Guinean Forests contain an estimated 2 800 vascular plant species, of which 650 species (c. 23%) are endemic (Poorter *et al*., 2004). These include monotypic genera such as *Dinklageodoxa* (Bignoniaceae), *Habropetalum* and *Triphyophyllum* (Dioncophyllaceae), *Apodiscus* (Euphorbiaceae) and *Polystemonanthus* (Fabaceae subfamily Detarioideae). However, given the large size of the UGF ecoregion, there are few endemics that have EOOs of less than 50 000 km^2 and thus qualify as Restricted-range Species.

The Broader Matambo Area has a high proportion of plant species that are endemic to the Upper Guinea Forest region, with 51 species recorded during wet and dry season fieldwork, of which the most well represented families are Fabaceae (9 spp) and Rubiaceae (7 spp). A feature of Upper Guinea Forest endemics is the relatively high proportion of species that are adapted to disturbed forests, i.e. light-demanding pioneer species (Poorter et al., 2004). A number of these were encountered during fieldwork, especially in the Pioneer Forest habitat, such as *Anthocleista nobilis*, *Mussaenda chippii* and *Sabicea discolor*. None of the endemics located during fieldwork have EOOs of less than 50 000km^2 and thus no Rr species were confirmed to occur. Only one species comes relatively close to this threshold, namely *Psychotria micheliae* (J.-G.Adam) Jongkind & W.D. Hawth. This small dwarf shrublet of the forest understory is endemic to Liberia and has an approximate EOO of 65 000 km^2 (based on records in the Global Biodiversity Information Facility). It was located at numerous localities in HF and LF in the Broader Matambo Area but was absent from disturbed forest.

5.9.6 AVIFAUNA

Approximately 254 bird species are expected to occur in the Broader Matambo Area (APPENDIX 5-3) which equates to 41 % of the approximate 615 species listed for Liberia as a whole (according to Robertson, 2001). Of the 254 expected species in this area, 208 (82 %) were confirmed through these surveys and another 46 species are predicted to be present (based on suitable habitat) but were not observed during the surveys.

Of the 254 bird species expected to be present, 143 (56 %) are restricted (endemic) to the Guinea-Congolian forest block. In addition, 78 % of Guinea-Congolian forest endemics in Liberia (c. 184 species) could also be present in the Broader Matambo Area. Of these, 128 species were confirmed in the Broader Matambo Area during the surveys.

5.9.6.1 Species of Conservation Concern

Of the 14 expected IUCN Red Listed bird species, 6 SCC were confirmed during the 2021 survey (TABLE 5-27; FIGURE 5-29). Although not specifically observed during the verification survey, these species are known to occur in the broader region.

TABLE 5-27: THREATENED AVIFAUNA SPECIES OBSERVED WITHIN THE MATAMBO AREA

FAMILY	GENUS	SPECIES	COMMON NAME	IUCN	THREAT
Numididae	*Agelastes*	*meleagrides*	White-breasted Guineafowl	VU	Deforestation, inter-specific competition & human persecution
Bucerotidae	*Bycanistes*	*cylindricus*	Brown-cheeked Hornbill	VU	Deforestation, fragmentation & hunting
Bucerotidae	*Ceratogymna*	*Elata*	Yellow-casqued Hornbill	VU	Deforestation, fragmentation & hunting
Pycnonotidae	*Criniger*	*olivaceus*	Yellow-bearded Greenbul	VU	Deforestation
Picathartidae	*Picathartes*	*gymnocephalus*	White-neck rock fowl	VU	Deforestation
Psittacidae	*Psittacus*	*Timneh*	Timneh's Parrot	VU	Wild bird trade and deforestation



FIGURE 5-29: COLLAGE ILLUSTRATING (CLOCKWISE) 1: A STOCK PHOTOGRAPH OF IUCN VULNERABLE PICATHARTES. 2: A PICATHARTES RECORDED BY CAMERA TRAP WITHIN THE SPECIES' OPTIMAL ROCKY CAVE/ DRAINAGE LINE HABITAT ON THE INTERFACE BETWEEN WESTERN SILVER HILLS AND EASTERN MATAMBO

5.9.6.2 Species of Special Consideration

***Picathartes gymnocephalus* (White-necked Rockfowl/ Picathartes)- IUCN Vulnerable**

Summary of conservation status, threats, population size and trends

- Significant regional reduction in population
- Decreasing population trend;
- Location: Eastern Matambo leading into Silver Hills
- Method of data acquisition: Camera trap and habitat; and
- Number of recordings: Single record, multiple habitats.

Picathartes gymnocephalus field observations

Picathartes gymnocephalus is known from six sites in Liberia and therefore, the sightings within the MDA add to the known population distribution data. Local hunters (with 100% confidence) testify to the rareness of the species but that it is sparsely distributed within the MDA within drainage line rocky/ cave habitats. The descriptions of the species, distributions and behaviour were near exact to the known literature and interviews provided an excellent supplementation to the habitat evaluation and recorded sightings. The recorded location was situated fairly adjacent to logging related disturbance due to the species' apparent tolerance for disturbance. Although logging activities pose a significant risk to the species, it cannot be used as a distributional predictor. However, all significant rock structures (large caves and cliffs/ waterfalls) should be considered critical to the breeding of the species which is considered to be a breeding resident.

5.9.7 MAMMALS

Based on habitat suitability and the six years of previous records within the region, an estimated 142 mammal species may be expected to occur within the Matambo area (APPE). During the 2021 study, a total of 29 species were observed, representing 20% of the expected species respectively. The relatively small proportion of observed vs. expected species is thought to be due to the uneven sampling effort, the lack of attention to small mammals and bat species as well as the increasing impacts within the region.

5.9.7.1 Species of Conservation Concern

In the 2021 baseline study it was stated that 42 mammal SCC were expected to occur within the Matambo Area (

APPENDIX 5-4). Of these, five were observed/ reported. A detailed account for each of these threatened mammal species that warrant special consideration is provided below. It must be stated that in 2021 species such as sooty mangabey, white and black-bellied pangolins as well as Chimpanzees were being persecuted at an alarmingly high degree of significance.

Although not specifically observed during the verification survey, these species are known to occur in the broader region. The species are not present in the pit areas where there is no suitable habitat present.

TABLE 5-28: THREATENED MAMMAL SPECIES OBSERVED/ REPORTED IN THE MATAMBO AREA

FAMILY	GENUS	SPECIES	COMMON NAME	IUCN	THREAT
Bovidae	*Syncerus*	*caffer nanus*	Forest Buffalo	VU	Hunting
Cercopithecidae	*Cercocebus*	*Atys*	Sooty Mangabey	VU	Habitat Loss, Hunting, Pet Trade
Manidae	*Manis*	*Tricuspis*	African White-bellied Pangolin	VU now **E**	Habitat Loss, Bushmeat
Hominidae	*Pan*	*troglodytes ssp. Verus*	West African Chimpanzee	CR	Habitat Loss, Hunting, Pet Trade
Manidae	*Phataginus*	*Tetradactyla*	Black-bellied Pangolin	VU	Habitat loss, Bushmeat

Since the 2021 surveys, White-bellied Pangolin *Phataginus tricuspis* has been reassessed to IUCN **Endangered** status and was recorded during the survey. In addition, Diana Monkey (*Cercopithecus diana*) and the King Colobus Monkey (*Colobus polykomos*), both of which are predicted to occur within the broader region, have been reassessed to IUCN **Endangered** status (Enviro- Insight, 2024).

5.9.7.2 Species of Special Consideration

***Pan troglodytes verus* West African Chimpanzee: IUCN Critically Endangered**

According to local interviews conducted during the 2021 baseline survey, the densities around the Matambo areas have decreased significantly due to large-scale logging.

***Syncerus caffer* Forest Buffalo: IUCN Vulnerable**

According to local interviews conducted during the 2021 baseline surveys, the densities around the Matambo areas have decreased significantly and in addition, are the cause of moderate crop losses and at least two deaths. The species will increasingly become the target of direct persecution in absence of viable mitigation measures.

5.9.8 HERPETOFAUNA

A total of 25 herpetofauna sites were surveyed across both the dry and wet seasons which covered a variety of habitat present within the broader Matambo area. Although not specifically observed during the verification survey of 2023, these species are known to occur in the broader region.

5.9.8.1 Amphibians

A total of 34 amphibian species were observed across all baseline surveys in the Matambo Area (TABLE 5-29). This represents remarkably high species richness, comprising 58% of the 59 species expected within the region of the PAOI, attributed to the diversity of habitats and presence of pristine habitats in place within the Matambo Area. The sampling effort was sufficient to detect most of the amphibian species and the proportion of species found to number of observations was similar on average to other Areas.

TABLE 5-29: AMPHIBIAN SPECIES AND COUNTS OBSERVED DURING THE 2021 MATAMBO BASELINE SURVEYS.[19]

FAMILY	SPECIES	RANDOM	HABITATS					
			ARF	ASV	CL	LF	SF	TL

[19] Habitats: Azonal Riparian Forest (ARF), Azonal Swamp Vegetation (ASV), Cultivated/Cleared Land (CL), Lowland Forest (LF), Secondary Forest (SF), and Transformed Land (TL). Random refers to ad hoc observations outside of survey sites. Counts are based on the number of individuals across all survey sites within the Exploration Area (note that the count per site is capped at 5).

Arthroleptidae	*Astylosternus occidentalis*	0	0	0	0	0	5	0
Arthroleptidae	*Cardioglossa occidentalis*	0	0	0	0	0	1	0
Arthroleptidae	*Leptopelis macrotis*	0	0	0	0	0	7	0
Arthroleptidae	*Leptopelis spiritusnoctis*	2	2	2	0	0	6	0
Arthroleptidae	*Leptopelis viridis*	1	0	8	0	0	7	0
Arthroleptidae	*Arthroleptis poecilonotus*	2	1	0	5	0	20	0
Bufonidae	*Sclerophrys maculata*	4	9	11	5	0	18	0
Bufonidae	*Sclerophrys cf. regularis*	0	0	0	0	0	1	0
Conrauidae	*Conraua alleni*	0	0	0	0	0	5	0
Dicroglossidae	*Hoplobatrachus occipitalis*	6	10	18	5	0	6	0
Hyperoliidae	*Afrixalus dorsalis*	0	1	5	5	0	5	0
Hyperoliidae	*Afrixalus fulvovittatus*	0	0	5	0	0	0	0
Hyperoliidae	*Hyperolius chlorosteus*	0	10	3	0	0	12	0
Hyperoliidae	*Hyperolius cf. concolor*	0	5	20	5	0	6	0
Hyperoliidae	*Hyperolius fusciventris*	1	16	30	6	0	10	0
Hyperoliidae	*Hyperolius guttulatus*	0	0	15	5	0	0	0
Hyperoliidae	*Hyperolius lamottei*	0	0	6	0	0	0	0
Hyperoliidae	*Hyperolius soror*	0	10	22	0	0	5	0
Odontobatrachidae	*Odontobatrachus natator*	0	0	0	0	0	5	0
Phrynobatrachidae	*Phrynobatrachus alleni*	0	0	0	0	0	8	0
Phrynobatrachidae	*Phrynobatrachus cf. natalensis*	1	0	0	0	0	1	0
Phrynobatrachidae	*Phrynobatrachus fraterculus*	0	0	7	0	0	2	0
Phrynobatrachidae	*Phrynobatrachus cf. gutturosus*	0	0	4	0	0	3	0
Phrynobatrachidae	*Phrynobatrachus latifrons*	1	0	7	5	0	0	0
Phrynobatrachidae	*Phrynobatrachus phyllophilus*	0	13	8	10	0	25	0
Phrynobatrachidae	*Phrynobatrachus cf. tokba*	5	0	2	5	0	0	0
Pipidae	*Xenopus tropicalis*	0	5	0	0	0	0	0
Ptychadenidae	*Ptychadena aequiplicata*	0	0	0	7	0	4	0
Ptychadenidae	*Ptychadena cf. bibroni*	1	8	24	0	0	6	0
Ptychadenidae	*Ptychadena longirostris*	13	0	10	0	0	11	0
Ptychadenidae	*Ptychadena mascareniensis OTU4/5*	0	0	6	0	0	0	0
Ptychadenidae	*Ptychadena oxyrhynchus*	2	0	0	0	0	0	0
Ranidae	*Amnirana albolabris*	0	1	8	0	0	10	0
Rhacophoridae	*Chiromantis rufescens*	0	2	1	0	0	0	0

Presence of Species of Conservation Concern

Two IUCN Near-Threatened/Data Deficient and eleven endemic (UGFE) or range-restricted amphibian species were confirmed within the Matambo broader Area. Based on habitats present in Matambo broader area, five Threatened or Near-Threatened species and eighteen endemic (UGFE) or range-restricted amphibian species are expected (APPENDIX 5-5).

5.9.8.2 Reptiles

A total of 21 reptile species, comprising 10 snakes and 11 lizards, were observed across all baseline surveys in the Matambo Area (TABLE 5-30). This represents a moderately high species richness and makes up 21% of the 100 species expected within the region of the PAOI. This is attributed to the cryptic nature of reptiles and snakes in particular. The sampling effort was not sufficient to detect most of the reptile species and the proportion of species found to number of observations was high higher on average than other Areas. Although not specifically observed during the verification survey of 2023, these species are known to occur in the broader region.

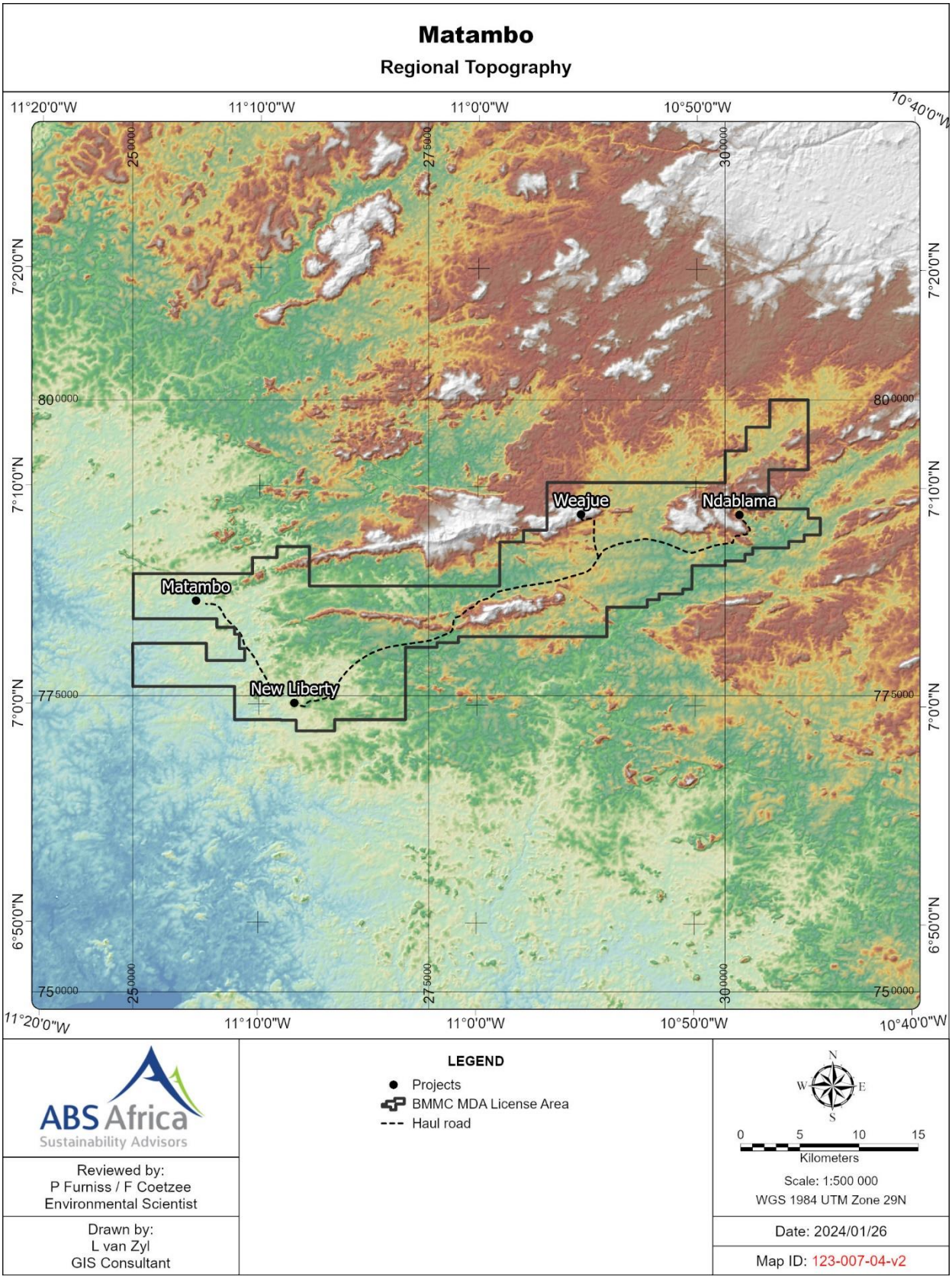
TABLE 5-30: REPTILE SPECIES OBSERVED DURING THE MATAMBO AREA BASELINE SURVEYS

FAMILY	SPECIES	RANDOM	HABITATS					
			ARF	ASV	CL	LF	SF	TL
Agamidae	Agama agama	14	1	1	10	0	17	0
Chamaeleonidae	Chamaeleo gracilis	4	0	1	0	0	0	0
Colubridae	Afronatrix anoscopus	0	0	1	0	0	0	0
Colubridae	Dipsadoboa underwoodi	0	1	0	0	0	0	0
Colubridae	Hapsidophrys smaragdinus	1	0	0	0	0	0	0
Colubridae	Toxicodryas pulverulenta	0	2	0	0	0	0	0
Colubridae	Natriciteres variegata	1	0	0	0	0	0	0
Elapidae	Naja guineensis	1	0	0	0	0	0	0
Gekkonidae	Hemidactylus cf. ansorgii	0	3	0	0	0	5	0
Gekkonidae	Hemidactylus mabouia	0	0	0	0	0	5	0
Gekkonidae	Lygodactylus conraui	1	0	0	0	0	0	0
Lacertidae	Holaspis laevigata	1	0	0	0	0	0	0
Lamprophiidae	Boaedon cf. fuliginosus	1	0	0	0	0	0	0
Lamprophiidae	Boaedon lineatus	0	0	0	0	0	1	0
Scincidae	Cophoscincopus simulans	0	0	0	0	0	3	0
Scincidae	Trachylepis affinis	2	0	0	0	0	7	0
Scincidae	Trachylepis maculilabris	0	0	0	10	0	7	1
Scincidae	Trachylepis paucisquamis	1	0	0	0	1	0	0
Varanidae	Varanus niloticus	0	1	0	0	0	0	0
Viperidae	Atheris chlorechis	0	0	0	0	1	0	0
Viperidae	Bitis rhinoceros	1	0	0	0	0	0	0

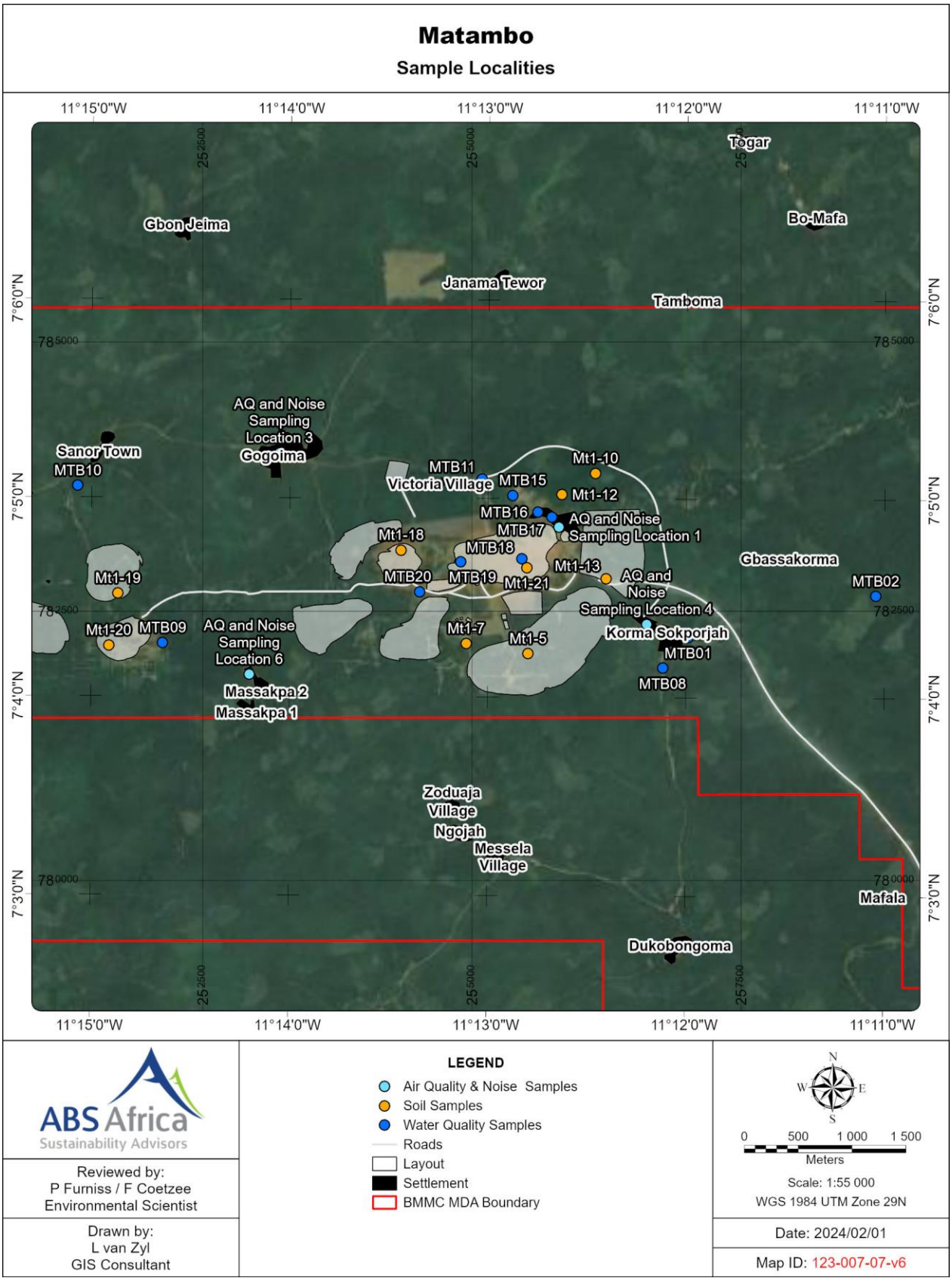
Presence of Species of Conservation Concern

Zero IUCN threatened and three endemic (UGFE) or range-restricted reptile species were confirmed within Matambo. Based on habitats present in the Matambo Broader Area, seven Threatened or Near-Threatened species and six endemic (UGFE) or range-restricted reptile species are expected (APPENDIX 5-6).

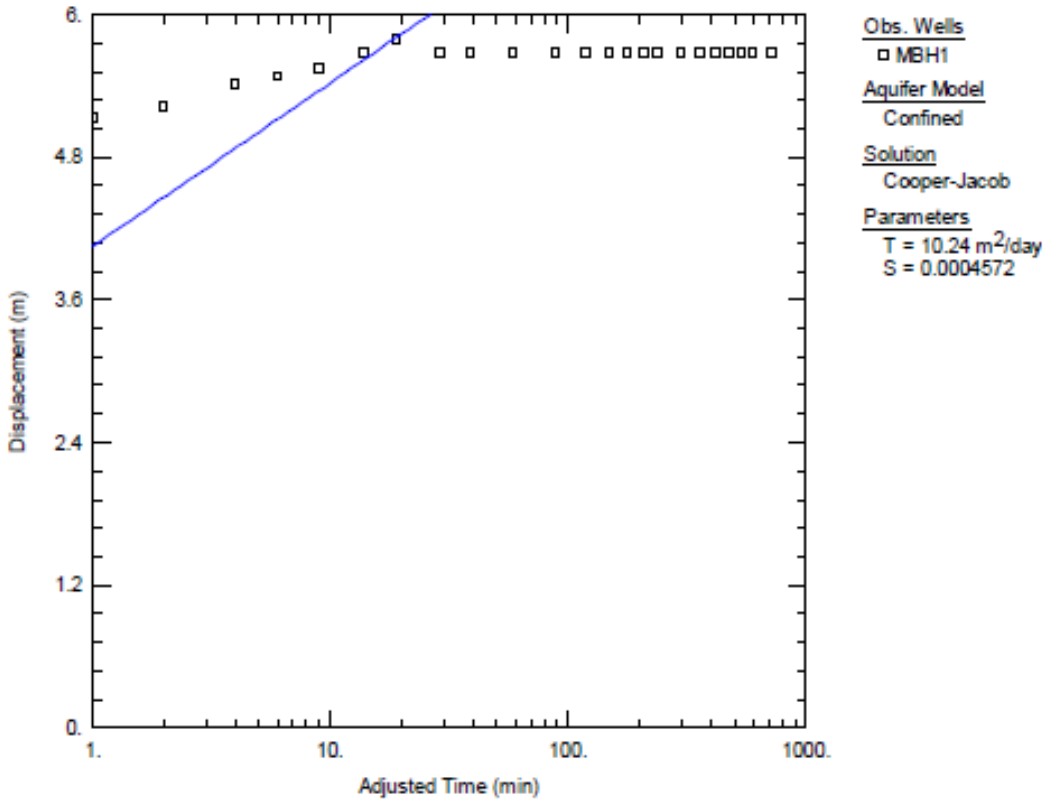
MAP 5-1: TOPOGRAPHY

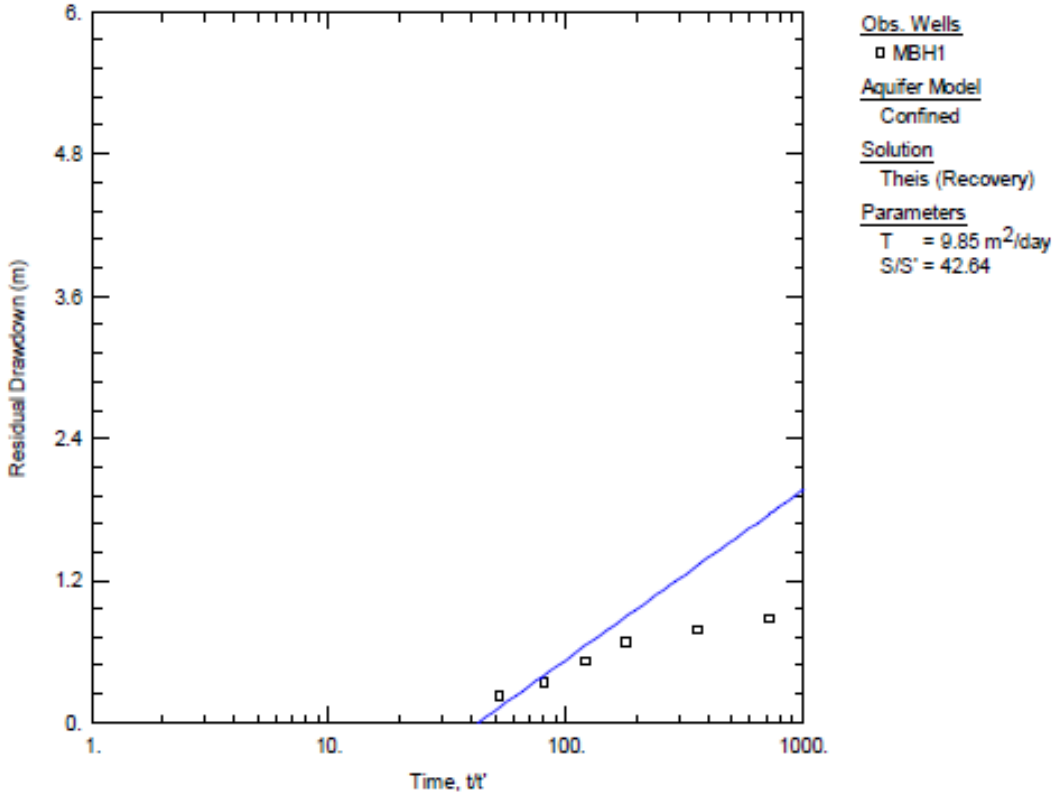


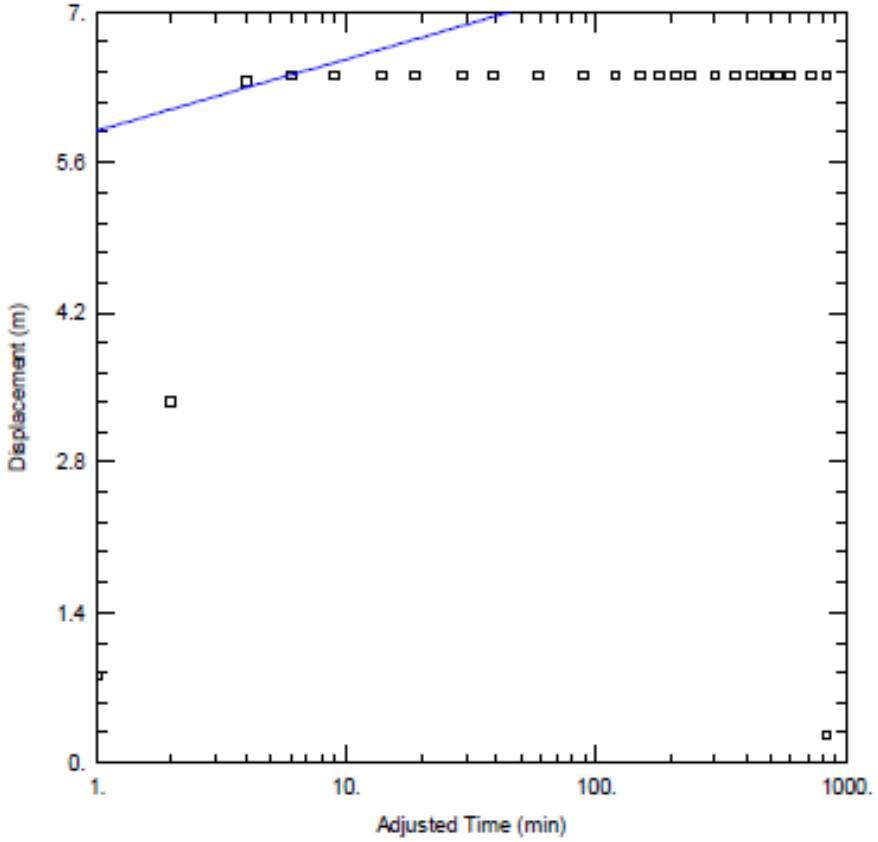
MAP 5-2: 2023 SAMPLING LOCATIONS

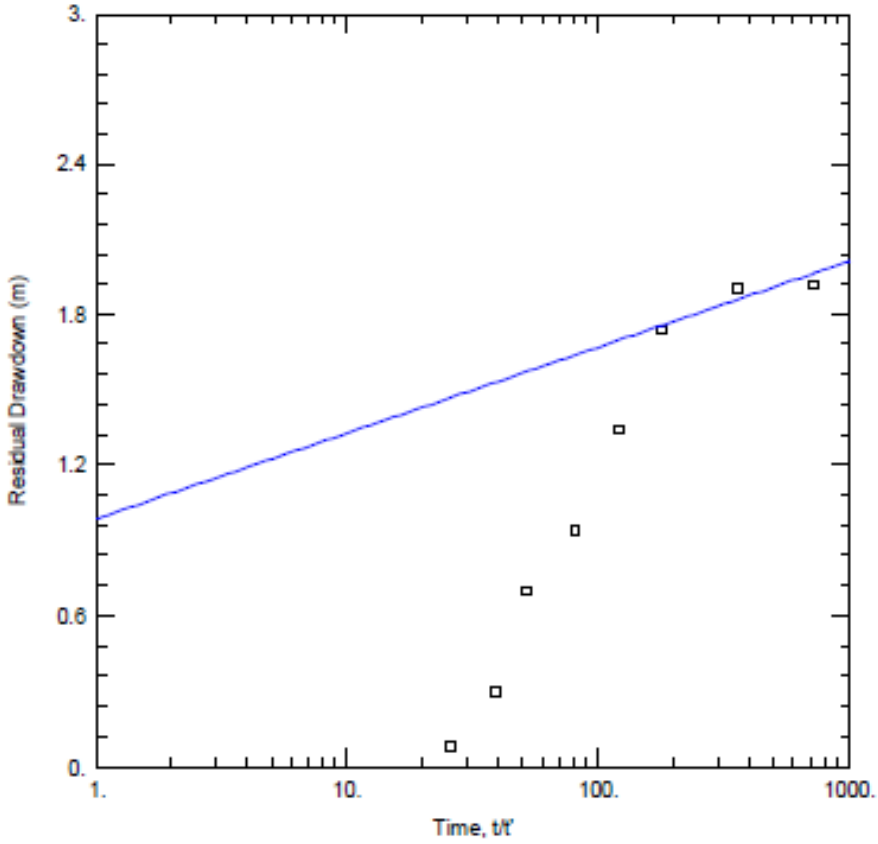


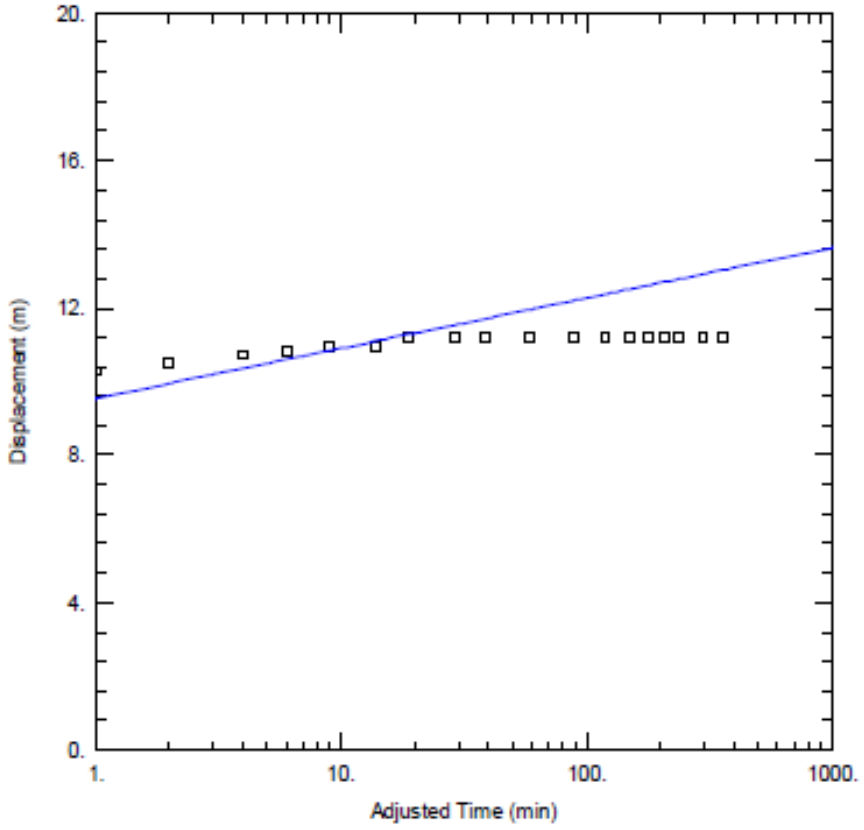
APPENDIX 5-1: PUMPING TEST GRAPHS (GEOSTRATUM, 2024)

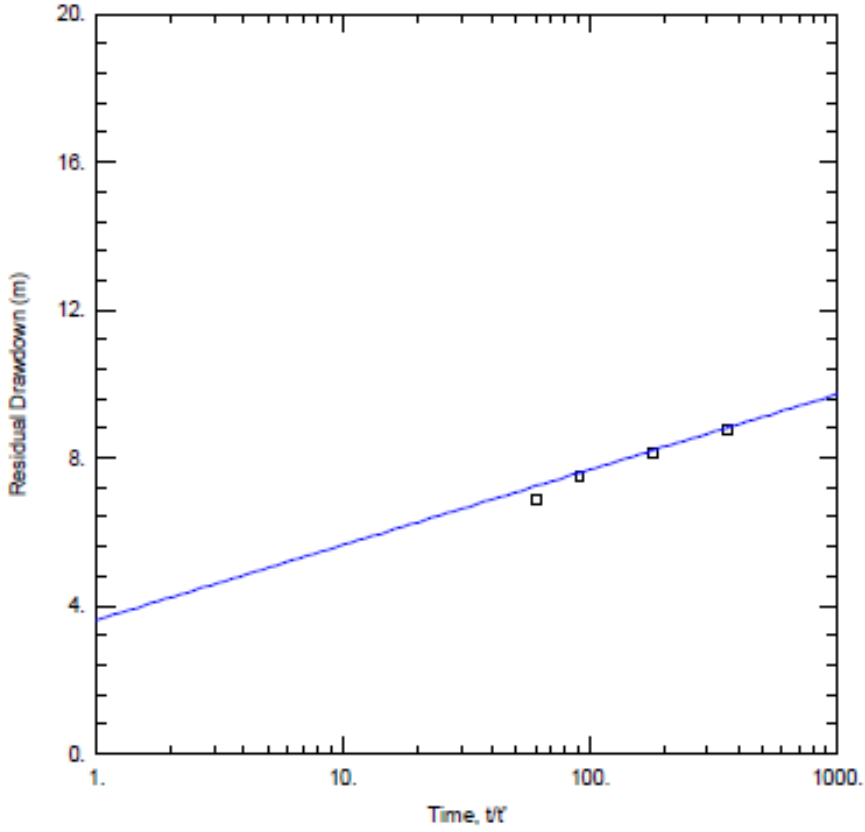


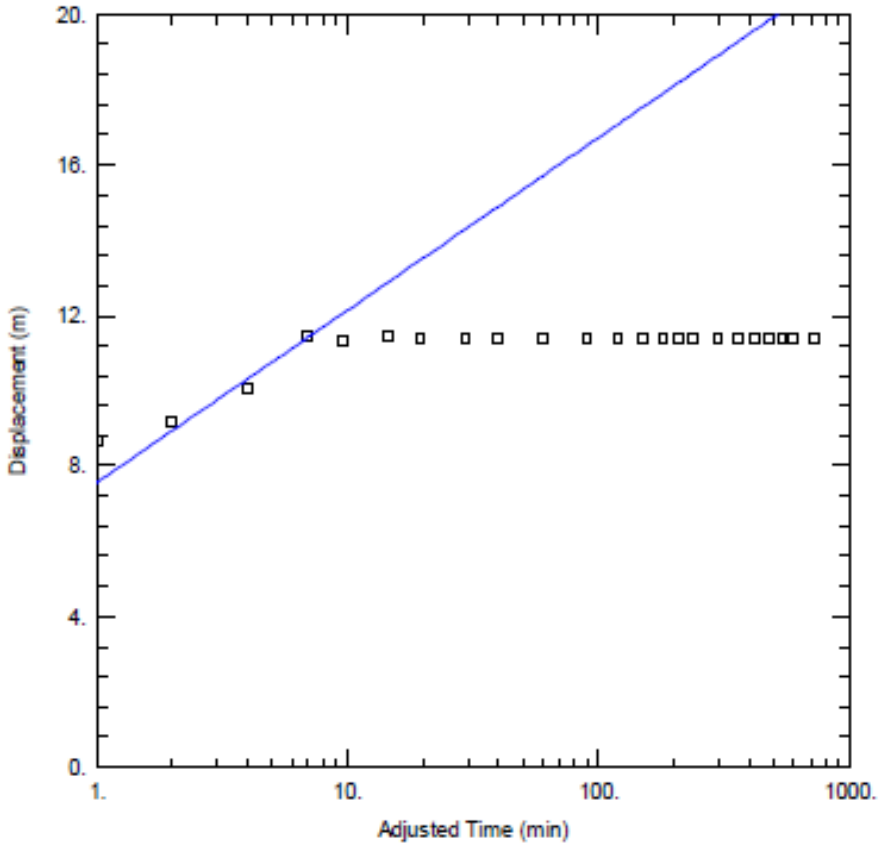


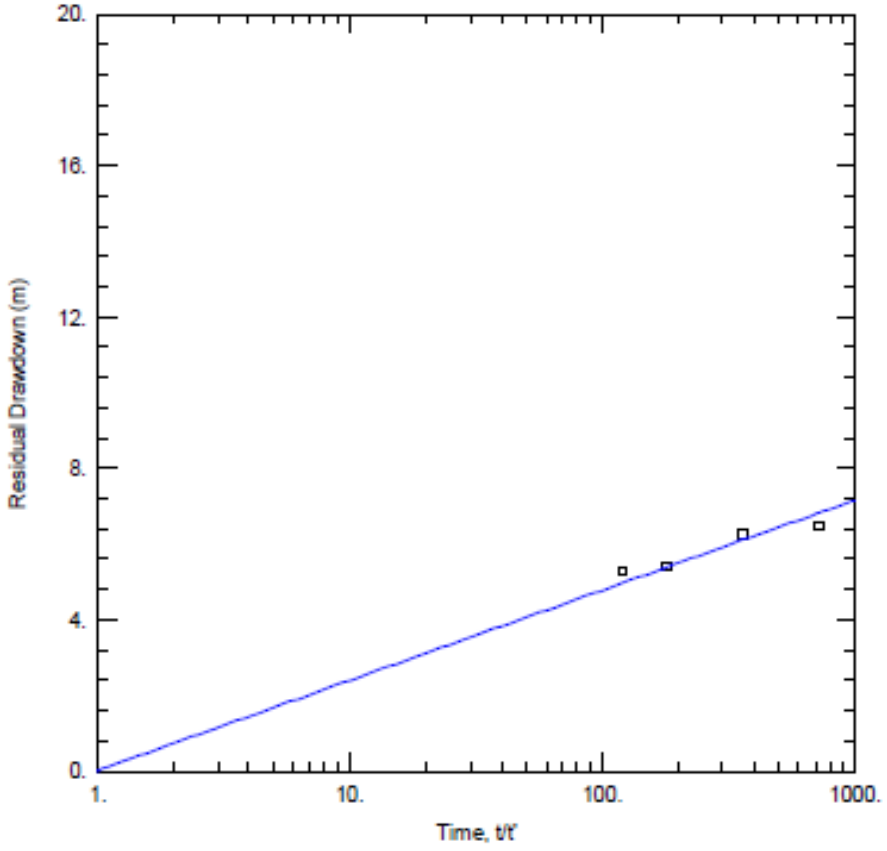

Displacement (m)
7.
5.6
4.2
2.8
1.4
0.
1.
10.
100.
1000.
Adjusted Time (min)
Obs. Wells
MBH2
Aquifer Model
Confined
Solution
Cooper-Jacob
Parameters
T = 0.05579 ft2/min
S = 4.747E-10

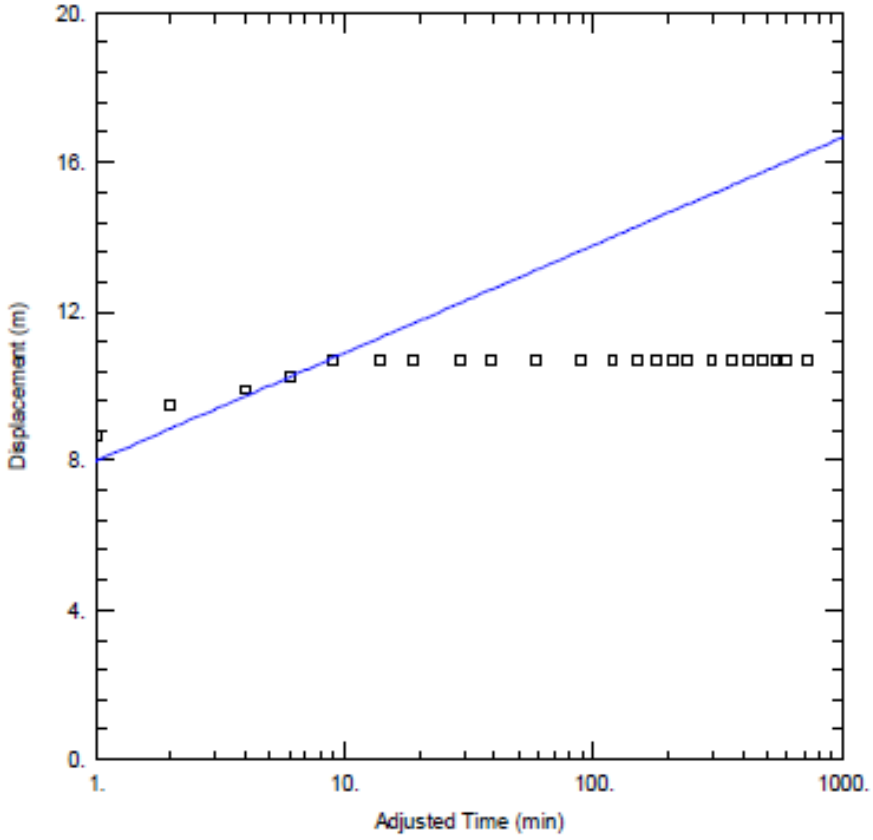

Residual Drawdown (m)
3.
2.4
1.8
1.2
0.6
0.
1.
10.
100.
1000.
Time, t/t'
Obs. Wells
MBH3
Aquifer Model
Confined
Solution
Theis (Recovery)
Parameters
T = 0.06534 ft2/min
S/S' = 0.001306

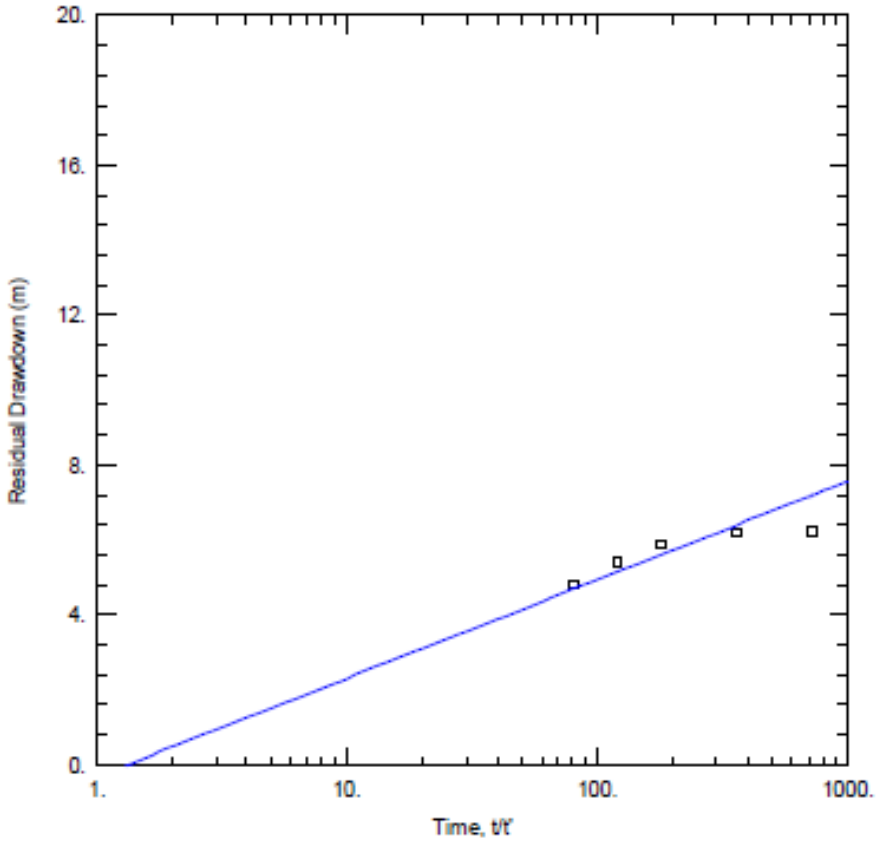

Displacement (m)
Adjusted Time (min)
Obs. Wells
MBH5
Aquifer Model
Confined
Solution
Cooper-Jacob
Parameters
T = 9.62 m2/day
S = 3.933E-8


Residual Drawdown (m)
Time, t/t'
Obs. Wells
MBH5
Aquifer Model
Confined
Solution
Theis (Recovery)
Parameters
T = 6.464 m2/day
S/S' = 0.01695


Displacement (m)
Adjusted Time (min)
Obs. Wells
MBH6
Aquifer Model
Confined
Solution
Cooper-Jacob
Parameters
T = 2.624 m2/day
S = 0.002301


Residual Drawdown (m)
Time, t/t'
Obs. Wells
MBH6
Aquifer Model
Confined
Solution
Theis
Parameters
T = 5.052 m2/day
S = 0.001478
Kz/Kr = 1.
b = 1. m


Displacement (m)
20.
16.
12.
8.
4.
0.
1.
10.
100.
1000.
Adjusted Time (min)
Obs. Wells
MBH7
Aquifer Model
Confined
Solution
Cooper-Jacob
Parameters
T = 2.245 m2/day
S = 0.0001506


Residual Drawdown (m)
20.
16.
12.
8.
4.
0.
1.
10.
100.
1000.
Time, t/t'
Obs. Wells
MHB7
Aquifer Model
Confined
Solution
Theis (Recovery)
Parameters
T = 2.475 m2/day
S/S' = 1.321

APPENDIX 5-2: RAPID ECOLOGICAL BASELINE STATUS VERIFICATION REPORT

Rapid Ecological Baseline Status Verification

2023

For

ABS

AVESORO MINING INC.

Bea Mountain Mining Corporation

Prepared by

Enviro-Insight CC

Alex Rebelo

Samuel Laurence

info@enviro-insight.co.za

TABLE OF CONTENTS

1 Introduction....4

1.1.1 Previous and Current survey....4

1.1.2 Upper Guinean forests....4

1.1.3 Timing and Location of the Survey....4

1.1.4 Definitions of Study Area / Area of Influence....5

1.2 Terms of reference....7

1.2.1 Outputs and deliverables....7

1.3 Assumptions and limitations....7

1.4 Project team....8

2 Methods....8

2.1 NDVI Analysis....8

2.2 Groundtruthing Analysis....8

2.1 A Note on Species of Conservation Concern (SCC)....9

3 Results....9

3.1 Matambo....9

3.1.1 Species of Conservation Concern....9

3.1.2 NDVI Analysis....9

4 Critical Habitat Assessment....12

4.1 Trigger Descriptions....12

4.1.1 Criterion 1....12

4.1.2 Criterion 2....15

4.1.3 Criterion 3....16

4.1.4 Criterion 4....17

4.1.5 Criterion 5....17

4.1.6 Exploration Area summary of critical habitat....18

5 Conclusion....20

LIST OF FIGURES

Figure 1: African forest zones reproduced according to Poorter et al. 2004 5

Figure 2: Spatial context of the study area and Exploration Areas showing the topography 6

Figure 5. Change in NDVI for the Matambo site (S2_SR/20230227T110011_-20230227T111853_T29NKH).....10

Figure 6. Most recent cloudless Sentinel 2 imagery for the Matambo site (S2_SR/20230227T110011_-20230227T111853_T29NKH). 11

Figure 7. Updated Critical habitat for the Matambo Exploration Area. 20

LIST OF TABLES

Table 1: Team members and contributions to this project 8

Table 2. IFC PS6 triggers and relevant habitats for the and Matambo Concession 18

1 INTRODUCTION

1.1.1 Previous and Current survey

Enviro-Insight has completed surveys over 10 years within the Mining Development Area (MDA) and delivered 19 previous reports. This rapid baseline verification incorporates data obtained from the previous 2021 surveys. However, significant developments from the Company (Avesoro) as well as significant current impacts unrelated to the development (in migration of artisanal miners) took place in the years between 2017/2018 and 2021. Thus, the baseline is a highly complex comparative verification of conditions within the MDA, although significantly accurate conclusions and predictions can be generated given the understanding of the survey over a long period of time. Due to an acceleration in development activities, the Company has requested Enviro-Insight CC (hereafter referred to as Enviro-Insight) to undertake a rapid verification in order to subsequently formulate the Environmental Impact Assessment (EIA) of the Company's Matombo Area, so that "key biodiversity values" can be identified in accordance with the Equator Principles lender criteria for natural and critical habitat in accordance with a future Impact Analysis.

1.1.2 Upper Guinean forests

The Upper Guinean Forests (UGF) extends from Senegal to Togo and are regarded as one of the biodiversity hotspots of the world. Woodland savanna stretching from the Sahel to the Gulf of Guinea, known as the Dahomey Gap, separates the UGF from the rest of the African forests (Figure 1) and consequently, the UGF have a high degree of plant and animal endemism (Poorter et al., 2004).

1.1.3 Timing and Location of the Survey

This assessment was conducted over two-season (wet and dry) in 2021 in order to inform and guide the development of the gold resources within targeted areas within the Avesoro MDA, Grand Cape Mount Country, Liberia. The resource deposits have been split into distinct study areas namely Gondaja, Leopard Rock, Matambo, Silver Hills and Weaju and West Mafa as well as a haul road from Matambo to NLGM. The Matambo concession was the target of this survey.

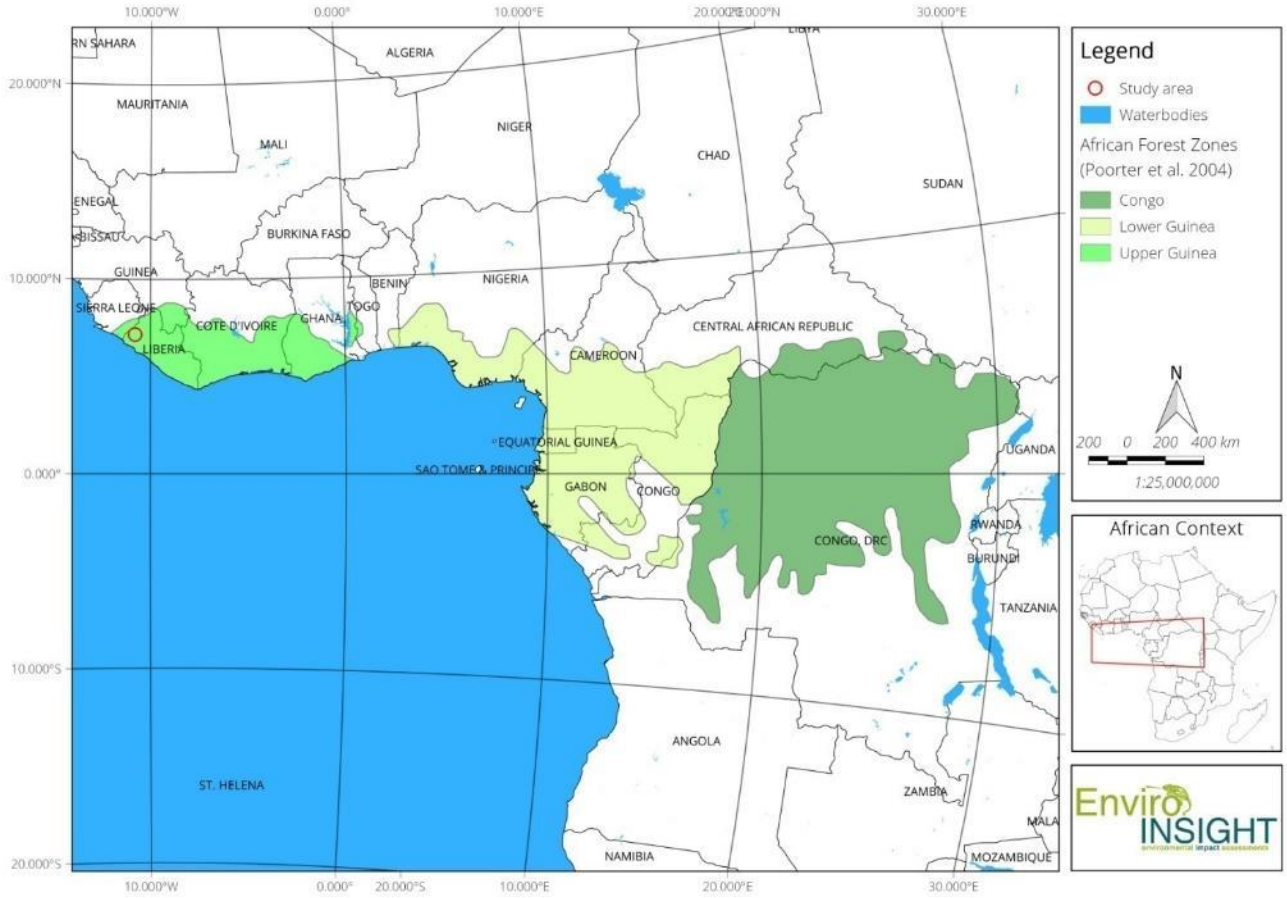


Figure 1: African forest zones reproduced according to Poorter et al. 2004

Guinean Moist Forest (analogous to UGF), one of the World Wide Fund for Nature's (WWF) *Global 200* Ecoregions, which represents 238 global Ecoregions selected for their "exceptional levels of biodiversity, such as high species richness or endemism, or those with unusual ecological or evolutionary phenomena" (WWF, 2016). The sub-sections below highlight the importance and rarity of the local biodiversity of the region on a global scale.

1.1.4 Definitions of Study Area / Area of Influence

The BMMC MDA refers to the Mining Development Area which covers all areas that the BMMC has mining rights and is termed the study area. Within the MDA, the Matambo Pit and other Exploration Areas were assessed for significant changes since the 2021 survey and can be viewed within Figure 2..

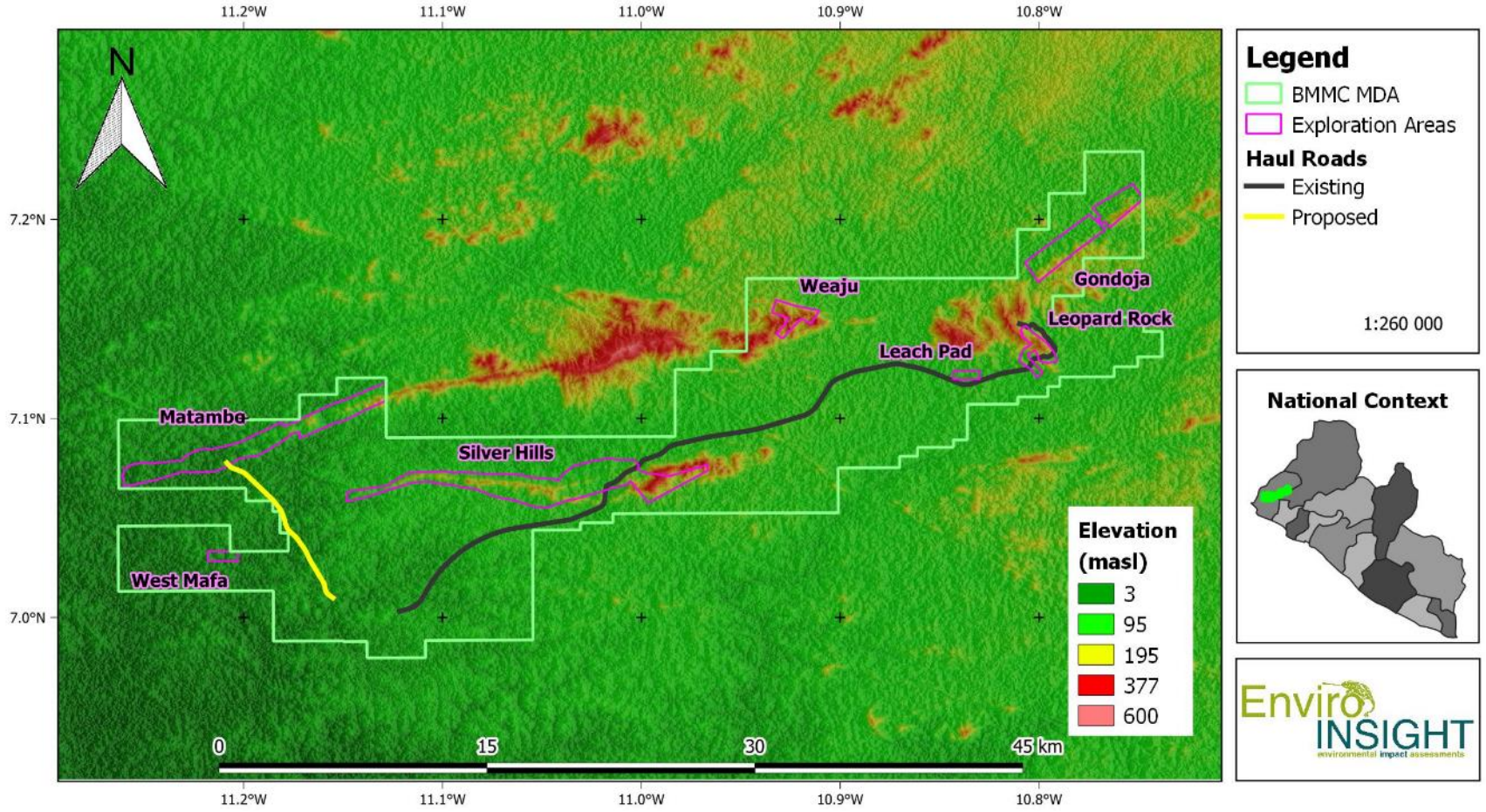


Figure 2: Spatial context of the study area and Exploration Areas showing the topography

1.2 TERMS OF REFERENCE

1.2.1 Outputs and deliverables

Key outputs and deliverables for this study:

1. Assess significant structural, ecological and disturbance level changes within the Matambo exploration and pit areas.
2. Report on updates and conclusions regarding species of conservation concern (SCC) and provide updated accounts of their presence on-site, the availability of suitable habitat in the wider landscape, gaps in information etc.
3. Map of natural/ modified habitat and Critical Habitat.
4. Make recommendations regarding any updated studies needed before an Impact Assessment can take place.

1.3 ASSUMPTIONS AND LIMITATIONS

- It is assumed that all third-party information obtained (e.g. spatial data) and discussed is correct at the time of writing this report;
- Many animals occur at naturally low densities and are cryptic and very difficult to detect, especially predatory animals and animals that are subjected to intensive hunting pressure. This makes it highly unlikely that all species occurring in a region will be detected during a short survey, such as the current study. Therefore, the current survey provides only a number of ecological “snapshots” of the faunal and floral communities present and are by no means exhaustive;
- Satellite imagery used to delineate habitats was limited to the best freely available Sentinel 2, which is limited to a 10 m resolution. The imagery could not accurately distinguish among some habitat types, such as late-stage secondary forest, mature forests, riparian and swamp vegetation.
- Suitable satellite imagery could not be obtained for a similar seasonality in 2021 due to the frequency and coverage of cloud-cover in the region. Thus the change in NDVI includes the construction of the New Liberty Haul Road, which was already present at the time of the baseline study.
- Similarly, no recent cloudless imagery could be found for later in the 2023 period, resulting in the opportunity for some recent land cover changes observed during the October 2023 being excluded from the analysis.
- There are major limitations regarding the available literature on the flora & fauna of West Africa, specifically regarding the geographic distributions of species, which reduces the confidence of predictions of species occurrence within the Exploration Area; and

1.4 PROJECT TEAM

Enviro-Insight put together a team of highly qualified ecology specialists and assistants for this project (Table 1).

Table 1: Team members and contributions to this project

Team Member	Specialty	Years of Experience
Samuel Laurence	Zoology, Ecology, Fieldwork, Author	16
Alex Rebelo	GIS	6

2 METHODS

2.1 NDVI ANALYSIS

Sentinel-2 MSI: MultiSpectral Instrument, Level-2A imagery (European Space Agency; https://scihub.copernicus.eu) was browsed for the Matambo area of interest and for the 2020-2021 and 2023 period using Google Earth Engine[1]. Sentinel 2 imagery offers regularly updated collections of satellite imagery with multispectral components at a 10-30 m resolution. Cloudless S2 imagery from similar seasons was best matched for 8th February 2020 (S2_SR/20200208T110119_20200208T110845_T29NKH) and the 27th February 2023 (S2_SR/20230227T110011_-20230227T111853_T29NKH), with very few other dates with no cloud-cover. The Normalised Difference Vegetation Index (NDVI) was derived from the Sentinel 2 imagery using the following calculation, where NIR is the near-infrared spectrum:

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

The Sentinel 2 imagery were scrutinised, and areas were selected that had undergone no discernible change from natural forest, these polygons were used to derive a corrected NDVI for more the 2023 NDVI raster, multiplying by the average NDVI in these 'no-change' areas for the 2020 NDVI raster and dividing by the same for the 2023 NDVI raster using R[2]. The change in NDVI between these periods was calculated by subtracting cell values for the corrected 2020 NDVI raster from the corrected 2023 NDVI raster.

2.2 GROUNDTRUTHING ANALYSIS

In October 2023, a rapid ground-truthing assessment was undertaken by a specialist ecologist to document via drone photography, rapid analysis and comparative assessment with the previous surveys, any change in ecology, disturbance and current impacts that would serve to undermine the confidence int eh NDVI analysis or the subsequent EIA document to be produced for the Matambo concession.

[1] https://earthengine.google.com/
[2] https://www.r-project.org/

2.1 A NOTE ON SPECIES OF CONSERVATION CONCERN (SCC)

The MDA is characterised by many SCC which may or may not warrant special attention as part of the Rapid Assessment Description. Therefore, as each site is addressed separately, all presence/ absence data from the previous surveys in relation to the updated IUCN Red List with subsequent conclusions being reserved for ecological situations which warranted further elaboration and explanations of impacts on SCC.

3 RESULTS

3.1 MATAMBO

3.1.1 Species of Conservation Concern

Of all the biodiversity disciplines, only mammals needed to be assessed in the rapid assessment.

3.1.1.1 Mammal Species of Conservation Concern

Since the previous surveys, White-bellied Pangolin *Phataginus tricuspis* has been reassessed to IUCN Endangered status and was recorded during the survey. In addition, Diana Monkey (*Cercopithecus diana*) and the King Colobus Monkey (*Colobus polykomos)*, both of which are predicted to occur within the exploration area of the concession, have been reassessed to IUCN Endangered status The implications are discussed below in the Critical Habitat Assessment section below. The total changes in Species of Conservation Concern are expressed in Appendix 1.

3.1.2 NDVI Analysis

Matambo shows some minor changes in NDVI, with some expansions in earth movement activity around the Bangoma Mine, an extensive new network of roads in the west and various patches of secondary forest being slashed and burnt for the ongoing local agricultural cycles in the lowlands. Note the river shows up as a loss in NDVI, but this is due to natural river processes/artefacts related to water reflectance rather than removal of riparian vegetation. The natural forest remaining predominantly on the hilly regions has remained seemingly unchanged (Figure 3; Figure 4).

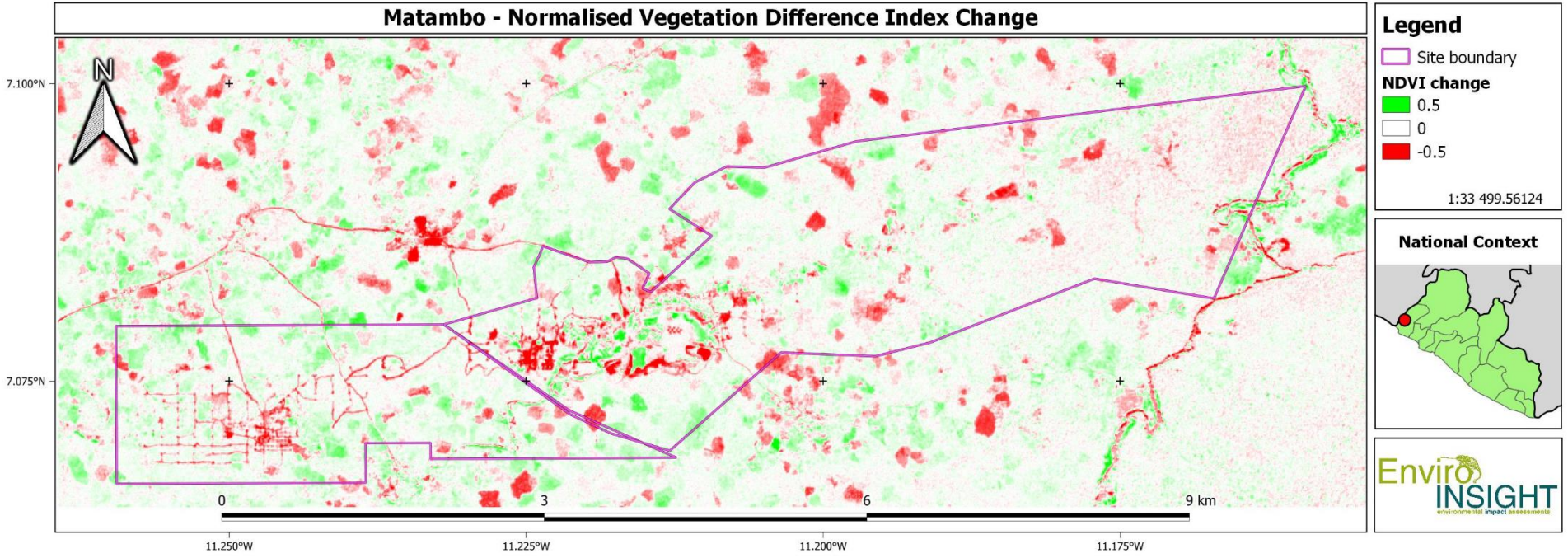


Figure 3. Change in NDVI for the Matambo site (S2_SR/20230227T110011_-20230227T111853_T29NKH).

Mobile: Sam - 072 437 1742
Mobile: Luke - 083 784 1997
Email: info@enviro-insight.co.za
Website: www.enviro-insight.co.za

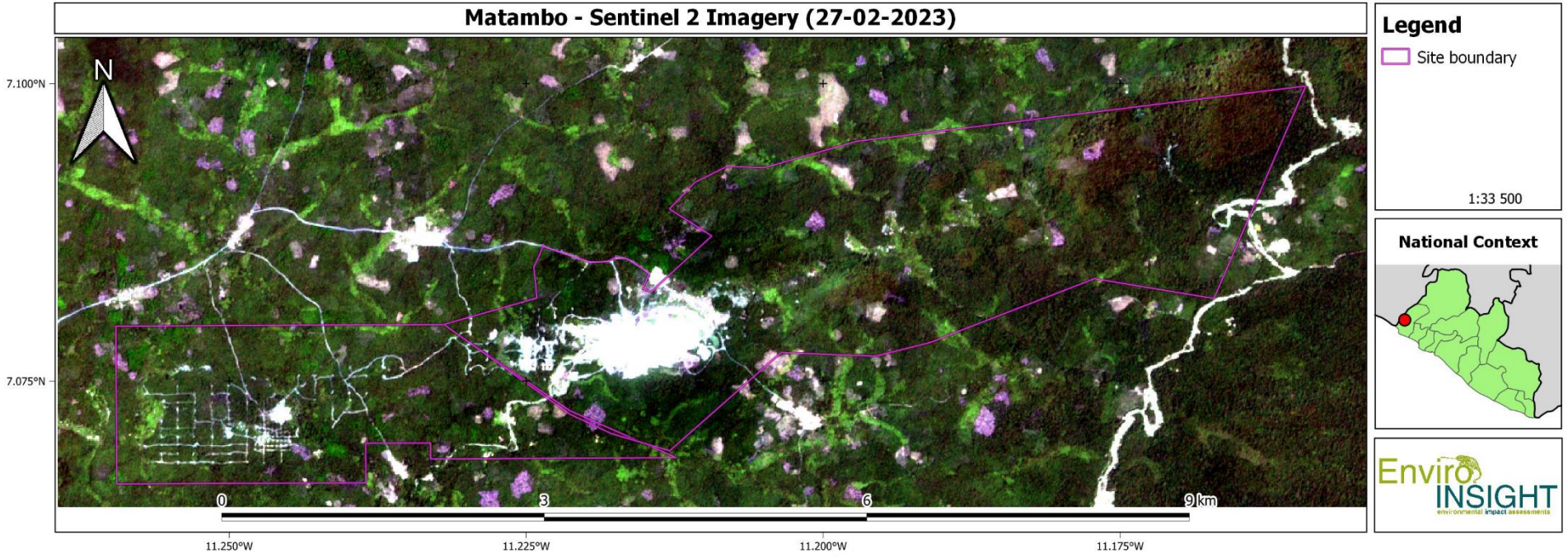


Figure 4. Most recent cloudless Sentinel 2 imagery for the Matambo site (S2_SR/20230227T110011_-20230227T111853_T29NKH).

4 CRITICAL HABITAT ASSESSMENT

4.1 TRIGGER DESCRIPTIONS

4.1.1 Criterion 1.

Habitat of significant importance to Critically Endangered and/or Endangered (IUCN 2023) species;

Thresholds for CH Criterion 1

- Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (= 0.5 % of the global population AND = 5 reproductive units of a CR or EN species).
- Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a) above.
- As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.

4.1.1.1.1 Flora

Several species are listed as Vulnerable (Table 3) but none of them trigger Criterion 1 which indicates that the loss of habitat would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a). Accordingly, CH for Criterion 1 is not triggered by any of the IUCN Vulnerable flora species.

***Placodiscus pseudostipularis* – EN**

The species has been assessed by the IUCN as EN B1+2c (Hawthorne, 1998a), and thus is a Critical Habitat-qualifying species. The proportion of the global population present in the study area is impossible to determine without very comprehensive coverage of all HF and LF habitats. The previous survey applied the precautionary principle since we cannot determine whether the population in study area has densities representing ≥ 0.5% of the global population and ≥ 5 reproductive units (GN72 threshold a). Therefore, the presence of this population of Endangered species qualifies HF and LF, but not SPFT, ARF or ASV as Critical Habitat.

4.1.1.1.2 Herpetofauna

Two relevant species, namely the rhinoceros viper (*Bitis nasicornis* upgraded to IUCN Vulnerable) and the Central African Rock Python (upgraded to Near Threatened) showed a reassessment to a higher Red List Category. However, and as in 2021, None of the VU species trigger criterion 1 because the loss of populations within all Exploration Areas is unlikely to result in these species being uplisted to EN or CR.

***Sclerophrys taiensis* (Tai Toad) – EN**

Although this species was not recorded at any Exploration Area, it is known to be extremely rare/shy (Rödel & Ernst 2000) and given that it is in close proximity to its known range (30-40 km) the precautionary approach is followed. The total area of all Exploration Areas adds up to 0.63 % of the IUCN species range and this qualifies for criterion 1 (> 0.5 % of global range). Although the concession fall outside the known range of the species, the IUCN range map is expected to overestimate the actual size of the suitable habitats for this species. All intact primary Lowland Forest is therefore triggered as critical habitat.

***Kinixys homeana* (Home's Hinged Tortoise) – CR**

This tortoise is listed by the IUCN as CR due to a rapid decline in forest habitat as well as hunting pressure, despite its large geographic distribution (Luiselli *et al.* 2021). Because extensive loss of primary forest has considerably reduced the available suitable habitat of this species, the Global Land Analysis and Discovery (GLAD) treecover2000 dataset (Hansen *et al.* 2013) was used (100 m resolution) to estimate the proportion of the known geographic range of this species that still contains suitable forested habitat. Primary forest was classified as all vegetation taller than 5m in height that had a canopy closure of 60% or more. The remaining forest habitat across all Exploration Areas, as a proportion of forest habitat within the geographic range of this species, is estimated at 0.032 % and therefore falls well below the 0.5 % threshold. However, due to the vast extent of suitable forest habitat within the concession (outside of the development area) continued deforestation in West Africa since 2000 and the constantly increasing pressure from hunting for bushmeat that causes population declines (even in primary forest), the Precautionary Approach is followed and therefore *K. homeana* is considered as a trigger for Criterion 1.

***Kinixys erosa* (Forest Hinged Tortoise) – EN**

This tortoise faces a very similar situation to *Kinixys homeana* but has a more extensive distribution extending into central Africa (Luiselli & Diagne 2015). The proportion of the combined area of all Exploration Areas to the species range (Rhodin *et al.* 2021), and considering only primary forest, is expected to be only ~ 0.002 %, far from the 0.5 % threshold due to its extensive distribution in Central Africa. We do **not** consider this species to trigger criterion 1. Nevertheless, the habitat of this species will likely be triggered as Critical Habitat by other forest-dependent species.

***Mecistops cataphractus* (West African Slender-snouted Crocodile) – CR**

The populations of this species are poorly known throughout its range and even recent presence data is lacking for many countries, including Liberia. It is not possible to use geographic range size to assess the threshold for this species with regards to the proportion of the population within Exploration Areas. This is because the Slender-snouted Crocodiles inhabit linear river systems, have specific habitat requirements along river, and are thought to be widely extirpated/ in decline across much of the range. Therefore, such calculations would be meaningless. Due to the dire situation of this species in the Upper Guinea ecoregion, tentative evidence for its presence in the concession and because patches of

intact forested rivers remain in the area and form a forest corridor to the Gola and Lofa-Mano National Park, we apply the Precautionary Principle and conclude that Criteria 1 is triggered. All medium to large streams/rivers and natural lakes with sections of intact forested banks are triggered as critical habitat.

4.1.1.1.1 Avifauna

The avifauna of conservation importance in Liberia is fairly well documented. Numerous avifauna species were identified mainly within the High Wet Evergreen Forest which is thought to be of conservation concern with only one species requires discussion in regard to its ability to Trigger Criterion 1.

- Criterion 1 - *Psittacus timneh* (Timneh Parrot) is listed as Endangered (IUCN 2022) and has been observed on multiple occasions within the PAOI . The species was sighted during the baseline ecological assessment in Azonal Riverine Forest while Tall // Short Forest Mosaic habitat within the concession provide suitable habitat. The concession does not however account for more than 0.5 % of the global population as it has an extensive distribution in West Africa and population numbers are estimated to be between 100,000 – 500, 000 (IUCN 2019). Multiple sightings were recorded over the 2021 survey period although only a few individuals were sighted which accounts for less than 0.5 % of the global population. It is however possible that > 5 reproductive units occur in the PAOI. This species therefore does not trigger Criterion 1.

4.1.1.1.1 Mammals

The mammals of conservation importance in Liberia are fairly well documented. However, crucial data, especially required for the evaluation of Critical Habitats, are often either outdated, contradictory between known sources or completely absent. Examples of such data requirements include densities of relevant species, distribution, migratory patterns and localized risks (to species) as well as factors driving the dynamics of a particular population. Nevertheless, using the existing data sets for the country and the Upper Guinea Forest (UGF) as well as the data acquired from the 2021 surveys for Criterion 1 are shown below.

- Criterion 1 - The West African Chimpanzee (*Pan troglodytes verus*) was observed across a wide distribution within eh MDA. A recent study estimated a population decline of 80% for this species and a range reduction of 20% within 24 years (Kühl *et al*. 2017); accordingly, *Pan troglodytes verus* were uplisted to Critically Endangered by the IUCN Red List of Threatened Species (Humle *et al.* 2016). It is estimated that the total abundance of *Pan troglodytes verus* is 52 811 with the highest numbers in Guinea, Liberia and Sierra Leone (Heinicke *et al*. 2019). Accordingly, in order to trigger the 0.5% of the global population for Criterion 1 the abundance of *Pan troglodytes verus* in the PAOI should be 280 or more. Limited population data for this species is available for the PAOI as this species is extremely difficult to sample quantitatively. However, according to GN73 (IFC 2019) "*special consideration should be given to great apes… Any area where there are great apes is likely to be treated as critical habitat*." Based on GN73 and the rapid decline in population numbers, a precautionary measure is taken, and High Wet Evergreen and Tall Wet Evergreen Forest are triggered as CH for this species in the Matambo Concession only.

The Endangered Pygmy Hippopotamus (*Choeropsis liberiensis*) was observed at various locations within the concession but is mainly confined to the two large perennial river systems namely the Yambasei and Lofa Rivers. The Mafa still may provide habitat for some individuals which therefore influences the Matambo Concession only. As a shy species, no quantitative data regarding densities of hippopotamus can be applied to the Matambo concession and this is compounded by the fact that very few meaningful studies have been conducted on the species. Based on a precautionary approach, it is expected that the PAOI hosts more than 0.5% of the global population and more than 5 reproductive units (IFC 2019) of this species within the three large perennial river systems. Accordingly, the presence of this species in these densities across the Yambasei, Lofa and possibly the Mafa Rivers within the Matambo Concession thus trigger Criterion 1.

Both Jentink's Duiker (*Cephalophus jentinki*) and Red-Colobus Monkey (*Piliocolobus badius*) are listed as Endangered but were not recorded in the concession. *C. jentinki* has a moderate probability of occurrence in the concession whereas *P. badius* has a high probability to occur in Matambo only. Since neither species were recorded and population numbers in the concession, it is still unknown (if they do occur here), these species do not trigger Criterion 1 thresholds of more than 0.5% of the global population and more than 5 reproductive units (IFC 2019). Both these species do not trigger Criterion 1 for CH. The upgrading of King Colobus, Diana Monkey and Long Tailed Pangolin to IUCN Endangered further solidify the delineated Critical Habitat within the Matambo Concession.

4.1.2 Criterion 2.

Habitat of significant importance to endemic and/or restricted-range species;

Threshold for CH Criterion 2

Areas that regularly hold = 10 % of the global population size AND = 10 reproductive units of a species.

4.1.2.1.1 Flora

The study area is located within a known floristic centre of endemism, defined by White (1983) as the Upper Guinea subcentre of the Guinea Congolian Regional Centre of Endemism. This is similar to the concept of the Upper Guinea Forests terrestrial ecoregion. The Upper Guinean Forests contain an estimated 2 800 vascular plant species, of which 650 species (c. 23%) are endemic (Poorter et al., 2004). However, given the large size of the UGF ecoregion, there are few endemics that have EOOs of less than 50 000 km^2 which is the upper threshold for classicisation as restricted-range species (IFC, 2012). Most of the species that do qualify as restricted-range are confined to montane areas such as Mt Nimba on the Guinea border. No restricted-range species were located in the study area, although one species comes relatively close to this threshold, namely *Psychotria micheliae* (J.-G.Adam) Jongkind & W.D. Hawth. This small dwarf shrublet of the forest understory is endemic to Liberia and has an approximate EOO of 65 000 km^2 (based on records

in the Global Biodiversity Information Facility). It was located at numerous localities in HF and LF in several Exploration Areas but was absent from disturbed forest.

Jasminum sp. nov. was recorded by Dr. Carel Jongkind and Gordon Sambolah in 2014 (TESA 2014) which must be assessed under Criterion 2. This species is currently still new to science (undescribed) and the only known individual occurs in the NLGM PAOI. It is therefore considered to be restricted to the micro habitat (which is unknown as no geographical location was provided in TESA 2014) in which it was found. Following the precautionary principle, this species is included here as an endemic species for the PAOI and therefore triggers CH for Criterion 2 in Matambo, as other known localities and population numbers are unknown at present.

4.1.2.1.2 Herpetofauna

Of the range restricted/endemic herpetofauna species (including any VU/NT/DD species), none had a proportion of distribution range that exceeded 10 % that falls within the combined area of the concession areas (~5000 ha). This proportion ranged from between 0.05 and 0.002 %, and still remained below the threshold even when only intact forest habitat was considered (where relevant). Therefore, criterion 2 was not triggered for any of these species.

4.1.2.1.3 Avifauna

Criterion 2 - Eleven bird species expected to occur within the concession of which nine species were recorded, are UGF endemic species. The concession populations do not represent more than 10 % of the global population size for any of these species when using the proportion of the global geographic distribution within the PAOI as a proxy for population proportion[3], since actual population data is not readily available for all species. Accordingly, none of the species trigger CH under this criterion.

4.1.2.1.4 Mammals

Of the range restricted/endemic mammal species (including any VU/NT/DD species), none had a proportion of distribution range that exceeded 10 % that falls within the area of the Exploration Areas (~5000 ha). This proportion ranged from between 0.05 and 0.002 %, and still remained below the threshold even when only intact forest habitat was considered (where relevant). Therefore, criterion 2 was not triggered for any of these species

4.1.3 Criterion 3.

Habitat supporting globally significant concentrations of migratory species and/or congregatory species.

4.1.3.1.1 Herpetofauna

[3] Although this assumes an even density distribution across the entire geographic range of the species which is not true, it is nevertheless applicable given that the expected geographical distributions are very large in extent and therefore less prone to error when inferring population size in the manner.

No congregatory or migratory species are expected within any of the Exploration Areas.

4.1.3.1.2 Avifauna

No congregatory or migratory species are expected within any of the Exploration Areas.

4.1.3.1.3 Mammals

No congregatory or migratory species are expected within any of the Exploration Areas

4.1.4 Criterion 4.

Highly threatened and/or unique ecosystems.

This criterion is not triggered because none of the ecosystems in the concession have been assessed as either highly threatened or unique. The concession is not located in an IUCN Red List Ecosystem and does not trigger either of the GN80 thresholds (IFC 2019). Caution should be exercised when interpreting the above since the IUCN has not completed the assessment for African ecosystems. Nevertheless, the large extent of the UGF and the lack of unique/endemic species to western Liberia strongly suggest that none of the ecosystems on this region would qualify for this criterion.

4.1.5 Criterion 5.

Areas associated with key evolutionary processes.

The UGF region has played an important role in the speciation of West African forest endemics. However, this region is vast in comparison to the spatial scope of the project. Key evolutionary processes and therefore not be negatively impacted by the project activities.

4.1.6 Exploration Area summary of critical habitat

The updated table of trigger species/triggers and presence in the Matambo concession is shown in Table 2.

Table 2. IFC PS6 triggers and relevant habitats for the and Matambo Concession

Trigger Species	IFC PS6 CH criterion	Habitat/s	Matambo
Flora			
Placodiscus pseudostipularis	1	Hillslope Forest, Lowland Forest	x
Herpetofauna			
Sclerophrys taiensis	1	Lowland Forest	x
Kinixys homeana	1	Hillslope Forest, Lowland Forest	x
Mecistops cataphractus	1	Forested Rivers and Streams (medium-large) buffered 30-100 m (based on 2017 RSPO guidelines[4])	x
Avifauna			
Psittacus timneh (Timneh's Parrot)	1	Hillslope Forest, Lowland Forest, Swamps (not mappable).	x[5]

[4] waterbodies: 100 m; <5 m wide streams: 30 m; 3-10 m wide rivers: 70 m; >10 m wide rivers: 200 m.
[5] seen on other side of Yambessi River

Trigger Species	IFC PS6 CH criterion	Habitat/s	Matambo
Mammals			
Pan troglodytes verus (West African Chimpanzee)	1	Hillslope Forest and Lowland Forest (following mitigation)	x[6]
Choeropsis liberiensis (Pygmy Hippopotamus)	1	Forested Rivers and Streams (medium-large) buffered 30-100 m (based on 2017 RSPO guidelines[7])	[8]
Piliocolobus badius (Upper Guinea Red Colobus)	1	Hillslope Forest, Lowland Forest?	[9]
Colobus polykomos	1	Hillslope Forest, Lowland Forest?	x
Phataginus tricuspis	1	Hillslope Forest, Lowland Forest, Swamp Forest	x
Cercopithecus diana	1	Hillslope Forest, Lowland Forest?	x
Loxodonta cyclotis	1	Lowland Forest, Swamp Forest	

[6] but only seen across the river
[7] waterbodies: 100 m; <5 m wide streams: 30 m; 3-10 m wide rivers: 70 m; >10 m wide rivers: 200 m.
[8] previously present, but not expected currently
[9] previously present, but not expected currently

The updated Critical Habitat Delineations are shown as Figure 5 and **Error! Reference source not found.**.

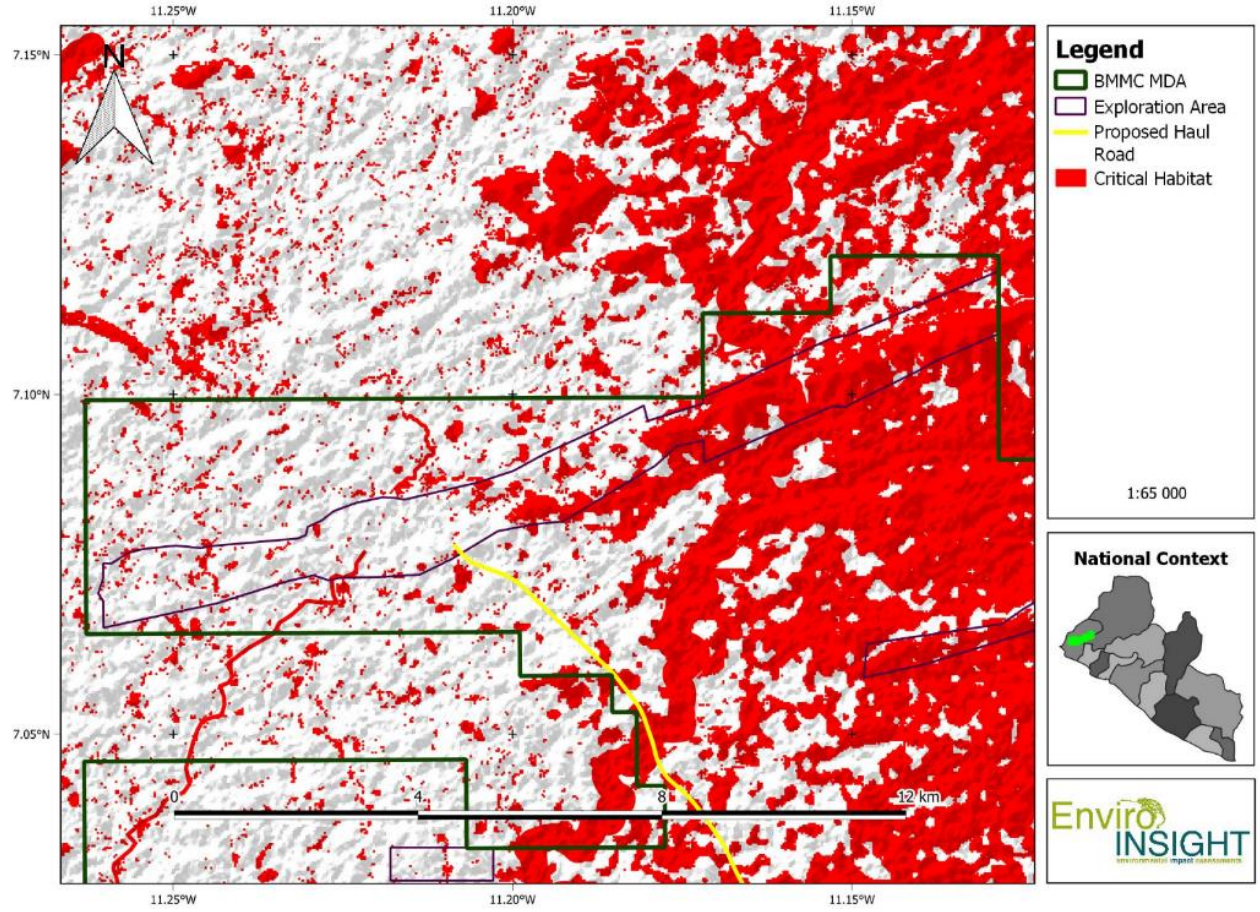


Figure 5. Updated Critical habitat for the Matambo Exploration Area.

5 CONCLUSION

There have been overall losses in vegetation cover as indicated by the NDVI change analysis but not to the extent which requires a new baseline survey to be conducted. Matambo shows a considerable construction of road network in the west and expansion of existing mining areas, but that the intact hilly forests has remained mostly unchanged.

Overall, the professional opinion from the rapid survey suggests that an EIA document can be generated with a high degree of confidence for the Matambo concession.

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APPENDIX 1

Group	Scientific Name	IUCN Status (E-I baseline 2021)	Redlist Category (have3)	Year Published	Assessment Date	Status CHANGED
Amphibians	*Leptopelis macrotis*	NT	NT	2014	2012-06-01 00:00:00 UTC	no
Amphibians	*Leptopelis occidentalis*	NT	NT	2014	2012-06-01 00:00:00 UTC	no
Amphibians	*Sclerophrys taiensis*	EN	EN	2020	2012-06-03 00:00:00 UTC	no
Avifauna	*Agelastes meleagrides*	VU	VU	2021	2021-01-05 00:00:00 UTC	no
Avifauna	*Bathmocercus cerviniventris*	DD	DD	2018	2018-08-09 00:00:00 UTC	no
Avifauna	*Bleda eximius*	NT	NT	2018	2018-08-10 00:00:00 UTC	no
Avifauna	*Bycanistes cylindricus*	VU	VU	2018	2018-08-10 00:00:00 UTC	no
Avifauna	*Ceratogymna elata*	VU	VU	2016	2016-10-01 00:00:00 UTC	no
Avifauna	*Criniger olivaceus*	VU	VU	2020	2020-05-07 00:00:00 UTC	no
Avifauna	*Hylopsar cupreocauda*	NT	NT	2021	2020-12-08 00:00:00 UTC	no
Avifauna	*Illadopsis rufescens*	NT	NT	2018	2018-08-09 00:00:00 UTC	no

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Avifauna	*Lobotos lobatus*	VU	VU	2018	2018-08-07 00:00:00 UTC	no
Avifauna	*Malaconotus lagdeni*	NT	NT	2021	2020-12-08 00:00:00 UTC	no
Avifauna	*Merops mentalis*	NT	NT	2021	2021-01-04 00:00:00 UTC	no
Avifauna	*Parmoptila rubrifrons*	NT	NT	2018	2018-08-09 00:00:00 UTC	no
Avifauna	*Picathartes gymnocephalus*	VU	VU	2018	2018-08-07 00:00:00 UTC	no
Avifauna	*Psittacus timneh*	EN	EN	2021	2020-04-02 00:00:00 UTC	no
Avifauna	*Stephanoaetus coronatus*	NT	NT	2018	2018-08-07 00:00:00 UTC	no
Mammals	*Anomaluru pelii*	DD	LC	2021		yes
Mammals	*Aonyx capensis*	NT	NT	2021	2020-01-31 00:00:00 UTC	no
Mammals	*Caracal aurata*	VU	VU	2015	2014-04-20 00:00:00 UTC	no
Mammals	*Cephalophus dorsalis*	NT	NT	2020	2016-01-07 00:00:00 UTC	no
Mammals	*Cephalophus jentinki*	EN	EN	2016	2016-01-07 00:00:00 UTC	no
Mammals	*Cephalophus silvicultor*	NT	NT	2016	2016-01-07 00:00:00 UTC	no
Mammals	*Cephalophus zebra*	VU	VU	2016	2016-01-07 00:00:00 UTC	no
Mammals	*Cercocebus atys*	VU	VU	2020	2019-06-01 00:00:00 UTC	no

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Mammals	*Cercopithecus diana*	VU	EN	2019	2019-03-20 00:00:00 UTC	yes
Mammals	*Choeropsis liberiensis*	EN	EN	2015	2015-02-23 00:00:00 UTC	no
Mammals	*Colobus polykomos*	VU	EN	2020	2019-06-25 00:00:00 UTC	yes
Mammals	*Crocidura buettikoferi*	LC	LC			no
Mammals	*Crocidura grandiceps*	NT	NT	2008	2008-06-30 00:00:00 UTC	no
Mammals	*Crocidura nimbae*	NT	NT	2008	2008-06-30 00:00:00 UTC	no
Mammals	*Genetta bourloni*	VU	VU	2015	2015-02-28 00:00:00 UTC	no
Mammals	*Genetta johnstoni*	NT	NT	2016	2015-02-28 00:00:00 UTC	no
Mammals	*Genetta poensis*	DD	DD	2015	2015-04-20 00:00:00 UTC	no
Mammals	*Grammomys buntingi*	DD	DD	2019	2018-06-20 00:00:00 UTC	no
Mammals	*Graphiurus crassicaudatus*	DD	DD	2016	2016-07-27 00:00:00 UTC	no
Mammals	*Heliosciurus punctatus*	DD	DD	2016	2016-06-03 00:00:00 UTC	no
Mammals	*Kerivoula cuprosa*	DD	DD	2019	2018-08-31 00:00:00 UTC	no
Mammals	*Loxodonta cyclotis*	CR	CR	2021	2020-11-13 00:00:00 UTC	no
Mammals	*Pan troglodytes*	EN	EN	2016	2016-03-24 00:00:00 UTC	no

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Mammals	*Panthera pardus*	NT	VU	2020	2015-07-11 00:00:00 UTC	yes
Mammals	*Phataginus tetradactyla*	VU	VU	2019	2019-05-08 00:00:00 UTC	no
Mammals	*Phataginus tricuspis*	VU	EN	2019	2019-05-08 00:00:00 UTC	yes
Mammals	*Piliocolobus badius*	EN	EN	2020	2020-01-27 00:00:00 UTC	no
Mammals	*Procolobus verus*	NT	VU	2020	2018-12-27 00:00:00 UTC	yes
Mammals	*Protoxerus aubinnii*	NT	NT	2020	2016-06-03 00:00:00 UTC	no
Mammals	*Smutsia gigantea*	VU	EN	2019	2019-05-02 00:00:00 UTC	yes
Mammals	*Syncerus caffer*	VU	NT	2019	2018-02-24 00:00:00 UTC	yes
Mammals	*Tragelaphus eurycerus*	NT	NT	2016	2016-07-07 00:00:00 UTC	no
Plants	*Albizia ferruginea*	NT	NT	2021	2020-01-30 00:00:00 UTC	no
Plants	*Amanoa bracteosa*	VU	LC	2022		yes
Plants	*Anopyxis klaineana*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Aphanocalyx microphyllus*	VU	LC	2019		yes
Plants	*Apodiscus chevalieri*	EN	EN	2019	2019-01-30 00:00:00 UTC	no
Plants	*Aulacocalyx divergens*	VU	VU	2021	2019-11-21 00:00:00 UTC	no
Plants	*Berlinia occidentalis*	VU	VU	1998	1998-01-01 00:00:00 UTC	no

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Plants	*Brachystegia leonensis*	VU	VU	2019	2019-01-23 00:00:00 UTC	no
Plants	*Campylospermum amplectens*	VU	VU	2017	1998-01-01 00:00:00 UTC	no
Plants	*Cavacoa baldwinii*	NT	NT	2020	2019-12-11 00:00:00 UTC	no
Plants	*Coffea humilis*	NT	NT	2017	2017-07-14 00:00:00 UTC	no
Plants	*Cola buntingii*	NT	NT	2019	2018-07-31 00:00:00 UTC	no
Plants	*Copaifera salikounda*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Crudia liberica*	CR	CR	2020	2020-06-08 00:00:00 UTC	no
Plants	*Cryptosepalum tetraphyllum*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Cynometra leonensis*	NT	NT	2021	2020-06-10 00:00:00 UTC	no
Plants	*Dactyladenia dinklagei*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Dactyladenia smeathmannii*	EN	EN	2019	2019-01-29 00:00:00 UTC	no
Plants	*Didelotia idae*	NT	NT	1998	1998-01-01 00:00:00 UTC	no
Plants	*Dracaena calocephala*	VU	VU	2019	2018-03-01 00:00:00 UTC	no
Plants	*Drypetes afzelii*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Entandrophragma angolense*	VU	NT	2021	2020-09-23 00:00:00 UTC	yes

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Plants	*Entandrophragma candollei*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Ficus pachyneura*	NT	NT	2020	2020-06-24 00:00:00 UTC	no
Plants	*Garcinia kola*	VU	VU	2004	2004-04-30 00:00:00 UTC	no
Plants	*Gilbertiodendron bilineatum*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Gilbertiodendron limba*	NT	NT	2012	2010-09-06 00:00:00 UTC	no
Plants	*Glenniea adamii*	VU	VU			no
Plants	*Guibourtia leonensis*	VU	VU	2019	2019-02-05 00:00:00 UTC	no
Plants	*Haplormosia monophylla*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Heritiera utilis*	VU	LC	2018		yes
Plants	*Homalium smythei*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Khaya ivorensis*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Leplaea adenopunctata*	EN	EN	2020	2020-08-05 00:00:00 UTC	no
Plants	*Leplaea cedrata*	VU	VU	2017	1998-01-01 00:00:00 UTC	no
Plants	*Lophira alata*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Milicia regia*	VU	VU	2020	2020-02-24 00:00:00 UTC	no
Plants	*Mitragyna ledermannii*	NT	NT	2021	2020-10-01 00:00:00 UTC	no

Plants	*Monocyclanthus vignei*	EN	EN	1998	1998-01-01 00:00:00 UTC	no
Plants	*Napoleonaea alata*	EN	EN	2019	2018-12-17 00:00:00 UTC	no
Plants	*Nauclea diderrichii*	NT	NT	2021	2020-10-08 00:00:00 UTC	no
Plants	*Neolemonniera clitandrifolia*	VU	VU	2019	2019-01-24 00:00:00 UTC	no
Plants	*Physacanthus nematosiphon*	NT	NT	2017	2017-02-28 00:00:00 UTC	no
Plants	*Placodiscus pseudostipularis*	EN	EN	1998	1998-01-01 00:00:00 UTC	no
Plants	*Terminalia ivorensis*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Tessmannia baikiaeoides*	VU	VU			no
Plants	*Tetraberlinia tubmaniana*	VU	VU	1998	1998-01-01 00:00:00 UTC	no
Plants	*Tieghemella heckelii*	EN	EN	1998	1998-01-01 00:00:00 UTC	no
Plants	*Trichoscypha bijuga*	NT	LC	2022		yes
Plants	*Trichoscypha linderi*	EN	EN	2020	2020-01-10 00:00:00 UTC	no
Plants	*Trichoscypha longifolia*	NT	NT	2019	2018-02-08 00:00:00 UTC	no
Plants	*Trichoscypha mannii*	VU	LC	2022		yes
Plants	*Xylopia dinklagei*	EN	EN	2019	2018-11-22 00:00:00 UTC	no
Reptiles	*Aparallactus lineatus*	NT	NT	2013	2012-07-16 00:00:00 UTC	no

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Reptiles	*Bitis nasicornis*	LC	VU	2021	2019-10-24 00:00:00 UTC	yes
Reptiles	*Cyclanorbis senegalensis*	VU	VU	2016	2016-05-20 00:00:00 UTC	no
Reptiles	*Kinixys erosa*	EN	EN	1996	1996-08-01 00:00:00 UTC	no
Reptiles	*Kinixys homeana*	CR	CR	2021	2019-02-13 00:00:00 UTC	no
Reptiles	*Mecistops cataphractus*	CR	CR	2014	2013-05-30 00:00:00 UTC	no
Reptiles	*Osteolaemus tetraspis*	VU	VU	1996	1996-08-01 00:00:00 UTC	no
Reptiles	*Python sebae*	LC	NT	2021	2019-10-24 00:00:00 UTC	yes
Reptiles	*Trionyx triunguis*	VU	VU	2017	2016-06-21 00:00:00 UTC	no

APPENDIX 5-3: AVIFAUNA SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS MATAMBO RESOURCE AREA

Likelihood (LOD): Confirmed (C), High (H), Moderate (M), Low (L). IUCN statuses: Critically Endangered (CR), Endangered (E), Vulnerable (V), Near-Threatened (NT).

Taxon	IUCN status	Habitat	Matambo	
			LOD	Rationale
Agelastes meleagrides	VU	Primary forest. Ecology poorly known. Population density is much lower in secondary forest. Waltert et al. (2010) show that it can occurs at high densities in areas of past disturbance and is not confined to unlogged primary forest. It has been reported in old secondary forest.	M	Suitable habitat although high levels of disturbance preclude viable populations
Bycanistes cylindricus	VU	Primary and mature secondary forest and lower densities around forest edges and farmbush but generally prefers undisturbed forest Occasionally inhabits plantations. Breeding dependent on the presence of large emergent trees and dead standing trees for nest sites.	C	Confirmed foraging
Ceratogymna elata	VU	Lowland primary forest, also occuring in logged and secondary forest, riverine forest and oil-palm plantations. Small scale migration in response to fruit availability.	C	Confirmed foraging
Criniger olivaceus	VU	Midstorey of lowland primary forest, mostly mature secondary forest, forest-grassland mosaic and riparian and montane forest.	C	Confirmed foraging
Bleda eximius	NT	Closed-canopy lowland forest preferring primary, wet evergreen forest, high forest and also mature secondary forest with some tolerance to forest degradation.	C	Confirmed foraging
Illadopsis rufescens	NT	This species is widespread in the forest zone, occurring in primary forest, mature secondary regrowth, coastal thickets and, less commonly, logged and disturbed forest.	C	Confirmed foraging
Malaconotus lagdeni	NT	The species inhabits the middle strata and canopy of evergreen rainforest, in lowland areas in West Africa and montane areas in It is most numerous in undisturbed forest, but nevertheless occurs in lightly and sometimes heavily logged forest.	H	Habitat is suitable for the species in limited areas
Hylopsar cupreocauda	NT	It is a species of forest, forest edge, and gallery forest It has been reported to benefit immediately following forest burning when some emergent trees remain, but to decline in secondary habitats thereafter tolerate logging to some degree). The species nests in holes in dead trees and branches.	H	Habitat is suitable for the species in limited areas
Merops mentalis	NT		C	Confirmed foraging

		The species shows some dependence on mature forest, being observed in clearings and along the edges of primary forest and old secondary forest), although it may also feed over agricultural land where a few large trees (alive or dead) remain standing (del). It appears to prefer evergreen and semi-evergreen forest with a broken canopy and small clearings, also frequenting the edges of forest by roads and swamps		
Picathartes gymnocephalus	VU	It is found in lowland primary and secondary forest, forest clearings, and gallery forest mainly in rocky, hilly terrain indicating a fairly high tolerance of disturbance (Thompson et al. 2004). The species is found in the proximity of flowing streams and rivers, where wet mud may be gathered for nest construction	C	Confirmed in rocky forested pockets although large – scale forest clearing may cause future displacement
Psittacus timneh	EN	Although typically inhabiting dense forest, individuals are commonly observed at forest edges, clearings, gallery forest, mangroves, wooded savannah, cultivated areas, and even gardens They may make seasonal movements out of the driest parts of the range in the dry season	M	Suitable habitat albeit limited
Parmoptila rubrifrons	NT	Lowland tropical moist forest, with preference for primary forest although will persist in the understorey of primary and secondary forest, and is often associated with forested streams and drainage lines.	M	Suitable habitat albeit limited
Bathmocercus cerviniventris	DD	It is found in dense secondary vegetation bordering small creeks and rivers in various forest types (primary and secondary forest, swamp forest, gallery forest, sub-montane forest) and, more rarely, lowland forest	M	Suitable habitat albeit limited
Stephanoaetus coronatus	NT	It inhabits forest, woodland, savanna and shrubland, as well as some modified habitats, such as plantations and secondary growth (), and can persist in small forest fragments including urban greenspace forests (It shows high resilience to heavy deforestation and degradation in some areas (	C	Confirmed foraging
Lobotos lobatus	VU	The species occurs in the canopy of tall trees in lowland rainforest It is sometimes found near to rivers, but also in open swamp-forest However, it would seem to tolerate some habitat alteration, as observations in Liberia have been in both primary and logged forest	H	Highly suitable habitat with the species possibly displaced by large-scale logging

APPENDIX 5-4: MAMMAL SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS THE MATAMBO RESOURCE AREA

Likelihood (LOD): Confirmed (C), High (H), Moderate (M), Low (L). IUCN statuses: Critically Endangered (CR), Endangered (E), Vulnerable (V), Near-Threatened (NT).

Taxon	IUCN status	Habitat	Matambo	
			LOD	Rationale
Anomalurus pelii	DD	Lowland and upper montane evergreen forest, usually only primary forest with occasional secondary incursions.	H	High potential based on habitat
Aonynx capensis	NT	Associated with larger water courses. Unusual to be far from water for long periods of time.	C	Confirmed on rivers as a watercourse associate
Caracal aurata	VU	Low density generalist subject to persecution. Prefers undisturbed environments however may occur widely.	L	Unlikely foraging resident
Cephalophus dorsalis	NT	Lowland evergreen forest, usually only primary forest but will occupy secondary and disturbed areas.	H	Low to moderate density species likely to occur due to lack of habitat
Cephalophus jentinki	EN	Lowland evergreen forest, usually only primary forest. Very low density species.	L	Extremely rare low density species
Cephalophus silvicultor	NT	Lowland evergreen forest, usually only primary forest but will occupy secondary and disturbed areas.	L	Sub-optimal habitat
Cephalophus zebra	VU	Hillslope and Hilltop evergreen forest, usually only primary forest	L	Extremely rare low-density species and unsuitable habitat
Cercocebus atys	VU	Generalist but prefers primary hillslope and hilltop forests. Will occupy secondary forests where persecution is low. Ground dwelling forager so is often more easy to hunt.	C	Confirmed throughout the concession, frequently hunted due to non-arboreal foraging habits
Cercopithecus diana	VU	Hillslope and Hilltop evergreen forest, usually only primary forest	L	Extremely rare low density species
Colobus polykomos	VU	Hillslope and Hilltop evergreen forest, usually only primary forest	L	Extremely rare low density species which is easily displaced by disturbance with lack of optimal habitat
Crocidura buettikoferi	LC	Lowland evergreen forest, usually only primary forest	L	Extremely rare low density species with lack of optimal habitat
Crocidura grandiceps	NT	Lowland evergreen forest, usually only primary forest	M	Possible due to some suitable habitat
Crocidura nimbae	NT	Lowland evergreen forest, usually only primary forest	L	Distribution
Genetta bourloni	VU	Lowland evergreen forest, usually only primary forest	H	Low density habitat generalist

Genetta johnstoni	NT	Lowland evergreen forest, usually only primary forest	H	Low density habitat generalist
Genetta poensis	DD	Lowland evergreen forest, usually only primary forest	L	Distribution
Grammomys buntingi	DD	Lowland evergreen forest, usually only primary forest	M	Low density habitat generalist
Graphiurus crassicaudatus	DD	Lowland evergreen forest, usually only primary forest	H	Low density habitat generalist
Heliosciurus punctatus	DD	Lowland evergreen forest, usually only primary forest	H	Low density species requiring forest habitat
Kerivoula cuprosa	DD	Lowland evergreen forest, usually only primary forest	L	Distribution
Loxodonta cyclotis	CR	Generalist preferring swamps, open secondary /primary forest and agricultural areas near to refugia. Will maintain close proximity to water courses in the dry season and overall avoids hilly terrain.	L	Unsuitable based on known distribution
Manis tricuspis	VU	Lowland and hillslope evergreen forest, primary and secondary.	C	Confirmed
Pan troglodytes verus	EN	Lowland evergreen forest, takes refuge on hillslopes and hilltops at night. Maintains a presence usually only primary forest but actively forages secondary and agricultural habitats. Maintains a presence cloes to permanent water in the dry season.	L	Sub-optimal habitat
Panthera pardus	NT	Low density generalist preferring more open and montaine habitat in Liberia.	L	Sub-optimal habitat
Phataginus tetradactyla	VU	Lowland and hillslope evergreen forest, primary and secondary.	C	Confirmed low-density species
Procolobus badius	EN	Lowland evergreen forest, usually only associated with primary forest and tall riparian forest margins.	M	Previously recorded along river habitat prior to current disturbance
Procolobus verus	NT	Lowland evergreen forest, usually only associated with primary forest and tall riparian forest margins.		Extremely rare low density species which is easily displaced by disturbance with lack of optimal habitat
Protoxerus aubinnii	NT	Lowland evergreen forest, usually only primary forest	M	Low density species requiring forest habitat
Smutsia gigantea	VU	Lowland and hillslope evergreen forest, usually only primary forest where caves are present.	L	Highly persecuted low-density species requiring low disturbance
Syncerus caffer	VU	Lowland evergreen forest, usually only open secondary and swamp forest patches. Makes active incursions into agricultural lands at night.	C	Confirmed low density species
Tragelaphus eurycerus	NT	Lowland evergreen forest, usually only open secondary and swamp forest patches. Makes active incursions into agricultural lands at night.	L	Outside of regional distribution

APPENDIX 5-5: AMPHIBIAN SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS THE MATAMBO RESOURCE AREA

Likelihood (LOD): Confirmed (C), High (H), Moderate (M), Low (L). IUCN statuses: Critically Endangered (CR), Endangered (E), Vulnerable (V), Near-Threatened (NT).

Taxon	IUCN status	Habitat	Matambo		Matambo Haul Road	
			LOD	Rationale	LOD	Rationale
Leptopelis macrotis	NT	Mostly primary forest streams, but also in swamp and secondary forest.	C	Confirmed	H	Suitable forest habitat is present
Leptopelis occidentalis	NT	Mostly primary forest streams, but also in swamp and secondary forest.	H	Suitable Hillslope and Lowland Forests	C	Confirmed
Sclerophrys taiensis	EN	Lowland Forest, along swamps and slow flowing streams	M	Suitable Lowland Forest, extremely rare and easily overlooked	M	Suitable Lowland Forest, extremely rare and easily overlooked

APPENDIX 5-6: REPTILE SPECIES OF CONSERVATION CONCERN LIKELIHOOD ACROSS MATAMBO RESOURCE AREA

Likelihood (LOD): Confirmed (C), High (H), Moderate (M), Low (L). IUCN statuses: Critically Endangered (CR), Endangered (E), Vulnerable (V), Near-Threatened (NT).

Taxon	IUCN status	Habitat	Matambo		Matambo Haul Road	
			LOD	Rationale	LOD	Rationale
Aparallactus lineatus	NT	Substrate under forest	H	A cryptic species easily overlooked, suitable forest present	H	A cryptic species easily overlooked, suitable forest present
Cyclanorbis senegalensis	VU	Seasonal ponds and marshes in savanna and forest, but also found in various freshwater habitats	M	Easily overlooked, riparian forest present	M	Easily overlooked, riparian forest present
Kinixys erosa	CR	Primary forests and associated secondary forests, often close to water	H	Suitable forest present	H	Suitable forest present
Kinixys homeana	EN	Primary forests and associated secondary forests, often close to water	H	Suitable forest present	H	Suitable forest present
Mecistops cataphractus	CR	Medium to large rivers and lakes in forest, but also sometimes in flooded forests and streams	H	Suitable riverine habitat present along sections of the Mafa River	H	Suitable riverine habitat present along sections of the Mafa River
Osteolaemus tetraspis	VU	Forested swamps and slow-flowing streams, can persist in secondary forest	H	Suitable riparian habitats is abundant	C	Confirmed
Trionyx triunguis	VU	Medium to large rivers with vegetated/forested banks as well as deep lakes, estuaries and coastal waters	H	Suitable riverine habitat present along sections of the Mafa River	H	Suitable riverine habitat present along sections of the Mafa River

CHAPTER 6
SOCIO-ECONOMIC BASELINE

TABLE OF CONTENTS

6 SOCIO-ECONOMIC BASELINE 6-1

6.1 GENERAL OVERVIEW 6-1
6.2 SOCIAL CONTEXT 6-1
6.2.1 Population and Demographics 6-1
6.2.2 Gender Demographics 6-2
6.2.3 Social Infrastructure 6-2
6.2.4 Emergency Services and Safety 6-3
6.3 ECONOMIC CONTEXT 6-3
6.3.1 Livelihood And Employment 6-3

LIST OF TABLES

TABLE 6-1: COMMUNITY PROFILE WITHIN STUDY AREA 6-2

LIST OF APPENDICES

APPENDIX 6-1: SOCIAL ECONOMIC PROFILES (PETRA 2024) 6-4
APPENDIX 6-2: SOCIAL ECONOMIC BASELINE (PETRA 2021) 6-5
APPENDIX 6-3: SOCIAL ECONOMIC BASELINE (PETRA 2024) 6-6

6 SOCIO-ECONOMIC BASELINE

Socio-economic baseline studies were conducted in the broader by Petra Resources in 2021 with more focussed baseline surveys undertaken in 2023 and 2024 as part of this ESIA. A summary of the 2021 and 2023 socio-economic baseline (APPENDIX 6-2 and APPENDIX 6-3) and Socio-Economic Profiles (APPENDIX 6-1) is provided in the sections to follow.

6.1 GENERAL OVERVIEW

Matambo is densely inhabited with much of the cleared land currently used for mining activities. Recent years have witnessed an increase in the alluvial mining activities – especially with the use of earth moving equipment. This scale-up and use of equipment has further contributed to the surge of people moving into the area. Apart from the few subsistence farms identified and the widespread alluvial mining, no other major forms of livelihood have been identified.

The 2023 field assessment identified ten (10) communities in the surrounding area, namely:

- Bangorma Town;
- Brown Village;
- God Blessing Village;
- Gogoima Community;
- Kumah Sorkporjah
- Massakpa_01;
- Massakpa_02;
- Sannoh Village;
- Yattesville Village; and
- Victoria Village

6.2 SOCIAL CONTEXT

6.2.1 Population and Demographics

According to the 2024 study, Victoria Village is an abandoned village. Reasons leading to its abandonment could not be determined during the survey; however, leadership and local authorities validated that it existed and believe it will exist again. The average population of 9 communities combined are approximately 8 884 (TABLE 6-1). Bangorma was identified as the largest community with a population of about 4 300, comprising of mostly children. The second largest community identified was Korma Sorkporiah, with a population of approximately 1 615 people, with most of the population identified as children. The smallest community is Godblessing Village with a population of 19, mostly comprising of men. Most communities in the area are old, established towns. These communities are all between 63 and 250 years old, with the exception of Godblessing Village, which was identified to be about 4 years old.

TABLE 6-1: COMMUNITY PROFILE WITHIN STUDY AREA

Village_Name	X_Coord	Y_Coord	Ave_POP.	Pop. Matrix	Appro. # of Structures	Age of Town	Leadership_Type	Leadership
Yatesville	250507	783452	200	Mostly Women	40	70	Town Chief	George Brown
Sanor town	251515	783981	450	Mostly Children	60	78	Town Chief	Foday Fahnbulleh
Brown Village	250870	783603	50	Mostly Women	4	83	Town Chief	
Korma Sokporjah	256827	782299	1615	Mostly Children	82	109	Dean Elder	Foday S. Tamon
Gbassakorma	257946	782984	NA	NA	NA	NA	NA	NA
Bangorma	255792	783364	4300	Mostly Children	339	109	Town Chief	Boakai Kemokai
Massakpa_01	252916	781565	500	Mostly Children	50	250	Town Chief	Lamie Dasalia
Massakpa_02	253041	781800	500	Mostly Women	60	63	Town Chief	Gbessay Massaley
Victoria Village	254730	783707	NA	NA	NA	NA	NA	NA
Gogoima	253140	783986	1250	Mostly Children	125	109.0	Dean Elder	Boakai Sonii
Godblessing Village	251074	782772	19	Mostly Men	3	4	Camp Master	Victor Yates

6.2.2 Gender Demographics

Across these communities the population was predominantly women and young children. Women are not seen in most appointed positions of authority within the communities. This may possibly be influenced by the dominance of Islam throughout the study area.

6.2.3 Social Infrastructure

Cultural and traditional practices have a strong influence within the project area hosting 6 locations each for Poro[1] and Sande[2] societies. The number of facilities and infrastructures supporting WASH activities are far below the national thresholds for access to domestic water, sanitation, and hygiene services.

There are three public pit–latrines within the community.

There are four (4) elementary schools serving the communities in the project area these schools have a maximum level of elementary status; post – elementary education is provided outside of the project area. It was also documented that forest wood is the primary source of heating energy – especially for cooking, while rechargeable LED lights are the primary source of light.

Three town halls have been identified in the area, where Palava Hut was identified to be used for general meetings and gatherings. A soccer field was also identified, which is used by the youth.

Eleven (11) sacred sites were identified in the study area, which comprise of seven (7) burial grounds, three (3) Sande and One (1) Poro bush, which are traditional societies for women.

Eighteen (18) handpumps were identified in the area and two (2) hand dug wells. Domestic water is also obtained from nine (9) stream locations. . One waterfall was also identified, which is usually only accessed and used by women.

Eight (8) mosques and three (3) churches were found in the study area.

1 Poro society traditional society restricted to only males in the community.
2 Sande society traditional social restricted to only females in the community.

6.2.4 Emergency Services and Safety

There is only 1 clinic servicing the communities, supported by 14 community health assistants [TTM[3]] and 2 herbalists for those seeking alternative medical treatment, with the common illnesses amongst both adults and children reported to be malaria, cold, fever and diarrhoea.

There are no police stations or court houses in the area.

6.3 ECONOMIC CONTEXT

6.3.1 Livelihood And Employment

Four (4) large scale artisanal mining pits have been identified in the project area. In the artisanal mining communities, respondents indicated that the majority of the men work the fields as miners, while the women remain at home rearing the children or engaging in micro-scale subsistence farming to supplement household diets.

An abandoned oil palm processing operation was found within the project area and 4 farms that are predominantly mixed farming including cassava, pineapples, and palm.

The baseline surveys identified no market spaces / locations across the communities; individual households have kiosks selling small edible items. The primary economic income sources across the communities are artisanal and small – scale mining, and subsistence farming.

[3] TTM are community members who are trained by the Ministry of Health to provide early diagnosis of illnesses and refer the patient to nearest health facility; information obtained by TTM are critical in the national health surveillances management.

APPENDIX 6-1: SOCIAL ECONOMIC PROFILES (PETRA 2024)



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Contents

1. Introduction and Background 3
2. Community Socio – Economic Profile [God Blessing Village] 6
3. Community Socio – Economic Profile [Bangorma Village] 8
4. Community Socio – Economic Profile [Brown Village] 10
5. Community Socio – Economic Profile [Gogoima Community] 12
6. Community Socio – Economic Profile [Kumah Sorkporjah Community] 14
7. Community Socio – Economic Profile [Victoria Village] 16
8. Community Socio – Economic Profile [Sannor Village] 18
9. Community Socio – Economic Profile [Yattesville] 20
10. Community Socio – Economic Profile [Massakpa_01] 22
11. Community Socio – Economic Profile [Massakpa_02] 24

1. Introduction and Background

This Social Impact Assessment Study [SIA] identified potential social impacts for which mitigation measures have been recommended based on the expected outcome of the Project. To help inform the understanding of the social layout and construct of each of the communities within the project area; a socio – economic profile of each community was conducted as part of the baseline data collection.

The data has been summarized in the subsequent tables below to capture the current socio – economic structure of each community. Victoria Village, which has been included in this list of communities is abandoned. Reasons leading to its abandonment could not be determined during the survey; however, leadership and local authorities validated that it existed and believe it will exist again.

The socio – economic baseline helps to inform the project of the pre-mining status of each of the communities within the project area; and helps predict the potential impacts both negative and positive on each of the communities during the construction and operations of the proposed project.

The data collected in during the socio – economic profile were based on Key Informant Interviews [KIIs]; and site visual inspections.

The socio – economic profile of the study area communities documented an average of approximately 8,884 residents within the 10 communities namely:

- Bangorma Community
- Brown Village
- God Blessing Village
- Gogoima Community
- Kumah Sorkporjah
- Massakpa_01
- Massakpa_02
- Sannor Village
- Yattesville, and
- Victoria Village

Across these communities the population was predominantly women and young children. Although women are a significant portion of the population, they are not seen in most appointed positions of authority within the communities. This may possibly be influenced by the dominance of Islam throughout the study area.

Cultural and traditional practices have a strong influence within the project area hosting 6 locations each for Poro[1] and Sande[2] societies. The number of facilities and infrastructures supporting WASH activities are far below the national thresholds for access to domestic water, sanitation, and hygiene services.

There is only 1 clinic servicing the communities and supported by 14 community health assistants [TTM[3]] and 2 herbalists for those seeking alternative medical treatment, with the common illnesses amongst both adults and children are malaria, cold, fever and running stomach.

There are 4 elementary schools serving the communities in the project area these schools have a maximum level of elementary status; post – elementary education is provided outside of the project area. It was also documented that forest wood is the primary source of heating energy – especially for cooking, while rechargeable LED lights are primary source of lightening energy.

There are no market spaces / locations across the communities; individual households have kiosks selling small edible items. The primary economic income sources across the communities are artisanal and small – scale mining; and subsistence farming.

Table 1: Socio - economic profile summary of communities in the project area

No.	Social Domain	Number
1	Population Demographics	8,884.0
	Women	More Dominant
	Men	Less Dominant
	Children	Most Dominant
2	**Leadership**	
	Town Chief	9.0
	Dean Elder	10.0
3	**Cultural / Traditional Sites**	
	Poro Society	6.0
	Sande Society	6.0
	Burial Sites	8.0
4	**WASH Services / Infrastructures**	
	Latrines	3.0
	Hand Pumps	18.0
	Hand Dug Wells	2.0
	Open Flowing Streams	9.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	11.0
	Soccer Field	6.0

[1] Poro society traditional society restricted to only males in the community.
[2] Sande society traditional social restricted to only females in the community.
[3] TTM are community members who are trained by the Ministry of Health to provide early diagnosis of illnesses and refer the patient to nearest health facility; information obtained by TTM are critical in the national health surveillances management.

	Town Hall	6.0
6	**Worship Site**	
	Church	3.0
	Mosque	8.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	1.0
	Herbalist	2.0
	Community Health Assistant /Mid Wives (TTM)	16.0
6	**Education Facilities**	
	Elementary School	4.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	Malaria, cough, cold, running stomach
	Common Illnesses Adults	Malaria, Open mole, typhoid and cold
9	Energy Management	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Average number of structures	763

2. Community Socio – Economic Profile [God Blessing Village]

Table 2: Socio - Economic Profile_God Blessing Village

No.	Social Domain	Number
1	Population / Demographics	19.0
	Women	Less Dominant
	Men	Mostly men
	Children	Less Dominant
2	**Leadership**	
	Town Chief (Camp Master)	1.0
	Dean Elder	0.0
3	**Cultural / Traditional Sites**	
	Poro Society	0.0
	Sande Society	0.0
	Burial Sites	0.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	0.0
	Hand Dug Wells	0.0
	Open Flowing Streams	0.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	0.0
	Soccer Field	0.0
	Town Hall	0.0
6	**Worship Site**	
	Church	0.0
	Mosque	0.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives	0.0
6	**Education Facilities**	
	Elementary School	0.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	N/A
	Common Illnesses Adults	Malaria and cold

9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	No
10	Number of structures	3



Figure 1: Residential structure in God Blessing Village

3. Community Socio – Economic Profile [Bangorma Village]

Table 3: Socio - Economic Profile of Bangorma Community

No.	Social Domain	Number
1	Population Demographics	4300.0
	Women	More Dominant
	Men	Less Dominant
	Children	Most Dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	3.0
3	**Cultural / Traditional Sites**	
	Poro Society	1.0
	Sande Society	1.0
	Burial Sites	2.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	4.0
	Hand Dug Wells	2.0
	Open Flowing Streams	0.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	3.0
	Soccer Field	1.0
	Town Hall	1.0
6	**Worship Site**	
	Church	1.0
	Mosque	2.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	1.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives (TTM)	9.0
6	**Education Facilities**	
	Elementary School	1.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0

8	Common Illnesses (Children <5)	Malaria, cough, cold, running stomach
	Common Illnesses Adults	Malaria, Open mole, typhoid and cold
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of structures	339



Figure 2: Aerial view of part of Bangorma Community

4. Community Socio – Economic Profile [Brown Village]

Table 4: Socio - Economic Profile_Brown Village

No.	Social Domain	Number
1	Population Demographics	50.0
	Women	Most dominant
	Men	More Dominant
	Children	Less Dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	0.0
3	**Cultural / Traditional Sites**	
	Poro Society	0.0
	Sande Society	0.0
	Burial Sites	0.0
4	**WASH Services / Infrastructures**	
	Latrines	1.0
	Hand Pumps	0.0
	Hand Dug Wells	0.0
	Open Flowing Streams	1.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	0.0
	Soccer Field	0.0
	Town Hall	0.0
6	**Worship Site**	
	Church	0.0
	Mosque	0.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives	0.0
6	**Education Facilities**	
	Elementary School	0.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	Malaria

	Common Illnesses Adults	Malaria, running stomach
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of structures	4



Figure 3: Aerial view of Brown Village

5. Community Socio – Economic Profile [Gogoima Community]

Table 5: Socio - Economic Profile_Gogoima Community

No.	Social Domain	Number
1	Population Demographics	1,250.0
	Women	More Dominant
	Men	Less Dominant
	Children	Most Dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	1.0
3	**Cultural / Traditional Sites**	
	Poro Society	1.0
	Sande Society	1.0
	Burial Sites	1.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	3.0
	Hand Dug Wells	0.0
	Open Flowing Streams	1.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	1.0
	Soccer Field	1.0
	Town Hall	1.0
6	**Worship Site**	
	Church	0.0
	Mosque	1.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives (TTM)	3.0
6	**Education Facilities**	
	Elementary School	1.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	Malaria

	Common Illnesses Adults	Malaria, headaches, diarrhea
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of Structures	125.00



Figure 4: Aerial view of part of Gogoima Community

6. Community Socio – Economic Profile [Kumah Sorkporjah Community]

Table 6: Socio - Economic Profie_Kumah Sorkporjah Community

No.	Social Domain	Number
1	Population Demographics	1615.0
	Women	More Dominant
	Men	Less Dominant
	Children	Most Dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	1.0
3	**Cultural / Traditional Sites**	
	Poro Society	1.0
	Sande Society	1.0
	Burial Sites	2.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	4.0
	Hand Dug Wells	0.0
	Open Flowing Streams	2.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	1.0
	Soccer Field	1.0
	Town Hall	1.0
6	**Worship Site**	
	Church	0.0
	Mosque	1.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	1.0
	Community Health Assistant /Mid Wives	2.0
6	**Education Facilities**	
	Elementary School	1.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	Access to Formal Justice	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	Malaria, skin disease, cold

	Common Illnesses Adults	cough, malaria, skin disease, eye irritation
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of Structures	82



Figure 5: Aerial view of part of Kumah Sorkporjah

7. Community Socio – Economic Profile [Victoria Village]

Table 7: Socio - Economic Profile_Victoria Village

No.	Social Domain	Number
1	Population Demographics	0.0
	Women	0.0
	Men	0.0
	Children	0.0
2	Leadership	
	Town Chief	0.0
	Dean Elder	0.0
3	Cultural / Traditional Sites	
	Poro Society	0.0
	Sande Society	0.0
	Burial Sites	0.0
4	WASH Services / Infrastructures	
	Latrines	0.0
	Hand Pumps	0.0
	Hand Dug Wells	0.0
	Open Flowing Streams	0.0
5	Community Shared Infrastructures	
	Market Space	0.0
	Religious Center	0.0
	Soccer Field	0.0
	Town Hall	0.0
6	Worship Site	
	Church	0.0
	Mosque	0.0
7	Health Facility	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives	0.0
6	Education Facilities	
	Elementary School	0.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	Access to Formal Justice	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	N/A

	Common Illnesses Adults	N/A
9	Energy Management	
	Firewood	0.0
	LED Lamps	0.0
	Commercial Generators	0.0
	Private Generators	0.0
10	Number of structures	0.0



Figure 6: Previous residential location in Victoria village (settlement abandoned)

8. Community Socio – Economic Profile [Sannor Village]

Table 8: Socio - Economic Profile_Sannor_Village

No.	Social Domain	Number
1	Population Demographics	450.0
	Women	More Dominant
	Men	Less Dominant
	Children	Most Dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	1.0
3	**Cultural / Traditional Sites**	
	Poro Society	1.0
	Sande Society	1.0
	Burial Sites	1.0
4	**WASH Services / Infrastructures**	
	Latrines	2.0
	Hand Pumps	0.0
	Hand Dug Wells	0.0
	Open Flowing Streams	1.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	2.0
	Soccer Field	1.0
	Town Hall	1.0
6	**Worship Site**	
	Church	1.0
	Mosque	1.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives	0.0
6	**Education Facilities**	
	Elementary School	0.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	Malaria, cold
	Common Illnesses Adults	Malaria, diarrhea, cholera

9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of Structures	60.0



Figure 7: Aerial view of Sannoh Village

9. Community Socio – Economic Profile [Yattesville]

Table 9: Socio - Economic Profile Yattesville

No.	Social Domain	Number
1	Population Demographics	200.0
	Women	Most dominant
	Men	Less dominant
	Children	More Dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	1.0
3	**Cultural / Traditional Sites**	
	Poro Society	1.0
	Sande Society	1.0
	Burial Sites	1.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	2.0
	Hand Dug Wells	0.0
	Open Flowing Streams	1.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	2.0
	Soccer Field	1.0
	Town Hall	0.0
6	**Worship Site**	
	Church	1.0
	Mosque	1.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives	0.0
6	**Education Facilities**	
	Elementary School	0.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	Access to Formal Justice	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	Malaria and running stomach

	Common Illnesses Adults	Malaria, running stomach, bone disease
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of Structures	40.0



Figure 8: Aerial view of Yattesville Community

10. Community Socio – Economic Profile [Massakpa_01]

Table 10: Socio - Economic Profile Massakpa_01

No.	Social Domain	Number
1	Population Demographics	500.0
	Women	More dominant
	Men	Less dominant
	Children	Most dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	1.0
3	**Cultural / Traditional Sites**	
	Poro Society	0.0
	Sande Society	0.0
	Burial Sites	0.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	1.0
	Hand Dug Wells	0.0
	Open Flowing Streams	1.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	1.0
	Soccer Field	0.0
	Town Hall	1.0
6	**Worship Site**	
	Church	0.0
	Mosque	1.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	0.0
	Community Health Assistant /Mid Wives	0.0
6	**Education Facilities**	
	Elementary School	0.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0

	Court House	0.0
8	Common Illnesses (Children <5)	Malaria, cough, cold, running stomach
	Common Illnesses Adults	STIs, Malaria, running stomach, bone disease
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of Structures	50.0



Figure 9: Aerial View of Massakpa_01

11. Community Socio – Economic Profile [Massakpa_02]

Table 11: Socio - Economic Profile Massakpa_02

No.	Social Domain	Number
1	Population Demographics	500.0
	Women	Most dominant
	Men	Less dominant
	Children	More dominant
2	**Leadership**	
	Town Chief	1.0
	Dean Elder	1.0
3	**Cultural / Traditional Sites**	
	Poro Society	1.0
	Sande Society	1.0
	Burial Sites	1.0
4	**WASH Services / Infrastructures**	
	Latrines	0.0
	Hand Pumps	4.0
	Hand Dug Wells	0.0
	Open Flowing Streams	2.0
5	**Community Shared Infrastructures**	
	Market Space	0.0
	Religious Center	1.0
	Soccer Field	1.0
	Town Hall	1.0
6	**Worship Site**	
	Church	0.0
	Mosque	1.0
7	**Health Facility**	
	Hospital	0.0
	Clinic	0.0
	Herbalist	1.0
	Community Health Assistant /Mid Wives	2.0
6	**Education Facilities**	
	Elementary School	1.0
	Junior High School	0.0
	Senior High School	0.0
	Vocational Center	0.0
7	**Access to Formal Justice**	
	Police Station	0.0
	Court House	0.0
8	Common Illnesses (Children <5)	malaria, cholera, diarrhea

	Common Illnesses Adults	malaria, running stomach, skin disease
9	**Energy Management**	
	Firewood	Yes
	LED Lamps	Yes, most dominant
	Commercial Generators	No
	Private Generators	Yes
10	Number of Structures	60.0

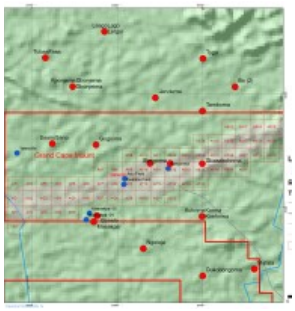


Figure 10: Aerial view of Massakpa_02 (foreground with Massakpa_1 visible)

APPENDIX 6-2: SOCIAL ECONOMIC BASELINE (PETRA 2021)









BMMC MDA Area
Social Impact Screening Report

MatambоExploration Target Area

Prepared for: Bea Mountain Mining Corporation

Prepared by: Petra Resources, Inc.

October 2021

Petra Resources, Inc. ©2021

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Contents

1. EXECUTIVE SUMMARY 3
1.1 Project Title / Location 6
Project Title 6
Matambo Exploration Target Area 6
Project Location 6
BMMC MDA License Area Grand Cape Mount County 6
1.2 Overall Description 7
1.3 Identifying and Management Social Risks 10
2. FIELD DATA METHODOLOGY 11
2.1 Screening Approach and Scope 11
3. FIELD DATA 11
4. SUMMARY OF FINDINGS 13
Matambo Photos 16
Social Screening Map 17

1. EXECUTIVE SUMMARY

Bea Mountain Mining Corporation (**BMMC**) is seeking to develop and mine potential gold resources in the Matambo exploration target area –within its Mineral Development Agreement Area (**MDA**). The exploration campaign shall entail drilling to help discover and define the vertical and horizontal profile of potential gold deposit in the Matambo area. The exploration drilling campaign shall also be supported by other exploration construction activities including construction of access tracks, drill pads, drill sumps, camps, etc.

These activities could have some negative social impacts on communities and their livelihood, while the positive ones of access to employment and income-earning is recognized. To ensure that potential impacts are identified and properly mitigated it is critical to document key socio – economic variables of the communities as well as spatially capture the social infrastructures which currently support these communities as the first step in the preparing for the environmental permitting process.

As part of its environmental and social management, BMMC is seeking to document and understand the potential social impact(s) associated with geological exploration activities, and as such requested Petra Resources, Inc. (**PRI**), a 3rd party independent, and licensed and certified by the Environmental Protection Agency of Liberia (**EPA**) to lead a social screening assessment that will document the potential social impact(s) associated with the exploration construction activities of the Matambo exploration target area.

This assignment refers to the statutory and internal obligations of BMMC in Liberia under the existing laws and regulations governing mineral exploration and environmental management. The exercise specifically aimed to identify existing conditions which may require further analysis as part of the subsequent, full-scale ESIA process as part of an application for an environmental permit to develop and operate a gold mine at Matambo.

To ensure a systematic approach to data collection, a geo-referencing methodology was developed to guide the process and ensure work could be thorough. A 500m^2 grid was created across the exploration license area as a broad potential area of influence, to document existing social assets including the following:

No	Social Variable
1	Settlement / Community / Village
2.	Education
3	Health Care
4	Domestic Water Access (Handpumps / Hand – Dug Wells / Surface Water)

5.	Sanitation
6.	Livelihood / Economic / Trade / Commerce
7.	Shared Spaces – including market, soccer pitches, Town Hall / Palava Hut
8.	Religious Infrastructures (Mosque / Church / Shrine)
9.	Cultural / Traditional / Heritage / Artifacts
10.	Graveyard / Cemetery
11.	Primary Mode of Transportation (Infrastructure and mode)
12.	General Forest Cover Type

Table 1: Survey Points of Interest

The 500m^2 made up a total of 35 cells. All 35 cells were physically inspected from 6th - 12th July 2021.

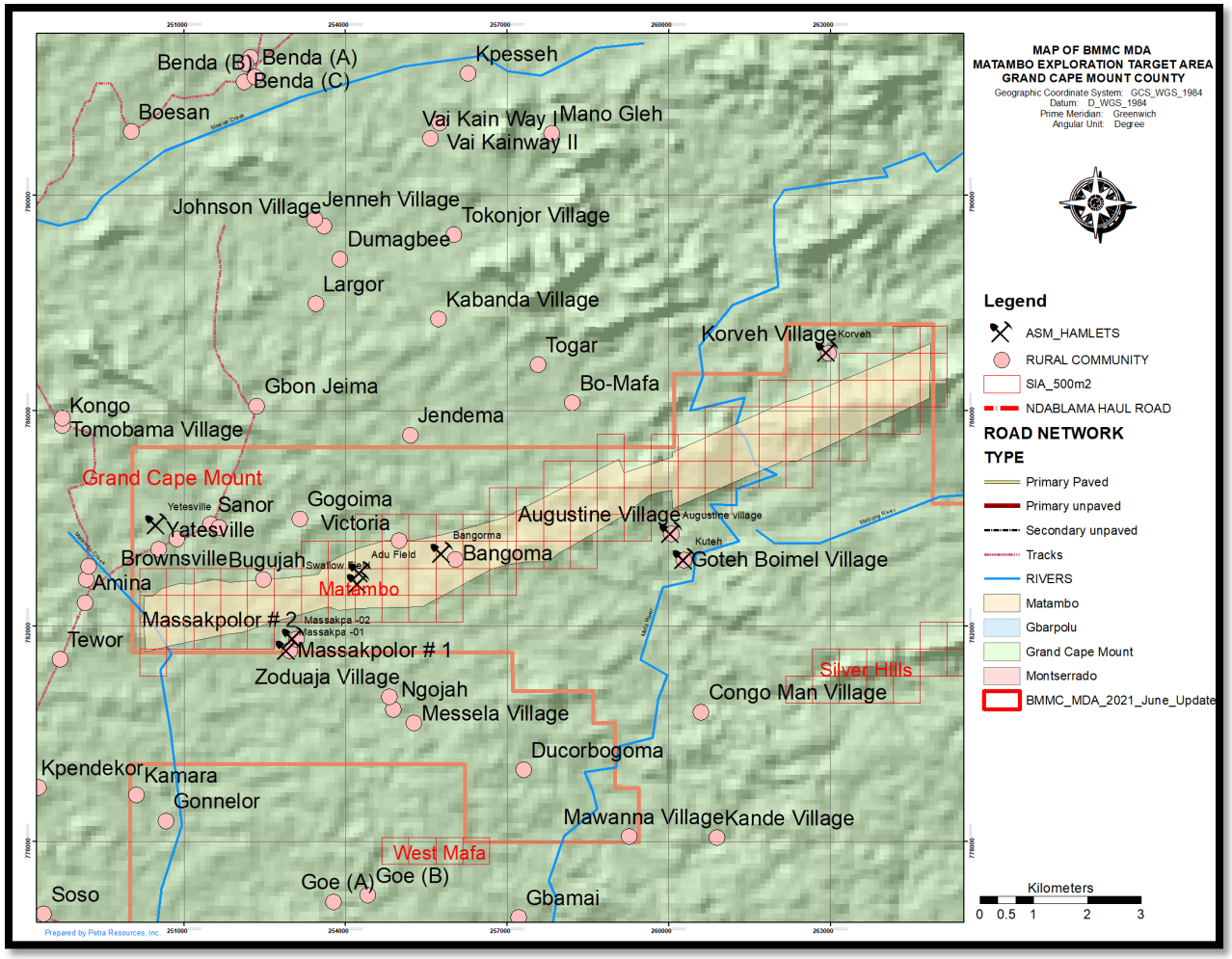


Figure 1: Map of Matambo Exploration Target Area

Matambo Exploration Target area is an artisanal small-scale mining (ASM) community located approximately 5.0km north of the West Mafa Exploration Target Area. The Matambo study area is rural and remote with approximately 13 villages and communities with an estimated population of 5,000 – 8,000 residents. One of the notable oldest villages Bangoma is one of the largest and is believed to be nearly 200 years old.

The history of this area is one of the oldest and richest in Liberia – it is known that the original inhabitants encountered in this area are from the historical towns of Masakpa_01 and Masakpa_02. Historical writings of Liberia associate the origin of the Vai Script[1] with the town of Bangoma. Due to its history of ASM activities across settlements in the across the study area, much of the forest vegetation has now been removed, settlements are spreading and there is an influx of people in search of gold.

[1] *Vai Script Five indigenous phonetic scripts were developed for the Mande language groups spoken in Liberia, Sierra Leone and southwestern Mali. The oldest of these is Vai, which was invented around 1832 by Momolu Duwalu Bukele of Liberia.*



Figure 2: Aerial photograph of the Matambo Exploration Target Area

1.1 Project Title / Location

Project Title	**Matambo Exploration Target Area**
Project Location	BMMC MDA License Area Grand Cape Mount County



Figure 3: Central view of Matambo town

1.2 Overall Description

The Matambo exploration target area is an ASM based landscape and residents have been involved in medium – scale mining activities as evident in 4 sizeable mine sites (Adu Field, Swallow field, Kaikweh Field and Yatesville) seen in Figure 2 above. These fields were observed to still be very active with an estimated 200 persons, mostly men across the 4 mines. In interviews conducted during the field screening exercise – they commenced mining activities in the area about 50yrs ago.

Beyond these mining settlements, the other surrounding hamlets are mostly farming villages / settlements. Nearly all farms observed were operated on a subsistence scale. Primary access to the area and communities is by motorcycle on small paths and the dilapidated laterite road which passes through the license area connecting the larger communities of Bangorma, Yatesville and Kormah about 1.5km each, north – east of Matambo.

No	Indicator	Description
1	Settlement / Community / Village	There are 8 settlements (2 abandoned) - 4 large artisanal mines and other small hamlets within the survey area.
2	Education	There are 2 elementary schools or formal education facilities in the survey area. 1 of the schools is situated on the outskirts of Bangorma and the other is at the entrance of Massakpa_02. Most of the residents here have no formal education.
3	Health	There is 1 health facility (clinic) and an additional approximately 14 (TTM)[2] in the survey area. Most of the interviewed respondents stated that the most common illness amongst them are malaria and cold.
4	Water & Sanitation	In the project area, there are 12 hand pumps (5 inactive), 4 open wells (1 inactive) and other domestic water supply is accessed via a flowing stream (the Matambo River) which runs through the survey area.
5	Livelihood / Economic / Trade / Commerce	Many of the residents here depend on the ASM sector for livelihood. A very small amount of subsistence farming of rice and cassava, was also observed.
6	Shared Spaces	The shared spaces are mostly town halls/palava huts. There are no market spaces or market halls in the target area.
7	Religious Practices / Infrastructures	Most of the residents indicate their alliance with the Islamic faith. There are 7 worship centers which include 5 mosques, and 2 churches.
8	Cultural / Tradition / Heritage / Artifacts	The area is well noted for its cultural and traditional societies. It is believed that the women society is the most powerful of the societies and there are 3 of such Sande bushes, while there is 1 Poro bush for the men.
9	Grave / Cemetary	There are a total of 7 – graveyards spread across the project area
10	Mode of Transportation	The primary mode of transportation is motorcycle via a dilapidated laterite road that cuts through the survey area; however, the road is pliable by 4-wheel drive vehicles also.
11	General Forest / Vegetation	The general forest vegetation is low - secondary forest vegetation. The average elevation of the area is 42 - 60m (ASL). Significant tracts of the canopies are opened, with patches in forested areas, which indicates history of disturbance

Table 2: Field screening variables summary

[2] *TTM are licensed traditional mid-wives that are responsible for child delivery services*



Figure 4: Active ASM activities in Matambo Exploration Target Area

1.3 *Identifying and Management Social Risks*

What are the potential social risks?	What is the potential level of significance of social risks?			What social assessment and management measure are required to address potential risks with low, moderate, and high significance?
Risk Description	Impact Probability (1-5)	Significance (Low, Moderate, High)	Comments	Assessment and Management measures as reflected in the project design.
Overall, All Risk Category	Low	☐		
	Moderate	☐		
	High	☒	Although heavily involved in ASM activities – due to the historical nature of the area – a more detail focus on historical artifacts must be included in the risk assessment	Documenting the history of the communities is critical in helping to preserve their history.
Based on the identified risk and risk categorization, what requirements of social – environmental management are required				Comments
A. Human Rights			☒	Through formal engagement for free and prior notice
B. Gender equality and women's empowerment			☒	Ensuring that women's issues are clearly incorporated into the project social management
C. Community health, safety and working conditions			☒	Through formal engagement with residents about free and prior notice
D. Cultural Heritage			☒	Very high risk due to the historical nature of the communities
E. Displacement and Resettlement			☒	Very high most of the exploration, construction activities are in close proximities to communities and/or infrastructure
F. Pollution presentation			☒	Ensuring there's a pollution prevention plan that governs the exploration activities

Table 3: Site social risk assessment

The potential social/heritage risks in the Matambo exploration site are high. The site hosts one of Liberia's oldest rural communities with a well-established oral history of being the birthplace of the Vai script. Although never formally researched or published for archaeological / heritage purposes, this is a phenomenal heritage. Construction could discover or destroy potential artifacts.

2. FIELD DATA METHODOLOGY

2.1 Screening Approach and Scope

The field screening approach included the use of satellite imagery overlaid by a grid measuring 500m^2 for the entire exploration target area. To ensure that data collection was consistent across the project, spatial records for specific Points of Interests (**Pols**) across 12 socio – economic variables as stated above in Table 1.



Figure 5: Aerial photo of historical mining environmental degradation at Matambo

3. FIELD DATA

Cell ID	X_Coord	Y_Coord	Infrastructure Type/ Asset	X-Coord	Y-Coord	Description
A2_MT	250468	787772	Mosque	250505	783426	Active (Mud & Zinc)
A2_MT	250468	787772	Hand pump	250485	783357	Active
A2_MT	250468	787772	Sande Bush	250515	783365	Active (Bush)
A2_MT	250468	787772	Graveyard (Muslim)	250638	785401	Active (Bush)
A2_MT	250468	787772	Church & Graveyard	250747	783397	Active (Concrete & Zinc)
A2_MT	250468	787772	Public Latrine	250575	783355	Active (Mud & Zinc)

A2_MT	250468	787772	Artisanal Mine	250821	782754	Active
A2_MT	250468	787772	Stream	250765	782962	Active
A3_MT	298298	787856	Artisanal Mine	251931	782308	Active
A6_MT	252214	781963	Mosque	253030	781791	Active (Mud & Zinc)
A6_MT	252214	781963	Hand pump	252916	781565	Active (Concrete)
A8_MT	253220	782027	Handpump-01	253057	781758	Active
A8_MT	253220	782027	Hand pump -02	253030	781791	Active
A8_MT	253220	782027	Handpump-03	253031	781797	Active
A8_MT	253220	782027	Handpump-04	252916	781565	Damaged
A8_MT	253220	782027	Mosque	253084	781770	Active (Mud & Zinc)
A8_MT	253220	782027	Stream-01(Matambo)	253043	781466	Active
A8_MT	253220	782027	Stream-02	253056	781389	Active
A8_MT	253220	782027	School	253031	781797	Active (Massakpa English and Arabic School/Concrete & Zinc)
A8_MT	253220	782027	Sande Bush	253129	781723	Active
A9_MT	254214	783709	Farm	254455	783339	Active (Mixed corps)
A9_MT	254214	783709	Farm	254398	783295	Active (Palm)
A9_MT	254214	783709	Farm	252341	783246	Active (Mixed corps)
A9_MT	254214	783709	Farm	255375	783619	Active (Cassava)
A10_MT	254257	782916	Artisanal Mine	254276	783003	Active
A12_MT	255355	783715	Mosque- 02	255869	783341	Active (Mud &Zinc)
A12_MT	255355	783715	Mosque -01	255576	783420	Active (Concrete & Zinc)
A12_MT	255355	783715	Graveyard- 01	256089	783248	Active (Muslim/bush)
A12_MT	255355	783715	Graveyard- 02	255428	783511	Active (Christian/Bush)
A12_MT	255355	783715	Graveyard -03	256089	783248	Active
A12_MT	255355	783715	Generator Site	256021	783224	Active
A12_MT	255355	783715	Handpump-01	255971	783246	Damaged
A12_MT	255355	783715	Handpump-02	255994	783242	Damaged
A12_MT	255355	783715	Handpump-03	255897	783377	Damaged
A12_MT	255355	783715	Handpump-04	255738	783373	Damaged
A12_MT	255355	783715	Handpump-05	255609	783420	Active
A12_MT	255355	783715	Open well-01	255829	783292	Active
A12_MT	255355	783715	Open well	255763	783373	Active
A12_MT	255355	783715	Open well	255699	785451	Active

A12_MT	255355	783715	Clinic	255619	783413	Active with Palava hut and hand pump, GOL (Concrete & Zinc)
A12_MT	255355	783715	Palava hut	255792	783364	Abandoned (Mud & Zinc
A12_MT	255355	783715	Town Hall	255828	783354	Active with office (Concrete, Tile & Zinc)
A12_MT	255355	783715	Poro Bush	255617	783823	Active
A12_MT	255355	783715	Sande Bush	255777	783399	Active
A12_MT	255355	783715	Church	255437	783528	Active (Mud & Zinc)
A12_MT	255355	783715	School	255401	783547	Active (Bangorma Public School, ABC-3rd grade)
A12_MT	255355	783715	Pump	255378	783574	Active
A12_MT	255355	783715	Football Field	255432	783602	Active (School pump)
A25_MT	260130	784971	Stream	260438	783143	Active
A25_MT	260130	784971	Graveyard	260411	783141	Active (Bush)
A31_MT	263239	786850	Hand pump	262957	787092	Active
A31_MT	263239	786850	Open well	262984	787096	Inactive
A31_MT	263239	786850	Mosque	262999	787090	Active (Mud & Zinc)
A31_MT	263239	786850	Palava Hut/Church	262931	787103	Active (Concrete & Zinc)
A31_MT	263239	786850	Graveyard	262946	787048	Active (Bush)
A31_MT	263239	786850	Latrine	262938	787059	Active, 2 rooms(M/F) Mud & Zinc

Table 4: Field data

4. SUMMARY OF FINDINGS

Matambo is densely inhabited with much of the cleared land currently used for mining activities. Recent years have witnessed an increase in the alluvial mining activities – especially with the use of earth moving equipment. This scale-up and use of equipment has further contributed to the surge of people moving into the area.

There is 1 health clinic and 2 education infrastructures within the Matambo study area, and road access is primarily by use of motorcycles. With the exception of the few subsistence farms identified and the widespread alluvial mining, no other major forms of livelihood identified in the Matambo area. Table 5 and Table 6 summarizes the socio – economic findings and supporting community infrastructure and assets in Matambo.

Variable	Description
Population Demographics **-Age** **-Gender**	Matambo is a rural town that is heavily involved into mining with an average population of 8,000 people, dominated by mostly men and children, with ages ranging from 2years to 97years.
Education Level	Most of the inhabitants are high school dropouts or no formal education
Livelihood / Income / Employment	The main source of income is ASM activity with very little into farming
Health	There is one health center in the project area. The health center is a clinic located in Bangorma with about 10 staff.

Table 5: Summary of socio – economic variables

Point of Interest	Asset	Number / Quantity	Description
Village	Village	9	Matambo – Rural farming village with an average population of 8000 people dominated by mostly children and men
Sanitation	Pit – Latrines	2	There are two public pit–latrines within the community. Open defecation is widely practiced within the general community of Matambo
School	Public School	2	Bangorma Public Elementary School with approximately 100 students and Massakpa Arabic and English Elementary School with approximately 75 students.
Shared Infrastructure	Palava Hut / Town Hall	3	Palava Hut that is used for general meetings and gathering in the community
	Soccer Field	1	Soccer field used by the youth of the community
Sacred Site	Burial Ground	7	There are 7 burial grounds in the town
	Cultural / Heritage	4	Sande (3)/Poro (1) bush – which is a traditional society for only females.
Water Access Points	Handpump	12	Hand pumps in the community that is functional

	Flowing Stream	4	There's a flow stream in the community that is used for domestic water supply
	Waterfall	0	A water fall that is accessed and used by only women
Access to Justice	Magisterial Court	1	There's no magisterial court located in the survey area of Matambo
Livelihood	Farm	4	Most of the farms are predominantly mixed farming including cassava, pineapples, and palm.
Industry	Oil Palm Production	1(Abandoned)	There's an abandoned oil palm processing operations within the project area
	Palm Wine Production	0	There are no palm wine processing operations within the project area
	Artisanal Mining	4	There are 4 large scale artisanal mining pits in the project area
Worship Center	Mosque	5	There are mosque and churches are within the project area of Matambo
	Church	2	

Table 6: Summary of community infrastructure and assets

Matambo Photos



Figure 6: Bangorma Mosque



Figure 7: Bangorma Clinic

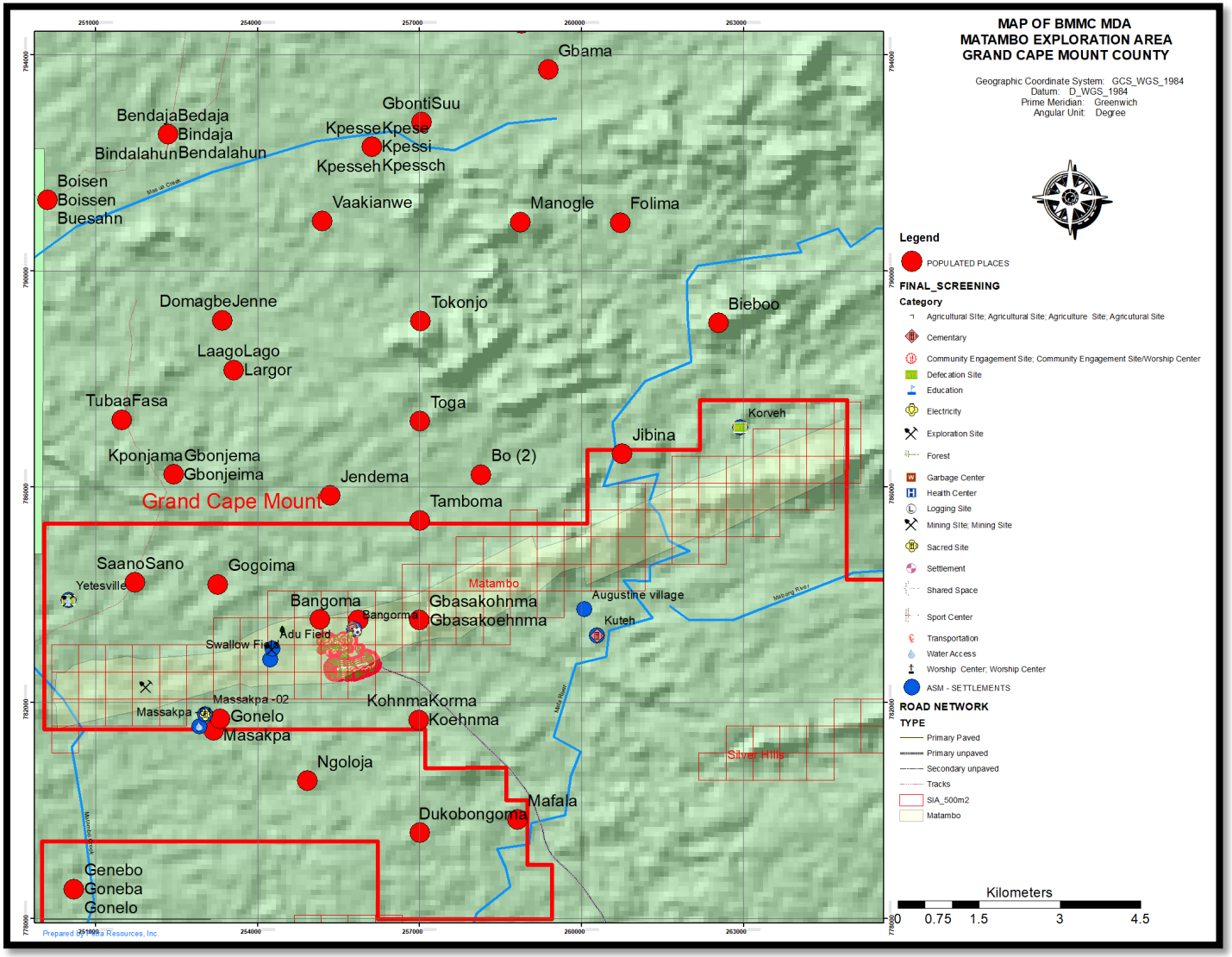


Figure 8: Stakeholder Engagement



Figure 9: Bangorma Public Elementary School

Social Screening Map



APPENDIX 6-3: SOCIAL ECONOMIC BASELINE (PETRA 2024)



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Contents

LIST OF TABLES 2
LIST OF FIGURES 2
EXECUTIVE SUMMARY 3
1.0 Project Description 4
2.0 Scope and Approach 6
2.1 Methodology 6
2.2 Project Awareness and Information 6
2.3 Survey Duration 7
3.0 SUMMARY OF FINDINGS 7
4.0 PHOTO DOCUMENTATION 9
APPENDICES 20
Appendix A: Points of Interests 21
Appendix B: List of Community Concerns / Issues 25

LIST OF TABLES

Table 1: Community engagement mode during field survey 6
Table 2: Summary of community thematic issues / concerns 8
Table 3: Community profile within study area 8

LIST OF FIGURES

Figure 1: SIA baseline map 5
Figure 2: Interview with Claim Owner at Pit 3 9
Figure 3: Proposed Pit 1 location, Bangorma 10
Figure 4: Proposed Camp Area, Bangorma Town 11
Figure 5: Connections of water bodies in the Proposed Pit 1 12
Figure 6: Gogoima Village 13
Figure 7: Korma Village 14
Figure 8: Massakpa 2 Creek 15
Figure 9: Engagement with Claim Owner at Proposed Pit3 16
Figure 10: Community Engagement @ Yatesville 167
Figure 11: Chinese Miners Camp Near the Haul Road 18
Figure 12: Korma Village 19

EXECUTIVE SUMMARY

Bea Mountain Mining Corporation [BMMC] is seeking to develop potential gold mineralization within its Mineral Development Agreement [MDA] area, specifically by establishing an open pit gold mine within the historically artisanal and small – scale mining area of Matabmo, Grand Cape Mount County. The proposed Matambo project area is located approximately 10.0km northeast of the New Liberty Gold Mine [**NLGM**]. The project Matambo project area is host to a vast amount of artisanal small-scale mining [**ASM**] activities located West of the Mafa River.

As part of its obligations of ensuring environmental and social protection for both the environment and the community for where BMMC operates; an Environmental and Social Impact Assessment [ESIA] was commissioned by BMMC to document the potential environmental and social impacts that may result from the construction or operations of the proposed mine.

Petra Resources, Inc. an independent licensed and certified EPA licensed environmental evaluator, conducted a social impact assessment for the proposed mine. Following the preliminary mine design layout, PRI conducted a site assessment around all the proposed supporting mine infrastructures and documented points of interest [PoIs]; these points of interests are related to existing communities' individuals and shared socio – economic infrastructures and or livelihoods.

The proposed open pit mine site design and layout seeks to construct the following supporting mining infrastructures:

- Camp Site
- Haul Road
- Central Open Pit
- Ore Stockpile for Central Open Pit
- Waste Rock Dump for Central Open Pit
- Central West Open Pit
- Heap Leach Stockpile Area
- Saprolite and Stockpile Area [Central West Open Pit]
- West West Open Pit
- West Waste Rock Dump
- West Saprolite and Stockpile Area, and
- Heavy Mining Equipment Workshop Area

PRI created a study area measuring approximately 1904ha with each cell grid measuring 400m$^{2.}$ The study area was determined by measuring a 500m radius from the center of proposed pit 1 near Bangorma Town. Data collection was undertaken in each of the grid cells across this area and documented all the potential points of interest. The data

collection exercise was also used as an opportunity to directly engage stakeholders across the study area to provide project information, as well as allowing them the opportunity voice their concerns and or support for the project.

The baseline assessment was conducted from 30th November – 13th December 2023. This report presents relevant project information used to engage communities at that time and the summary of findings from the baseline data collection exercise.

1.0 Project Description

BMMC is seeking to construct, operate and manage three open pits at Matambo. The project will include the construction of an open – pit mine, a waste rock dump, and the construction of a previously permitted private haul road (approximately 10km) and other supporting infrastructures.

BMMC is seeking to document and understand the potential social impact of the Project on the surrounding communities, referred to as the project affected communities. Through this process of identification of social impacts, BMMC will develop appropriate mitigation measures to reduce potential negative impacts on project affected communities. Mitigating these impacts is critical for obtaining regulatory approval and continued compliance and enables the Company to maintain its social license to operate in the area.

In July 2021 Petra Resources, Inc. (**PRI**) conducted a high-level reconnaissance social impact assessment determine potential social impact of the proposed project. Following the completion of the reconnaissance survey, PRI presented its findings to BMMC.

In November 2023, BMMC formally began the formalization of the Environmental and Social Impact Assessment process in keeping with the national statues and guidelines which includes the following:

- Publication of the Notice of Intent
- Submission of an Environmental Project Brief
- Environmental and Social Impact Study
- Stakeholders Engagement and Consultations
- Submission of Environmental and Social Impact Study Report
- Submission of Environmental and Social Impact Management Plan
- Implementation of Environmental and Social Impact Management Plan

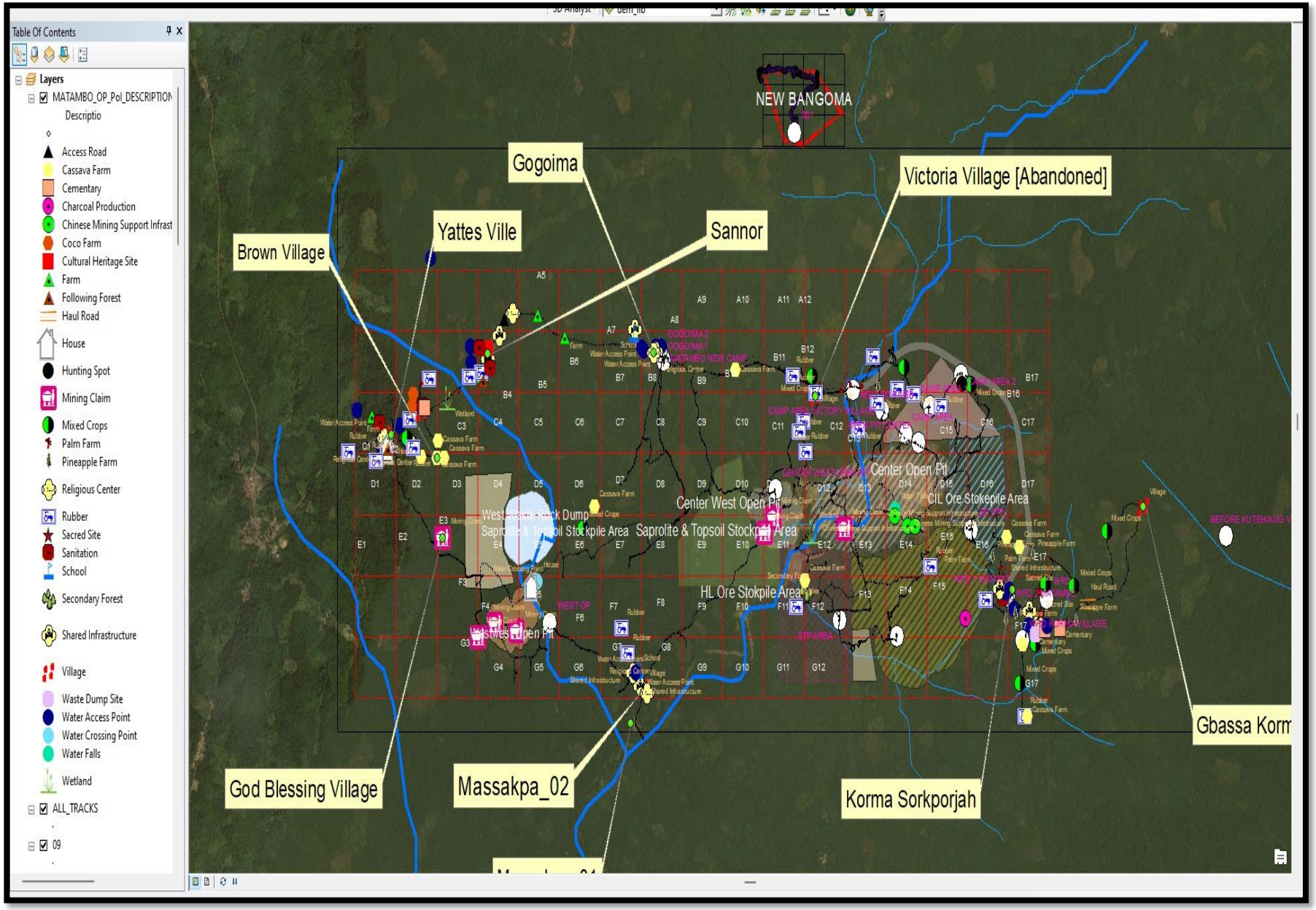


Figure 1: SIA baseline map

2.0 Scope and Approach

2.1 Methodology

To ensure a thorough assessment around all the proposed infrastructures and community assets, a grid of 400m^2 was established; the assessment involved documenting any socio-economic assets within each grid. The documentation included:

- Demographics
- Leadership
- Natural Hazards
- Cultural Heritage
- Nutrition & WASH Services / Infrastructures
- Community & Gender Equality Issues
- Community and Shared Infrastructures
- Religion / Traditional Practices
- Health
- Trade and Commerce
- Education
- Security

2.2 Project Awareness and Information

The field assessment also consisted of providing project awareness and information in keeping with national and international standard of the Free Project Information and Consent [FPIC] act. The following communities were directly engaged either via provision of project information document, prior notice, or installation of suggestion / grievance box within the community.

Community / Institution	Engagement Mode			
	Prior Notice	Project Information Document	Grievance / Suggestion Box	Verbal Notice
Bangoma Town	☒	☒	☒	☐
Gogoima Town	☒	☒	☒	☐
Saanor Village	☒	☒	☒	☐
Yattesville Village	☒	☒	☐	☐
Massakpa_01 & Massakpa_02	☒	☒	☒	☐
Korma Sorkporjah	☒	☒	☒	☐
God Blessing Village	☒	☒	☐	☒
Brown Village	☒	☒	☐	☒

Table 1: Community engagement mode during field survey

2.3 Survey Duration

The field survey was conducted from 30th November – 13th December 2023.

3.0 SUMMARY OF FINDINGS

During the survey a total of 146 points of interests [Appendix A]. were documented spatially and a physical description of each documented. A total of 30 topics across 11 socio – economic areas [Appendix B] were also documented as concerns from the communities encountered.

During the survey several communities were engaged and documented, as very little prior information existed in the study records for them.

A summary of the issues / concerns raised is presented in the table below, while Appendix B contains the details.

Water Pollution	Employment	Compensation	ASM Benefits	Road Rehabilitation	Health Care Access	Social Cohesion	Air Quality	Noise & Vibration	School	Sanitation
6.0	3.0	3.0	4.0	3.0	2.0	2.0	1.0	1.0	3.0	2.0

Table 2: Summary of community thematic issues / concerns

Table below provides a summary of the community profiles.

Village_Name	X_Coord	Y_Coord	Ave_POP.	Pop. Matrix	Appro. # of Structures	Age of Town	Leadership_Type	Leadership
Yatesville	250507	783452	200	Mostly Women	40	70	Town Chief	George Brown
Sanor town	251515	783981	450	Mostly Children	60	78	Town Chief	Foday Fahnbulleh
Brown Village	250870	783603	50	Mostly Women	4	83	Town Chief	
Korma Sokporjah	256827	782299	1615	Mostly Children	82	109	Dean Elder	Foday S. Tamon
Gbassakorma	257946	782984	NA	NA	NA	NA	NA	NA
Bangorma	255792	783364	4300	Mostly Children	339	109	Town Chief	Boakai Kemokai
Massakpa_01	252916	781565	500	Mostly Children	50	250	Town Chief	Lamie Dasalia
Massakpa_02	253041	781800	500	Mostly Women	60	63	Town Chief	Gbessay Massaley
Victoria Village	254730	783707	NA	NA	NA	NA	NA	NA
Gogoima	253140	783986	1250	Mostly Children	125	109.0	Dean Elder	Boakai Sonii
Godblessing Village	251074	782772	19	Mostly Men	3	4	Camp Master	Victor Yates

Table 3: Community profile within study area

4.0 PHOTO DOCUMENTATION

MATAMBO PHOTO LOG



Figure 2: Interview with Claim Owner at Pit 3



Figure 3: Proposed Pit 1 location, Bangorma



Figure 4: Proposed Camp Area, Bangorma Town



Figure 5: Connections of water bodies in the Proposed Pit 1



Figure 6:Gogoima Village



Figure 7: Korma Village



Figure 8: Massakpa 2 Creek



Figure 9: Engagement with Claim Owner at Proposed Pit 3



Figure 10: Community Engagement @ Yatesville



Figure 11: Chinese Miners Camp Near the Haul Road



Figure 12: Korma Village

APPENDICES

Appendix A: Points of Interests

Appendix B: List of Community Concerns / Issues

Appendix A: Points of Interests

Infrastructure	POI	X_Coord	Y_Coord	Potential Construction Impact
WestWest Open Pit	Massakpa 1	252916	781565	*Water pollution * Dust pollution impact *Noise pollution impact
	Massakpa 2	253041	781800	*Water pollution * Air pollution impact *Noise pollution impact
	Pump	253032	781787	Water pollution due to construction activities upstream
	Hall	253009	781809	No potential impact
	Mosque	253077	781765	Potential removal
	Mining claim	251586	782217	Potential removal
	Mining claim/Village	251074	782778	Potential removal
	Mining claim	251802	782172	Potential removal
	Mining claim	251420	782129	Potential removal
	School	252994	781916	Residual impact (increment in students)
	Toilet	252934	781897	No potential impact
	Field	252934	781897	No potential impact
	Pump	252971	781901	Water pollution due to construction activities upstream
	Farm	252892	782027	Potential removal
	Farm	252828	782186	Potential removal
Outside Infrastructure Area	Sanor town	251515	783981	Residual impact (population increase and traffic)
	Yatesville	250507	783452	Residual impact (population increase and traffic)
	Gogoima	253140	783986	Residual impact (population increase and traffic)

	Brown Village	250870	783603	Residual impact (population increase and traffic)
Center Open Pit	Farm	255961	783639	Potential removal due to construction activities
	Farm	255693	783714	Potential removal due to construction activities
	Farm	255600	783895	Potential removal due to construction activities
	Waterfall	255514	782965	Water pollution and disturbance of water flow upstream
	Farm	255536	783752	Potential removal due to construction activities
	Farm	256733	782717	Potential removal due to construction activities
	Farm	256862	782680	Potential removal due to construction activities
	Farm	255968	782675	Potential removal due to construction activities
	Farm	255857	782594	Potential removal due to construction activities
	Farm	254546	782329	Potential removal due to construction activities
	Forest	254638	782427	Potential removal due to construction activities
	Farm	254631	782498	Potential removal due to construction activities
	Tunnel	254690	782818	Potential removal due to construction activities
	Farm	255155	783487	Potential removal due to construction activities
	Farm	254981	783737	Potential removal due to construction activities
Camp Area	Farm	254510	783839	Potential removal due to construction activities
	Farm	254703	783839	Potential removal due to construction activities
	Farm	254782	783780	Potential removal due to construction activities
	Old Village	254730	783707	Potential removal due to construction activities
	Farm	254737	783724	Potential removal due to construction activities
	Farm	254617	783539	Potential removal due to construction activities
	Farm	254568	783472	Potential removal due to construction activities
	Farm	254634	783337	Potential removal due to construction activities
	Farm	255068	783781	Potential removal due to construction activities
	Farm	255337	783659	Potential removal due to construction activities

	Farm	255184	783766	Potential removal due to construction activities
Center Waste Rock Dump	Korma Sorkporjah	256827	782299	* Dust pollution from haul road * Noise from haul road traffic
	Town hall	256924	782204	No potential impact
	Pump	256907	782209	No potential impact
	Office	256897	782200	No potential impact
	Mosque	256938	782215	No potential impact
	Center	256827	782299	No potential impact
	School	256572	782398	Residual impact (increment of students)
	Toilet	256572	782387	No potential impact
	Pump	256601	782421	No potential impact
	Field	256537	782449	Potential water pollution
	Pump	256637	782441	Potential water pollution
	Pump	256679	782316	Potential water pollution
	Farm	256765	782081	No potential impact
	Pump	256823	782209	Potential water pollution from haul road construction
	Farm	256893	782092	No potential impact
	Gabbage	256893	782151	No potential impact
	Grave	256987	782185	No potential impact
	Creek	257004	782204	Water pollution from haul road construction
	Grave	257128	782192	No potential impact
	Charcoal	256203	782253	No potential impact
	Farm	257280	782245	Potential removal for waste rock dump
	Road	257400	782348	No potential impact
	Farm	257269	782466	No potential impact
	Farm	256992	782482	No potential impact

	Sande bush	256930	782433	Potential removal for waste rock dump construction
	Farm	256742	781835	Potential removal for waste rock dump construction
	Farm	256786	781613	Potential removal for waste rock dump construction
	Farm	256815	781614	Potential removal for waste rock dump construction
	Farm	256690	782289	Potential removal for waste rock dump construction
	Farm	256596	782246	Potential removal for waste rock dump construction
	Farm	256401	782374	Potential removal for waste rock dump construction
	Farm	256557	782579	Potential removal for waste rock dump construction
	Farm	256464	782657	Potential removal for waste rock dump construction
	Farm	256609	782787	Potential removal for waste rock dump construction
	Sande bush	256943	782290	No potential impact
West Waste Rock Dump	God Blessing Village	251074	782772	* Dust pollution * Noise pollution * Water pollution

Appendix B: List of Community Concerns / Issues

Date	Community	Name of Stakeholder	Role/Title	Contact	Issues Raised
6-Dec-23	Massakpa_02	Gbessay Massaley	Town Chief	N/A	The mining activities from upstream **has polluted our water downstream** which we **used for drinking** and it is not safe now.
6-Dec-23	Massakpa_02	Jenneh Kemoh	Chairlady	N/A	Teachers are not paid, and the **school building in Massakpa needs serious renovation**. The **road** that leads to the town is also **damaged** because of the **heavy machine** the company is using on the road. Two **boys almost died** early August 2023 because of the **rise in the water level** due to road construction and blockage of waterway.
06 – Dec - 23	Massakpa_01	Mohammed Roger	Head Man	N/A	**Machine sound** is giving them sleepless nights. When the machine is working, the ground or the **houses vibrate**. They consider themselves as **affected community, but the company is not recognizing that** because they don't currently have their land deed but it's in process. He stated that their **water is polluted**, at first, they used to fish in the water but now, no fish is in the water. He also said, they have **cleared the pit area** near the town **without the community consent**. When rain falls, **access to the town is difficult** because of the **rise in the water level** due to the road construction. The company promised that the road was going to be fixed – but nothing done to date.
06 – Dec -23	Massakpa_01	Lasanna K. Fahnbulleh		N/A	Community has reported the issue of **water pollution** to the Commissioner on multiple occasions; however, nothing has been done to address the issue. As a result, residents of the community have started **digging the banks of the Matambo River to get safe drinking water.**
06 – Dec -23	Massakpa_01	Cyrus Kolafala		N/A	He stated that the **air is polluted by the carbon** from the company machine and the **soil** as well because of the chemical.
	Massakpa_01	Jebbeh Kemokai	Chairlady	N/A	She stated that there is **no employment for the women**, and she also said that the **company is currently working in her farm without compensation**.

03-Dec-23	Korma-Sokporjah	Boikai Tamu	Citizen	N/A	When it comes to health care, Electoral participation, and all Governmental issues, **we do all in Bangorma**. Now that the town will be relocated, what becomes of all **these services**?
03- Dec -23	Korma-Sokporjah	Yatta Talawalley	Mid-wife	N/A	We are **Mid-wives, and we practice only at the Government clinic** located at **Bangorma**, and now that the relocation be done with the facility, what becomes of our need to **that service**?
03 – Dec - 23	Korma-Sokporjah	Henry B. Sackie	Citizen	770982777	Korma-Sorkporjah, Wojah,Dugbor-gongorma, Shireff village, Augustine village, Kuteh ,Gogoima, Massakpa 1&2,Jenedamah,Boo-Mafa, and Toogaii are **catchment communities attached to the clinic in Bangorma to address their health needs**. Now the **relocation is going to take away the clinic** that we will be **struggling to reach**. What will be done for us in this direction?
03 – Dec -23	Korma-Sokporjah	Massa Talawalley	Speaker of the Women	777812782	How will we gain access to Jenewonday and Kenjor, if the company take over Bangorma and **others route that connect us to these places**?
03 – Dec - 23	Korma-Sokporjah	Boakai Tamu	Quarter Chief Tamu quarter.		We used to **access Kinjor by bush road**, now the haul road has completely made it **impossible for us to get Kinjor.** We are asking the Company to please make a way for us to gain access to Kinjor. We **live by the river Mafa, eat from the river, and do many other things with the river, now the river is blocked and we are unable to eat from it no longer**.
03 – Dec - 23	Korma-Sokporjah	James Tamu	Citizen		Complained that his **crops got damaged** during the construction of the haul road. According to him, all efforts made to address the issue of his crops has proven fruitless. He's also asking that the **company address issue surrounding his damaged crops.**
03 – Dec - 23	West_West Open Pit	Movie	Claim owner	N/A	Concerned about **employment benefits** if they are relocated from the mountain.
06- Dec -23	West_West Open Pit	Nauahah A. Massalay	Claim owner	7779037280	What will become of my **artisanal mining equipment and manpower (laborers), who will compensate for them** as we are hearing that the mine claims will be taken over by the Company?
06 – Dec -23	West_West Open Pit	Jusu Massalay	Asst. Field Manager	770510163	Will the **miners be given the privilege to recommend some field workers for employment** with the company?
06 – Dec - 23	West_West Open Pit	Sando Golafaley	Field Manager	779037280	What will become of **me and my pit workers** in term of benefits.
06 – Dec - 23	West_West Open Pit	Sando Paul	Claim owner	777143522	Will the Company **relocate us to another mining claim,** or we ourselves will find another place to work?
13 – Dec - 23	Gogoima	Patrick J.Conteh	Patrick J.Conteh	881119954	We are appealing to the company for the **reconditioning of our school**.

13 – Dec -23	Gogoima	Dean Elder	Boakai T.Sonnii	N/A	Our community Elders should be given some level of compensation because our eating ground has been taken over by the company.
13 – Dec - 23	Gogoima	I.Daniel Rogers	Town Chief	N/A	Our **drinking water has been polluted** by the company **septic tank leakage running into our drinking creek**. Our handpump is not sustainable to provide drinking during the dry season. Our working area that provide some means of livelihood for our people has been taken over by the company, therefore, the company should be able to absorb our people for employment.
05 – Dec -23	Sannoh	Foday J. Kamara	Youth Chairman	N/A	Complain that their **drinking water is affected** by the company activities upward. Want BMMC to build toilet facility for them.
05 – Dec -23	Yattesville	Dorathy Varney	Citizen	N/A	Is appealing to the company to provide **water, toilet, and Town Hall facilities** for Yattesville.

CHAPTER 7
ENVIRONMENTAL IMPACT AND RISK ASSESSMENT METHODOLOGY

TABLE OF CONTENTS

7 ENVIRONMENTAL IMPACT AND RISK ASSESSMENT METHODOLOGY 7-1

7.1 IDENTIFICATION AND DEFINITION OF IMPACTS 7-1
7.2 IMPACT SIGNIFICANCE RATING 7-1
7.3 ACTIVITIES THAT MAY IMPACT THE RECEIVING ENVIRONMENT 7-4
7.3.1 Construction Phase Activities 7-4
7.3.2 Operational Phase Activities 7-4
7.3.3 Closure And Decommissioning Phase Activities 7-4

LIST OF TABLES

TABLE 7-1: CRITERIA FOR ASSESSING THE SIGNIFICANCE OF IMPACTS 7-2
TABLE 7-2: SIGNIFICANCE RATING MATRIX 7-3
TABLE 7-3: POSITIVE/ NEGATIVE MITIGATION RATINGS 7-4

7 ENVIRONMENTAL IMPACT AND RISK ASSESSMENT METHODOLOGY

7.1 IDENTIFICATION AND DEFINITION OF IMPACTS

The first phase of impact assessment is the identification of the various project activities which may impact upon the identified environmental aspects. The identification of significant project activities is supported by the identification of the various receiving environmental receptors and resources. These receptors and resources allow for an understanding of the impact pathways and assessment of the sensitivity of the receiving environment to change. The significance of the impact is then assessed by rating each variable numerically, according to defined criteria as provided in TABLE 7-1.

7.2 IMPACT SIGNIFICANCE RATING

The purpose of the significance rating of the identified impacts is to develop a clear understanding of the influences and processes associated with each impact. The severity (magnitude), spatial scope and duration of the impact together comprise the consequence of the impact; and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read from a significance rating matrix as shown in TABLE 7-2 and TABLE 7-3.

The model outcome of the impacts is then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes are adjusted. Arguments and descriptions for such adjustments, as well as arguments for each specific impact assessments are presented in the text and encapsulated in the assessment summary table linked to each impact discussion.

.

TABLE 7-1: CRITERIA FOR ASSESSING THE SIGNIFICANCE OF IMPACTS

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
SPATIAL SCOPE OF IMPACT	**RATING**
Activity specific	1
Area specific	2
Whole project site / local area	3
Regional	4
National	5
DURATION OF IMPACT	**RATING**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5
FREQUENCY OF ACTIVITY / DURATION OF ASPECT	**RATING**
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
FREQUENCY OF IMPACT	**RATING**
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

CONSEQUENCE

LIKELIHOOD

Activity: a distinct process or task undertaken by an organisation for which a responsibility can be assigned.

Environmental aspect: an element of an organisation's activities, products or services which can interact with the environment.

Environmental impacts: consequences of these aspects on environmental resources or receptors.

Receptors: comprise but are not limited to people or man-made structures.

Resources: include components of the biophysical environment.

Frequency of activity refers to how often the proposed activity will take place.

Frequency of impact refers to the frequency with which a stressor will impact on the receptor.

Severity: refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

Spatial scope: refers to the geographical scale of the impact.

Duration: refers to the length of time over which the stressor will cause a change in the resource or receptor.

TABLE 7-2: SIGNIFICANCE RATING MATRIX

CONSEQUENCE (SEVERITY + SPATIAL SCOPE + DURATION)															
LIKELIHOOD (FREQUENCY OF ACTIVITY + FREQUENCY OF IMPACT)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

TABLE 7-3: POSITIVE/ NEGATIVE MITIGATION RATINGS

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-High	76-100	Improve current management	Maintain current management
	Low-Medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very Low	1-25	Maintain current management	Improve current management

7.3 ACTIVITIES THAT MAY IMPACT THE RECEIVING ENVIRONMENT

The key project activities for the Matambo Open Pit Mine Project upon which the impact assessment was based are described in the project description chapter. These activities are summarized below per project phase.

7.3.1 Construction Phase Activities

- Compaction of laydown areas and construction areas;
- Establishing haul road and access roads;
- Transportation of construction material to the site;
- Material required to construct mine related infrastructure;
- Construction and the laying down of support infrastructure;
- Construction of the water management and reticulation network;
- Servicing of equipment and machinery;
- Pumping of fuel;
- Demarcation and signage of heritage sites;
- Establishment of a consumables storage facility; and
- Installation of power supply infrastructure.

7.3.2 Operational Phase Activities

- Development of three open pits;
- Open pit mining which includes blasting;;
- Establishing low-grade ore stockpiles;
- Stockpiling of ore material at the existing Run of Mine stockpile;
- Establishing two Waste Rock Dump (WRD) facilities;
- Transporting of ore to the processing plant at NLGM;
- Use of the haul roads and access roads; and
- Progressive rehabilitation

7.3.3 Closure And Decommissioning Phase Activities

- Removal of certain infrastructure;

- Removal and rehabilitation of the storm water management infrastructure;
- Treatment/removal of any contaminated soil;
- Rehabilitation of access roads by ripping and allowing natural vegetation to recolonize if they will not be used by villagers;
- The storm water management infrastructure will remain permanent features;
- Ripping of non-backfilled infrastructural footprint areas;
- Establishment of vegetation; and
- Environmental monitoring of decommissioning activities.

CHAPTER 8
PHYSICAL IMPACTS

TABLE OF CONTENTS

8 PHYSICAL IMPACTS 8-3

8.1 SURFACE WATER QUANTITY 8-3
8.2 GEOHYDROLOGY 8-3
8.2.1 Construction Phase 8-3
8.2.2 Operational Phase 8-3
8.2.3 Long Term Post-Closure Phase 8-4
8.3 SOILS AND LAND CAPACITY 8-5
8.3.1 Construction Phase Impacts 8-7
8.3.2 Operational Phase Impacts 8-8
8.3.3 Decommissioning & Closure Phase Impacts 8-8
8.4 GREENHOUSE GAS EMISSIONS 8-9
8.4.1 Potential Effects of Climate Change on the Project and Community 8-9
8.5 NATIONAL GHG STRATEGY AND PLANS 8-10
8.5.1 Liberia's National GHG Strategy and Plans 8-10
8.5.2 Project GHG Emissions 8-10
8.6 AIR QUALITY 8-11
8.6.1 Impact Significance Rating 8-11
8.7 NOISE 8-12
8.7.1 Impacts 8-12
8.7.2 Impact Significance Rating 8-13
8.8 VIBRATION AND BLASTING 8-13
8.8.1 Impacts 8-14
8.9 PHYSICAL IMPACT MATRIX 8-17

LIST OF FIGURES

FIGURE 8-1: SOILS AND AGRICULTURE SENSITIVITY 8-6
FIGURE 8-2: FLY ROCK IMPACT ZONE POST MITIGATION 8-16

LIST OF TABLES

TABLE 8-1: GREENHOUSE GAS EMISSIONS INVENTORY 8-10
TABLE 8-2: LIST OF RECEPTORS FOR BLASTING IMPACT 8-14

LIST OF APPENDICES

APPENDIX 8-1: PHYSICAL IMPACT MATRIX..... 8-18

8 PHYSICAL IMPACTS

The following sections provide a summary description of the primary impacts of the Project activities on physical environmental aspects including Hydrology, Geohydrology, Air Quality, Noise, Ecological as well as Blasting and Vibration.

The impact ratings before and after mitigation measures are implemented are provided in APPENDIX 8-1. Mitigation measures are discussed in detail in Chapter 14 of the ESIA Report.

8.1 SURFACE WATER QUANTITY

Based on the proposed project activities, the following potential impacts to surface water were identified:

- Minor decrease is expected to site surface water quantity for both the SW-East and SW-West CMA's
- Minor reduction to flood peaks and volumes with an average of roughly 5% reduction,[1]
- Slightly reduced mean annual runoff (MAR).

8.2 GEOHYDROLOGY [2]

The geohydrological assessment was conducted based on the available information, preliminary site work data and the numerical groundwater flow and contaminant transport modelling results.

During the risk assessment the risk to the groundwater levels and quality were evaluated. Each of the identified risks was then rated as per the discussion in Chapter 7 of this ESIA.

8.2.1 Construction Phase

Minor groundwater inflow could be expected during initial overburden removal. No material impact on surrounding groundwater levels is foreseen. Mine water should be discharged in settling ponds to mitigate the expected high suspended solids load, before releasing it in the environment.

8.2.2 Operational Phase

8.2.2.1 Open Pit Dewatering

Abstraction of groundwater (and surface water) from the proposed open pit workings will generate dewatering cones (groundwater drawdown) in the surrounding aquifer units. The extent of the mine dewatering cone is currently being quantified through numerical groundwater modelling.

The extent of groundwater drawdown at the open pits would most likely be site specific for both the Matambo Center and West sites. The potential impact associated with open pit dewatering include:

- Potential impact of community wells, situated in the Bangoma village next to the proposed Matambo Pit 1. Eight (8) potential community wells were identified at this locality of which 3 are located within the pit footprint area and hence will be destroyed by mining. It is our understanding that the Bangoma community will be relocated by the mine to a new village site outside the impact zone of the mine, namely New Bangoma. The potential impact on community wells will, therefore, be mitigated by the relocation process with water being supplied to the community by the mine.

  The northern upstream villages of Yatesville/Bakana, Saano and Gogoima are more than 1.2 km away from the proposed 3 mining pits and the Korma Sokporjah and Massakpa villages to the south(east) are 950 to 1000 m away from the Matambo Pit 1 and Matambo Pit 3 respectively. Based on the distance to village wells and the short duration of mining (2 years), it is unlikely that mine dewatering would have an impact on these community wells.

- Some loss in stream baseflow contribution is expected due to the development of the dewatering cones around the open pit areas. Mean annual runoff for the Matambo River catchment at Matambo East is about 74.25

[1] Peens and Associates – Matambo Surface Water Quantity Assessment 2024
[2] Geostratum – Matambo Hydrogeology Assessment 2024

Mm^3 and for the tributary at Matambo West about 27.92 Mm^3. The large runoff volumes will far overshadow the loss in groundwater contribution to surface water flow. High-level indications are that this groundwater baseflow contribution loss could be less than 2 % of surface runoff. Groundwater (and surface water) discharge from the open pits will compensate for this groundwater baseflow component loss and the potential impact was rated as having a ***Low*** significance.

8.2.2.2 Mine Water Discharge into The Matambo River Drainage System

Pit contact water is likely to be non-acidic, however, it could contain elevated salts and metals compared to pre-mining ambient groundwater quality.

The mine water will contain suspended solids. Open pit water should be discharged in settling ponds/dams or the open pit sump to mitigate the expected high suspended solids. Open pit water could furthermore become enriched in nitrate due to ammonium nitrate (or other nitrogen compound) explosives used in the mining process.

Mine water quality predictions and monitoring are proposed which should be used with a mass balance model to quantify the potential impacts on stream water quality. The site is situated in a high rainfall area and current surface water quality data for other similar operations on the New Liberty Gold Mine property suggests that sufficient dilution of mine is taking place, downstream of the mine (Geostratum, 2023).

With the correct management measures, the impact could be of ***Low*** to ***Low-Medium*** significance.

8.2.2.3 Waste rock dumps

Environmental geochemical test work was undertaken to characterise potential leachate from waste rock material. The data from the acid base accounting and NAG tests can be used classify material as either “potentially acid forming” (PAF), “non-acid forming” (NAF) or “uncertain”. The data from the NAG tests strongly suggest that all the tested samples could be classified as NAF.

Potential plume migration for both the Matambo East (Center) and West waste rock dumps would be affected by open pit dewatering. It is expected that contaminant migration would be towards the groundwater drawdown cones around the open pits.

The groundwater quality risk will be over a small area (site specific) and it is not expected that the contaminant plumes will reach community water supply points during the operational phase. The potential impact will remain post-mining and the risk was therefore rated as ***Low-Medium***.

8.2.2.4 Low-grade Ore and Other Ore Stockpile Areas

The Matambo Center low-grade ore stockpile is situated adjacent to the Matambo River and it is critical to allow for proper storm water management. Contact water and sediment wash should be captured and runoff/seepage discharge should preferably only take place if the quality complies to the Liberian Third Schedule - Part B (EPA, 2018) an IFC Mining Effluent Guidelines (2007).

Potential groundwater contamination from the low-grade ore stockpile could migrate to the Matambo River and could potentially impact the stream quality. It is expected that the groundwater plume would have a low to low-medium impact on stream water quality. The life-of-mine is relatively short which will limit the potential impact. The heap leach stockpile site could be rehabilitated at closure after transferring the ore to the Heap leach Facility.

A similar approach should be followed for other runoff mine (ROM) and ore stockpile sites across the proposed mine. These include proper site preparation and compaction of the foundation material, stormwater management and rehabilitation once decommissioned.

8.2.3 Long Term Post-Closure Phase

8.2.3.1 Groundwater Levels and Open Pit Decant

In the post operational environment, the groundwater levels within the aquifers surrounding the mine will start to recover. The open pits will flood after dewatering stops and is likely to decant on surface (pit lake overflow or spillage) after a few years, into the Matambo River. It is also our understanding that induced flooding of Matambo 2 West pit would take place by temporary diverting river water into the mine void.

The potential impact from the decanting pits will be of ***Low*** significance. The exposed part of the flooded pit will contain saprolitic rock (and most likely the pit lake water level zone, including the fluctuation zone and the upper oxidation zone, e.g. the epilimnion). The saprolite does not normally pose a significant contaminant risk and with the high surface runoff it is not expected to have a material impact on stream water quality. The impact must be qualified in more detail during mine implementation and again before closure.

8.2.3.2 Waste Rock Dumps

Potential ongoing groundwater contamination could take place from the waste rock dump areas. The groundwater plumes will not impact community water supply points. The potential impact on the Matambo River quality, although seen as a ***Low*** to ***Low-Medium*** risk, will require regular water quality monitoring.

It is advisable to rehabilitate the waste rock dumps with a topsoil and saprolite cover to ensure noncontact surface runoff and potentially slightly better subsurface seepage quality.

8.3 SOILS AND LAND CAPACITY [3]

The footprint of the proposed expanded mining area forms much larger part of the Mineral Development Agreement (MDA), with some areas already disturbed and new areas that will require clearing of soils. Impacts are identified at their source and traced through the potential pathways to the receptor. This helps in an understanding of the impacts' significance in relation to the sensitivity of the receiving environment.

The soils associated with the areas that are to be disturbed by the mining and its associated activities are rated as moderately sensitive to non-sensitive in nature and will be moderately easy to work on and with. Un-managed soil stockpiles and soil that is left uncovered/unprotected (cleared areas etc.) will be lost to wind and possibly water erosion, loss of nutrient store and inherent fertility, and exposure to compaction.

Of a more positive impact will be the concurrent rehabilitation of all temporary infrastructure used during the start-up and construction phase where rehabilitation can be implemented.

[3] Earth Science Solutions – Matambo Soil and Land Capability Assessment 2024

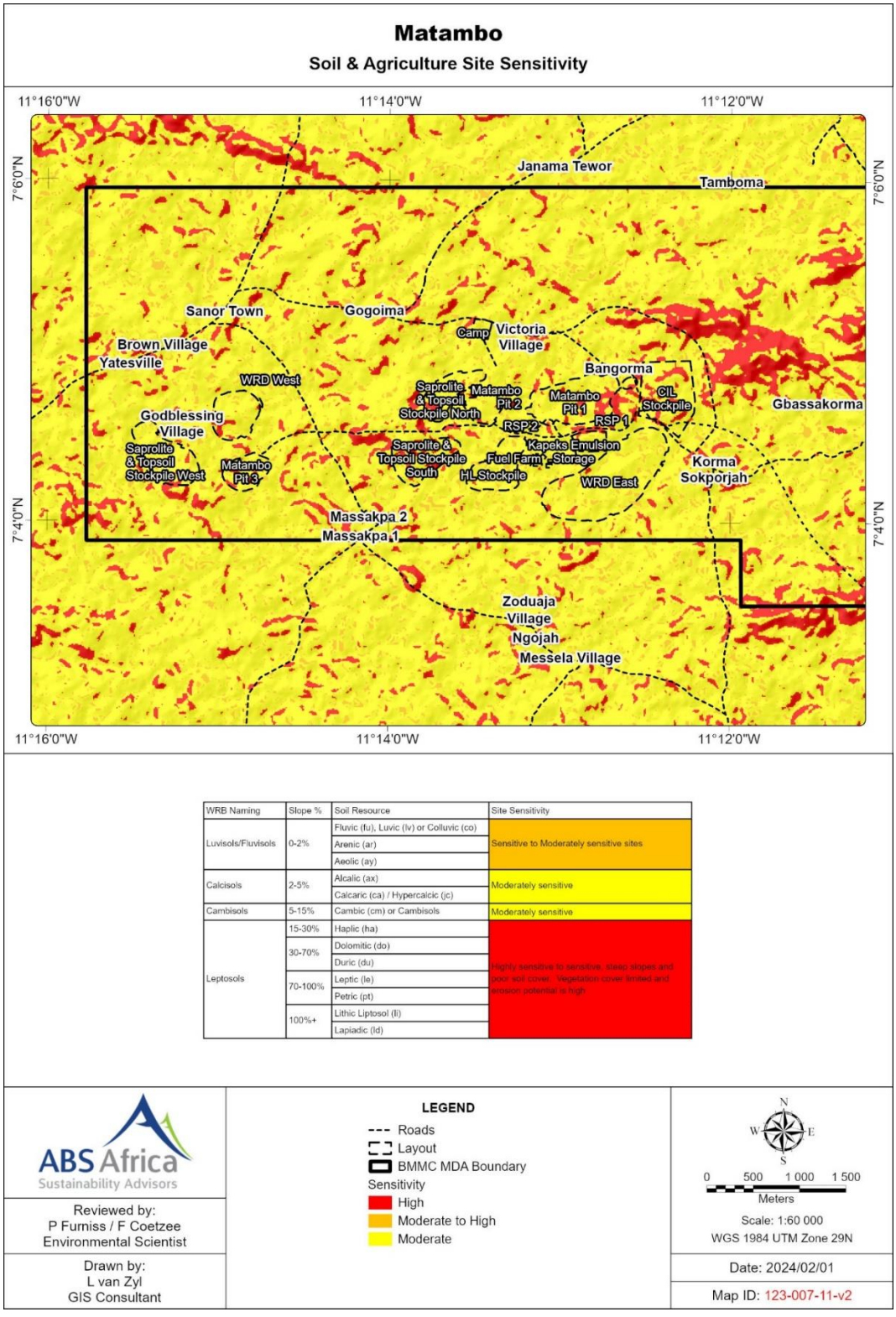


FIGURE 8-1: SOILS AND AGRICULTURE SENSITIVITY

These impacts can however be managed and reduced to acceptable levels with well-designed and implementable mitigation. Impacts are delineated for each phase of the LOM:

8.3.1 Construction Phase Impacts

The open pit mining and construction of the support infrastructure will entail the removal and stockpiling of significant quantities of soil, as well as the complete removal of soil and soft overburden in places where open pit mining is planned and where the foundations for the larger structures are to be excavated.

These impacts will be most dominant during the construction phase but will continue throughout the operation and into the decommissioning phase, the open cast mining voids and Waste Rock Stockpiles/Dumps being permanent features that will be left un-mitigated in the landscape. The main impacts will include the loss of land use and utilisable resource (sterilisation and erosion), compaction and possible contamination or salinisation.

Overall, the construction phase will require:

- The de-vegetation of the footprint areas and the exposure of the soils for all areas that are to be disturbed;
- The stripping of all utilisable soil prior to construction;
- The preparation (levelling and compaction) of lay-down areas, foundations and pad footprint areas for stockpiling of utilisable soil removed from the infrastructural footprint areas;
- The clearing, stripping and stockpiling from the construction of all access and haulage roads, the camp, workshops and fuel farm, water and electrical reticulation servitudes; and
- The use of heavy machinery over unprotected soils.

The impacts described are confined to the mining footprint, for all but the effects that might be felt outside of the immediate area of disturbance due to downwind and downstream influence of dust and erosion by water, both of which could affect downstream receptors and the users.

8.3.1.1 Impact Significance

The sterilisation (loss of the utilisation of the soil) resource will impact the land use (subsistence/rough grazing and the natural wilderness) status of the areas to be disturbed. These activities are of social and to some extent economic benefit to the local people, the ecosystem services and receiving environments.

The construction of the mining infrastructure and its support activities will, if un-managed and without mitigation have a variance of impacts based on the duration and spatial extent/scale of the disturbance planned.

The impacts and their significance will include:

- A definite high negative impact on the environment due to the loss of the soil area and the ecosystem services (use of soils for food production etc.) on the activities associated with the permanent infrastructure (WRD and Open Pit Mining);
- A definite medium negative impact on the environment due to the loss of the soils and ecosystem services on the activities associated with the support infrastructure as listed. These activities are considered medium or Low negative but reversable;
- A definite medium or high negative impact due to contamination (hydrocarbon and reagent chemical spills, raw materials and spillage of the raw product), compaction of working/laydown areas and storage facility footprint areas and the potential for erosion (wind and water – dust and suspended solids) over unprotected areas;
- The continuation of impacts throughout the construction phase and into the operational phase, and
- The impacts being confined to the site.

8.3.1.2 Residual Impacts

The management procedures outlined in Chapter 14 will likely reduce the significance of the impacts to ***Medium*** or ***Low*** in the medium term for all areas other than the Open Pits and WRD. These features will remain at a ***Medium*** to ***High*** significance rating.

8.3.2 Operational Phase Impacts

Loss of utilisable resource (Sterilisation and erosion), compaction, de-nutrification and contamination or salinisation. Un-managed soil stockpiles and soil that is left uncovered/unprotected (cleared areas etc.) will be lost to wind and possibly water erosion, loss of nutrient store and inherent fertility, and exposure to compaction.

- The sterilisation of the soil resource on which the facilities are constructed. This will be an on-going loss for the duration of the operation for all but the WRD and the Open Cast Mining areas that will be sterilised permanently.
- The creation of dust and the possible loss (erosion) of utilisable soil down-wind, and the deposition and contamination by sediments within the freshwater environment.
- Compaction of the in-situ and stored soils and the loss of ecosystem services (soil nutrient stores and utilisation potential).
- Contamination of the soils by dirty water run-off and/or spillage of raw materials and/or hydrocarbons from vehicle and machinery or from spillage and dust from the transported materials.
- Contamination of soils by use of dirty water for road wetting and general dust suppression.
- Sterilisation and loss of soil nutrient pool, organic carbon stores and fertility of stored soils.
- Impact on soil structure and soil water balance.

Un-managed soil stockpiles and soil that is left uncovered/unprotected (cleared areas etc.) will be lost to wind and possibly water erosion, loss of nutrient store and inherent fertility, and exposure to compaction.

Of a more positive impact will be the concurrent rehabilitation of all temporary infrastructure used during the start-up and construction phase where rehabilitation can be implemented

8.3.2.1 Impact Significance

The mining operations and its associated activities will have a medium or possibly high negative significance rating for the un-mitigated impacts associated with the operational phase of the project. The impacts are likely to last for the life of the operation (permanent to irreversible if not rehabilitated) and confined to the site or immediate vicinity. The frequency is likely to be continuous for all but the Open Cast Pits and the WRDs that are permanent and irreversible.

It is inevitable that some of the soils will be lost during the operational phase if they are not well managed and a mitigation plan is not implemented as part of the general management schedule.

However, the impacts on the soils during the operational phase (stockpiled, peripheral soils and downstream [wind and water] materials) can be mitigated with well designed and implemented management procedures.

8.3.2.2 Residual Impact

In the long term (Life of the operation) and if implemented correctly, the above mitigation measures will reduce the impact on the utilisable soil reserves (erosion, contamination, sterilization), and result in a reduction in the significance rating.

However, if the soils are not retained/stored and managed, and a workable management plan is not implemented, the residual impact will remain elevated and result in the impacting of secondary areas (Borrow Pits etc.) in order to obtain cover materials for the rehabilitation process that will need to be undertaken. Closure will then definitely incur additional costs.

8.3.3 Decommissioning & Closure Phase Impacts

Net loss of soil volumes and utilisation potential due to change in material status (Physical and Chemical) and loss of nutrient base.

The impacts on the resource are both positive and negative, with:

- The loss of the soil's original nutrient store and organic carbon due to leaching of the soils while in storage or if left exposed.
- Erosion and de-oxygenation of materials while stockpiled.
- Compaction and dust contamination due to vehicle movement while rehabilitating the area.
- Erosion due to slope stabilisation and re-vegetation of disturbed areas.
- Contamination of replaced soils by dirty water ingress and dust suppression on roadways.
- Hydrocarbon or chemical spillage from contractor and supply vehicles.
- Positive impacts of reduction in areas of disturbance and return of soil utilization potential, uncovering of areas of storage and rehabilitation of compacted materials.

8.3.3.1 Impact Significance

The impact will remain a net loss of the soil resource if no intervention or mitigating strategy is implemented. The significance rating will remain high or medium and negative if there is no active management (rehabilitation and intervention) in the decommissioning phase, and closure will not be possible. This will result in an irreversible impact that is continuous.

However, with well-engineered and implemented management, the negative impact can be improved to low negative as the soils are replaced and amelioration implemented.

On-going rehabilitation during the operational (temporary infrastructure used during exploration and construction phase) and decommissioning phases will bring about a net long-term positive impact on the soils. The land capability will likely be returned to wilderness status at best.

The negative impacts associated with the rehabilitation during decommissioning and closure will be medium due to the necessity for vehicle movement while demolishing infrastructure and rehabilitating the operational footprint(s). Dust will potentially be generated, and soil will probably be contaminated, compacted and lost due to erosion.

However, with well-planned and implemented rehabilitation and the reduction in the footprint of disturbance, the stabilising of slopes and where feasible the re-vegetation of disturbed areas there will be a reduction in the impact significance to ***Low.***

8.3.3.2 Residual Impacts

On closure of the project, the long-term negative impact on the soils will be reduced from a significance rating of medium or low if the management plan set out in the Environmental Management Plan is effectively implemented.

8.4 GREENHOUSE GAS EMISSIONS [4]

8.4.1 Potential Effects of Climate Change on the Project and Community

8.4.1.1 Temperature

With the increase in temperature there is the likelihood of an increase in discomfort and the possibility of heat related illness (such as heat exhaustion, heat cramps, and heat stroke). Both have the potential to negatively affect communities, staff performance and productivity. There is also the possibility of the overheating of equipment/machinery with effects on mine production.

8.4.1.2 Rainfall

An increase in rainfall may result in an increased possibility of flooding and erosion. As with temperature, significant changes in rainfall may require that the Project water balance, and corresponding water management strategy, be revised. Flooding may negatively affect food production.

[4] Airshed Planning Professionals – Matambo Air Quality Impact Assessment 2024

8.4.1.3 Secondary Effects

Changes in temperature and rainfall may also result in several secondary human health effects for staff and the community in the Project area. These may include:

- An increase in the number of cases of vector-borne diseases (e.g. malaria);
- An increase in the number of cases of water-borne diseases (e.g. algal blooms and cholera);
- An increase in the number of cases of bacteria-related food poisoning; and
- Lower crops yield, and nutritional quality of crops may result in communities developing dietary deficiencies.

8.5 NATIONAL GHG STRATEGY AND PLANS

8.5.1 Liberia's National GHG Strategy and Plans

In August 2018, Liberia ratified the Paris Agreement, and submitted its Nationally Determined Contribution (NDC) in 2021. In terms of the latter, Liberia aims reduce its economy-wide greenhouse gas emissions by 64% below the projected business-as-usual level by 2030. The strategy will be a combination of the following: unconditional GHG reductions of 10% below business as usual (BAU), resulting in an absolute emissions level of 11,187Gg CO_2e in 2030; with an additional 54% reduction conditional upon international support, which would result in an absolute emissions level of 4,536.64 Gg CO_2e in 2030.

Liberia is further committed, through several national programs and policies, including the Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategy, to reducing GHG emissions levels in line with its target. In demonstration of its commitment, the country has already submitted its forest reference emissions level to the Secretariat of the United Nations Framework Convention on Climate Change and aims to, among other things, achieve its Vision 2030 through a low-carbon, climate-resilient development pathway through the implementation and periodic updating of key national and climate change policies and action plans to achieve its targets.

8.5.2 Project GHG Emissions

A greenhouse gas emissions inventory was compiled for the proposed Matambo Project operations based on the estimated fuel usage of the vehicle fleet. Greenhouse gas emissions from vehicles hauling ROM from the Matambo Project to NLGM were not included in the inventory.

IPCC emission factors for Mobile Combustion (Chapter 3) as published in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories were used to estimate greenhouse gas emissions. For the greenhouse gas emissions inventory, a heat of combustion of 43.0 MJ/kg was used. The emission factors used for diesel combustion are 74 100kg CO_2/TJ for both mobile and stationary sources, 4.15 kg CH_4/TJ for mobile sources and 3.0 kg CH_4/TJ for stationary sources and 28.6 kg N_2O/TJ for mobile sources and 0.6 kg N_2O/TJ for stationary sources. A default diesel density of 832 kg/m³ was assumed.

TABLE 8-1: GREENHOUSE GAS EMISSIONS INVENTORY

NO	EQUIPMENT	POWER (kW)	ANNUAL AVERAGE FUEL CONSUMPTION (M³/A)	ANNUAL AVERAGE CO_2 EMISSIONS (TCO_2EQ/A)	ANNUAL AVERAGE CH_4 EMISSIONS (TCO_2EQ/A)	ANNUAL AVERAGE N_2O EMISSIONS (TCO_2EQ/A)	ANNUAL AVERAGE GHG EMISSIONS (TCO_2EQ/A)
8	Excavator PC1250	485	2 888	7 656.7	9.3	91.8	7 758
12	Drill Rigs Sandvick Pantera	250	2 233	5 920.1	7.2	70.9	5 998
10	Volvo A40G Truck	347	2 583	6 847.6	8.3	82.1	6 938
30	Dump Truck Komatsu 785 HD	895	9 993	26 492.4	32.1	317.5	26 842
4	Loader CAT 980H	265	789	2 091.8	2.5	25.1	2 119

4	Dozer CAT D9	337	1 003	2 660.1	3.2	31.9	2 695
3	Grader Cat 140M	174	389	1 030.1	1.2	12.3	1 044
3	Water Cars Mercedes 4142	340	759	2 012.8	2.4	24.1	2 039
2	Cylinder Bomag	115	171	453.9	0.5	5.4	460
3	Fuel Truck Mercedes 4142	340	759	2 012.8	2.4	24.1	2 039
10	Excavator PC850	363	1 621	4 298.0	5.2	51.5	4 355
6	Drill Rigs Sandvick Ranger DX800	168	625	1 657.6	2.0	19.9	1 679
Total			23 815	63 133.9	76.4	756.6	63 967

8.6 AIR QUALITY

The mine layout plan was finalised after the air dispersion modelling and impact assessment was concluded. The final layout for the Matambo Pit 1 and Pit 2 operations remains the same as the initial design, and while the Matambo Pit 3 location remains the same, the final location for the Matambo 3 WRD is approximately 250 m of the initially proposed location, while the final proposed location for the Matambo 3 topsoil stockpile is approximately 650 m southwest of the initially proposed location. The impact of these changes to the final layout are not expected to influence the results and findings of the air quality study, and the impact significance and air quality management recommendations remain unchanged.

Dispersion modelling simulations indicate that simulated concentrations of all pollutants were well below the WHO Air Quality Guidelines at all sensitive receptor locations surrounding the mining operations at the Matambo 2 and Matambo 3 open pits.

Simulated daily and annual average PM_{10}, $PM_{2.5}$ and NO_2 concentrations could exceed the WHO AQGs, as well as the WHO interim targets for these pollutants, at Bangorma when mining activities are undertaken at the Matambo 1 pit (if the residents of Bangorma are not relocated). It is recommended that no mining, stockpiling or hauling activities be undertaken within 250 m of residential locations to avoid exceedances of the WHO AQGs at such locations. Simulated concentrations of all pollutants were below the WHO AQGs at the proposed accommodation camp location and the proposed relocation site.

Simulated dust fallout could exceed the chosen assessment level of 600 mg/m²/day at Bangorma when mining is undertaken at the Matambo 1 pit. Simulated SO_2 and CO concentrations are well below the WHO AQGs for the entire study area.[5]

8.6.1 Impact Significance Rating

- The overall significance of construction and decommissioning phase air quality impacts on nearby sensitive receptor locations is considered ***Low*** negative for the Matambo 1 pit and ***Very Low*** for the Matambo 2 and 3 pits. If the residents of Bangorma are relocated prior to construction of the Matambo 1 pit, the significance reduces to ***Very Low*** for the Matambo 1 pit as well**.**
- The significance of the operation phase is ***Low*** negative for the Matambo 2 and 3 pits, which can be reduced to ***Very Low*** negative with best practice mitigation measures.
- Due to likely exceedances of the WHO air quality guidelines at Bangorma, the significance of operational phase impacts is ***Medium*** to ***High*** negative if the residents of Bangorma are not relocated but can be reduced to ***Low*** negative if the residents of Bangorma are relocated more than 400 m away from any mining, hauling or stockpiling operations. With mitigation measures employed and the residents of Bangorma relocated, the significance of the activities at the Matambo 1 pit reduces to ***Very Low*** negative.

[5] Airshed Planning Professionals – Matambo Air Quality Impact Assessment 2024

- Air quality impacts during the construction and closure phases are expected to be similar in nature to operational phase impacts but less severe and over a smaller area than during the operational phase.
- Minimal impacts are expected post-closure, with wind erosion from unrehabilitated areas being the main source of fugitive dust post-closure. It is recommended that all areas be reshaped and rehabilitated to minimise wind erosion potential.

8.7 NOISE[6]

The mine layout plan was finalised after the air dispersion modelling and impact assessment was concluded. The final layout for the Matambo Pit 1 and Pit 2 operations remains the same as the initial design, and while the Matambo Pit 3 location remains the same, the final location for the Matambo 3 WRD is approximately 250 m of the initially proposed location, while the final proposed location for the Matambo 3 topsoil stockpile is approximately 650 m southwest of the initially proposed location. The impact of these changes to the final layout are not expected to influence the results and findings of the air quality study, and the impact significance and air quality management recommendations remain unchanged.

The Matambo Project is situated in a forested area, with nearby activities including logging and small-scale informal gold mining. Sensitive receptors in the vicinity of the Matambo Project include the villages of:

- Bangorma (< 100 m northeast of Matambo Pit 1),
- Korma Sorkpoja (1 km southeast of Matambo Pit 1),
- Zoduaja (2 km south of Matambo Pits 1&2),
- Masakpolor (1 km southeast of Matambo Pit 3 and 1.5 km southwest of Matambo Pit 2),
- Gogoima (1.2 km northwest of Matambo Pit 2 and 1.7 km northeast of Matambo Pit 3),
- Sanor (1.5 km north of Matambo Pit 3),
- Brownsville (1.4 km northwest of Matambo Pit 3) as well as the accommodation camp, located approximately 500 m north of the Matambo Pits 1 & 2.

8.7.1 Impacts

The propagation of noise generated during the operational phase was calculated with CadnaA in accordance with ISO 9613. Meteorological and site-specific acoustic parameters along with source data were applied in the model.

Results for all the operations:

- The simulated equivalent continuous day-time rating level ($L_{Req,d}$) of 55 dBA (Liberian noise guideline level) extends for approximately 700 m around the perimeter of the mining areas, with possible exceedances of the 55 dBA level at the accommodation camp and the village of Bangorma (if the residents of Bangorma are not relocated).
- Measured baseline night-time noise levels already exceed 45 dBA (Liberian noise guideline level) at all four sampling locations, and mining activities will result in increased noise levels, with cumulative levels of 50 dBA simulated up to 1700 m from the operations and exceedances of 55 dBA during the night simulated at up to 1000 m from the operations.
- An increase of 3 dBA above the baseline up to approximately 1000 m from the mining operations during the day and 1700 m from the mining operations during the night is possible, which means that noise sources at the Matambo Project might be audible at Gogoima, Masakpolor, Korma Sorkpoja, Bangoma and the accommodation camp, but according to the SANS 10103 ratings, are only expected to be disturbing to the residents of Bangorma and the accommodation camp, and possibly to the residents of Masakpolor and Gogoima during the night.
- The accommodation camp is expected to be mostly vacant during times when the mine is operational during the day, but it is recommended that the residents of Bangorma be relocated prior to the commencement of mining operations at the Matambo 1 open pit.

[6] Airshed Planning Professionals – Matambo Noise Impact Assessment 2024

- Public / Community complaints could be received from the residents of Masakpolor, Korma Sorkpoja and Gogoima. When mining is conducted at night, community reaction will be higher and complaints will be much more frequent.
- Mining between 22:00 and 6:00 at the Matambo 1 open pit could be severely disturbing to the residents of Bangorma if they are not relocated.

8.7.2 Impact Significance Rating

The overall significance of construction and decommissioning phase noise impacts on nearby NSRs is considered ***Very Low*** negative if the residents of Bangorma are relocated and mining activities are limited to the daytime. If the residents of Bangorma are located and mining is conducted 24hrs a day, the impact is considered ***Low***. If the residents of Bangorma are not relocated the impact at Bangorma is considered ***Medium Negative***.

- No noise impacts are expected post-closure.

8.8 VIBRATION AND BLASTING[7]

The impacts assessed are for the planned blasting activities during the operational phases of the Matambo Mine Project where blasting activity will be undertaken in three separate open pits. The pits are referred to as Pit 1, Pit 2, and Pit 3. The main and largest pit is Pit 1 on the eastern flank of the mining area. The closest permanent communities that may be affected by ground vibration air blast and fly rock aspects of blasting are:

- Bangorma in the eastern half of Pit 1.
- Goigoima to the north of Pit 1 and Pit 2.
- Parts of Saano and Bakana to the north of Pit 3.
- The two small communities of Masakpa to the south of Pits 2 and 3.
- Possible impacts are assigned to Ground Vibration, Fly Rock and Air Blast:
  - **Ground vibration** impact on local communities and artisanal workings within 250 m of the blast area. The communities of concern are well outside the limiting criteria of ground vibration induced damage to buildings (12.7 mm/s) and outside the limit of concern for people inside the buildings (5 mm/s). Therefore, there will be no vibration impact on any communities living in the area will no risk of damage to buildings and no impact on human sensitivity. The integrity of the artisanal workings (tall faces and possible underground mining) will not be known and therefore a low vibration limit is necessary if there are nearby near-surface underground workings that could collapse because of ground vibration.
  - **Fly Rock**. The range is dependent on stemming length. There is a risk that fly rock could reach parts of Masakpa and the peripheries of Bangorma. Unmitigated blasting measures will pose a significant risk to people, buildings and structures within the development footprint. When mitigated, fly rock will be limited to within a few tens of metres from the blasts and will only impact the HME workshop, fuel farm and other mine structures that are closer than 500 m from blasting.
  - **Air Blast**. The unmitigated zone of influence for air blast will affect most of the nearby communities. The range of influence will depend on the wind direction and velocity. As each blast will be small, the impact will be limited, and it will only occur over a brief time. Once blasting migrates deeper into the mine, the impacts on surface of air blast, dust and fumes will disappear to insignificant levels.

[7] AJ Rorke – Matambo Blasting Impact Assessment 2024

TABLE 8-2: LIST OF RECEPTORS FOR BLASTING IMPACT

RECEPTORS	MINIMUM DISTANCE FROM CLOSEST BLASTING	IMPACT SIGNIFICANCE BEFORE MITIGATION	ASPECTS	MITIGATION REQUIRED	IMPACT SIGNIFICANCE AFTER MITIGATION
Bangoma	0 to 70 m from Pit 1	High	Vibration, air blast, fly rock, fumes	Yes	Low
Two communities of Masakpa	925 m from Pit 3	Medium high	Air blast, fly rock	Yes	Low
Gogoima community	1020 m from Pit 2	Medium high	Air blast, fly rock	Yes	Low
Saano community	1640 m from Pit 3	Medium low	Air blast, fly rock	Yes	Low
Bakaana community	1500 m from Pit 3	Medium low	Air blast, fly rock	Yes	Low
Jene Wonde community	2040 m from Pit 3	Low	None	No	Low
Kormah community	880 m from Pit 1	Medium high	Air blast, fly rock	Yes	Low
Nkoloja north community	2010 m from Pit 1	Low	None	No	Low
Public roads within 1000 m of blasting	1000 m from any blasting	Medium high	Fly rock, dust cloud	Yes	Low
HME workshop and fuel farm	250 m from Pit 1	High	Fly rock	Yes	Medium Low
Mine camp	610 m from Pit 1 and Pit 2	Medium high	Fly rock, air blast	Yes	Low
Artisanal workings	Closer than 1000 m from any blasting	Medium high	Fly rock, vibration	Yes	Low

8.8.1 Impacts

8.8.1.1 Vibration

There will be a ***Low*** significance from blast induced ground vibration for buildings located closer than 500 m. There will be a ***Medium Low*** significance for the artisanal worker if they are mining tunnels or work under benched terraces. This will require mitigation to keep PPV levels below about 5 mm/s and thus reduce the significance to ***Low.*** The mitigation measure include:

- The blast timing designs must ensure that the MIC (maximum instantaneous charge mass) will keep ground vibration at a safe limit at artisanal workings.
- Notify the artisanal miners of each blast and, if there is a risk that vibration will exceed 5 mm/s for nearby artisanal workings evacuate all people from these workings when blasting.

8.8.1.2 Air Blast

Air blast control will be important to maintain the goodwill of people living in the communities around the mine. Without mitigation, air blast can result in numerous complaints and therefore the significance has been rated ***Medium High.***

It will be necessary to stem all blastholes with coarse stemming material (example aggregate) and introduce delays into the presplit holes to mitigate air blast. The mitigation will help to bring the zone of influences to within 100 m from blasting.

8.8.1.3 Fly Rock

The significance for fly rock has been rated as ***High*** without mitigation as it will impact parts of Masakpa and buildings to the northwest of Bangoma. It will result in a major risk to property and people in Bangorma when blasting in the western half of Pit 1 if houses are still occupied at the time (FIGURE 8-2).

Fly rock is extremely dangerous and must be controlled through adequate quality stemming and appropriate stemming length design in each blasthole and control needs to be applied to prevent the occurrence of over-charged holes.

- Care should be taken not to under-burden holes. In other words, holes close to free faces that could cause blow-outs from the free face of high energy gas need to be prevented.
- All people should be cleared to an exclusion zone of at least 500 m from any blast. However, the exclusion zone may need to be extended beyond 500 m if the rock quality and stemming control measures do not keep fly rock range limited.
- Any parts of Bangoma that are outside the pit limits should be relocated to a safer distance from the mine.

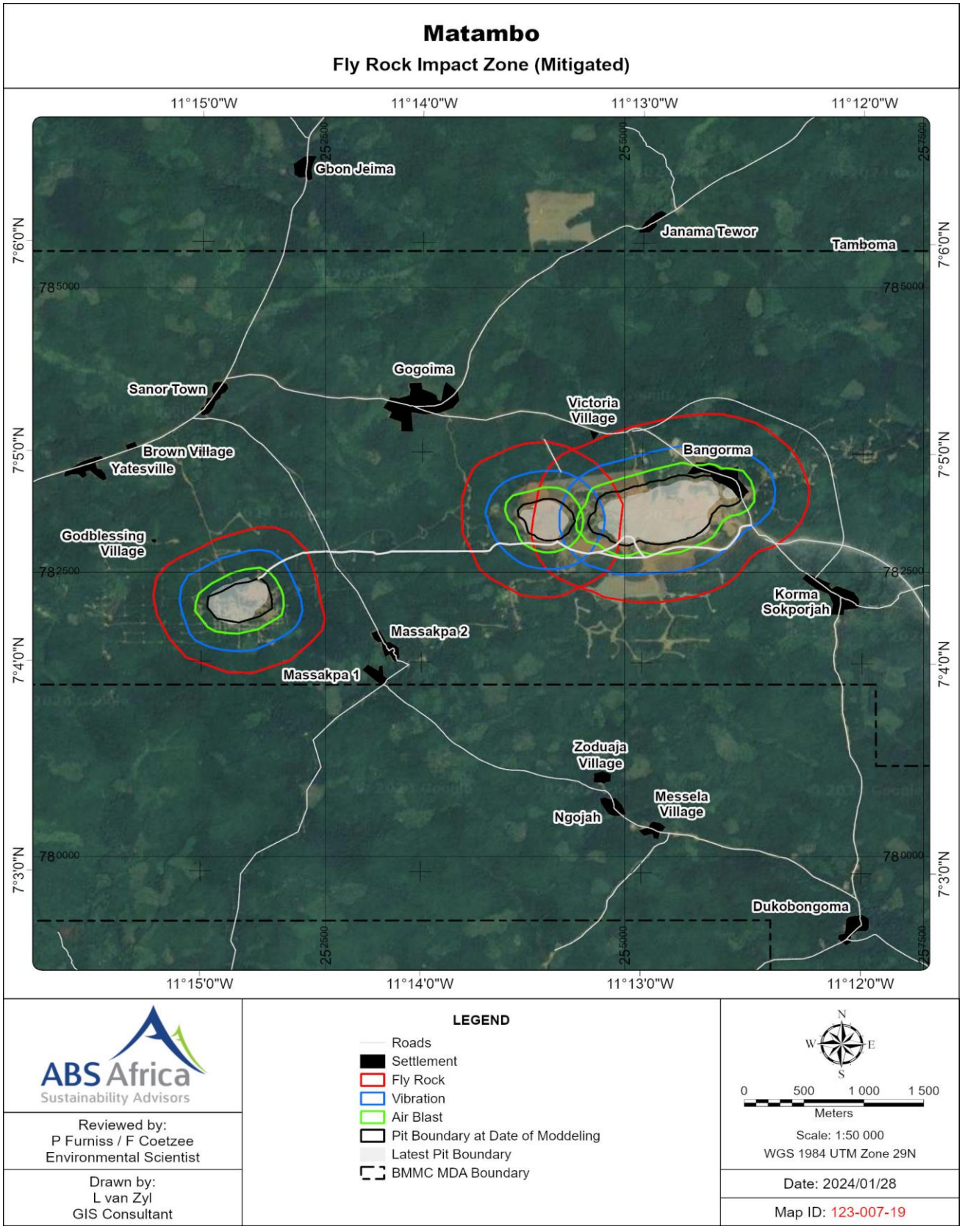


FIGURE 8-2: FLY ROCK IMPACT ZONE POST MITIGATION

8.9 PHYSICAL IMPACT MATRIX

The impact ratings of the physical impacts assessed for the Project are provided in the impact matrix (APPENDIX 8-1).

APPENDIX 8-1: PHYSICAL IMPACT MATRIX

Environmental & Social Impact Risk Assessment

Physical

Geohydrology

Project Activity	Hydrology and Surface Water Resources		Likelihood		Consequence			
Dewatering of open pit areas - drawdown cone	Phase of Project	Construction, Operational & Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Reduced ground water volumes and availability to communities	4	4	3	3	4	80
			Significance Post- Mitigation					
			1	2	2	2	4	24

Project Activity	Hydrology and Surface Water Resources		Likelihood		Consequence			
Dewatering of open pit areas - drawdown cone	Phase of Project	Operational	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Reduced Water Availability and Stream Base Flow	4	2	2	2	4	48
			Significance Post- Mitigation					
			4	1	1	2	4	35

Project Activity	Hydrology and Surface Water Resources		Likelihood		Consequence			
Discharging of open pit water in Matambo River/Tributaries	Phase of Project	Operational & Post-closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Surface water quality deterioration	4	4	2	3	4	72
			Significance Post- Mitigation					
			4	3	2	2	4	56

Project Activity	Hydrology and Surface Water Resources		Likelihood		Consequence			
Waste Rock Dumps Poor quality seepage from the WRDs	Phase of Project	Operational & Post-closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Groundwater quality deterioration	5	3	2	2	5	72
			Significance Post- Mitigation					
			5	3	2	1	5	64

Project Activity	Hydrology and Surface Water Resources		Likelihood		Consequence			
Heap leach/ore stockpiles - Poor quality seepage from the ore	Phase of Project	Operational	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from		5	3	2	2	5	72

material	Resulting Impact from Activity	Groundwater quality deterioration	Significance Post- Mitigation					
			4	3	2	1	4	49
Project Activity	Hydrology and Surface Water Resources		Likelihood		Consequence			
Post-closure pit-lake developments	Phase of Project	Post-Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Groundwater quality deterioration	5	1	1	2	5	48
			Significance Post- Mitigation					
			5	1	1	2	5	48

Soils & Land Capacity

Project Activity	Soils		Likelihood			Consequence		
Loss of Soil Utilisation – permanent loss from System	Phase of Project	Construction Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Open Cast Mining & WRD activities	5	5	4	3	5	120
			Significance Post-Mitigation					
			5	5	3	2	5	100
Project Activity	Soils		Likelihood			Consequence		
Loss of soil Utilisation - Erosion & Compaction	Phase of Project	Construction phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Open Cast Mining & WRD activities	4	4	4	2	4	80
			Significance Post-Mitigation					
			4	4	3	1	4	64
Project Activity	Soils		Likelihood			Consequence		
Loss of soil Utilisation - Product & Hydrocarbon Spills	Phase of Project	Construction phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Open Cast Mining & WRD activities	4	4	4	3	4	88
			Significance Post-Mitigation					
			4	3	3	1	4	56
Project Activity	Soils		Likelihood			Consequence		
Support Activities - including Workshops and Fuel Farm, Camp, Mine Offices, Haulage Roads/Way, Access Routes and Topsoil Stockpiles	Phase of Project	Construction phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Removal from the System	4	5	4	3	4	99
			Significance Post-Mitigation					
			4	4	4	2	4	80
Project Activity	Soils		Likelihood			Consequence		
Support activities - Workshops, Fuel Station, Camp, Mine offices, Haulage roads, Access routes and topsoil stockpiles	Phase of Project	Construction phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Erosion and Compaction	4	4	4	4	4	96
			Significance Post-Mitigation					

topsoil stockpiles	Activity		4	3	3	2	4	63
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Support activities - Workshops, Fuel Station, Camp, Mine offices, Haulage roads, Access routes and topsoil stockpiles	**Phase of Project**	**Construction phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Cumulative Impact**	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	**Product and Hydrocarbon spills**	4	4	4	4	4	96
			Significance Post-Mitigation					
			4	3	3	2	4	63
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Maintenance of soil stockpiles and unprotected areas associated with the WRD as well as soils stockpiled from the Open cast Mining areas. Ineffective Housekeeping and	**Phase of Project**	**Operational Phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	**Loss of Soil Utilisation - O/C Mining, TSF & WRD**	4	5	5	3	5	117
			Significance Post-Mitigation					
			4	5	3	2	5	90
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Maintenance of soil stockpiles and unprotected areas associated with the WRD as well as soils stockpiled from the Open cast Mining areas. Ineffective Housekeeping and	**Phase of Project**	**Operational Phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	**Contamination due to Product and Hydrocarbon Spillage during operation**	4	4	4	3	4	88
			Significance Post-Mitigation					
			3	3	3	2	2	42
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Maintenance of soil stockpiles and unprotected areas associated with the WRD as well as soils stockpiled from the Open cast Mining areas. Ineffective Housekeeping and	**Phase of Project**	**Operational Phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	**Erosion and Compaction - wind, water and vehicle movement**	4	5	3	3	3	81
			Significance Post-Mitigation					
			4	3	3	2	3	56
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Maintenance and operation of Workshops and Fuel Farm, Camp, Mine Offices, Haulage Roads/Way, Access Routes and Topsoil Stockpiles.	**Phase of Project**	**Operational Phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	**Loss of soil Utilisation due to Support Infrastructure.**	4	5	4	3	4	99
			Significance Post-Mitigation					
			4	4	3	2	4	72
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Maintenance and operation of Workshops and Fuel Farm, Camp, Mine Offices, Haulage Roads/Way, Access Routes and Topsoil Stockpiles.	**Phase of Project**	**Operational Phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	**Contamination due to Product and Hydrocarbon Spillage**	4	5	4	3	4	99
			Significance Post-Mitigation					
			3	3	3	2	2	42
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Maintenance and operation of	**Phase of Project**	**Operational Phase**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**

Workshops and Fuel Farm, Camp, Mine Offices, Haulage Roads/Way, Access Routes and Topsoil Stockpiles.	Impact Classification	Direct Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Erosion and Compaction - wind, water and vehicle movement	4	5	3	3	3	81
			Significance Post-Mitigation					
			4	3	3	2	3	56
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Stabilisation and rehabilitation where possible of the Open Cast Mining voids (battering back of slopes and fencing off of	Phase of Project	Decommissioning & Closure Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Permenant loss of soil Nutrient Pool	5	4	4	2	4	90
			Significance Post-Mitigation					
			4	3	2	2	3	49
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Stabilisation and rehabilitation where possible of the Open Cast Mining voids (battering back of slopes and fencing off of	Phase of Project	Decommissioning & Closure Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Loss of soil Nutrient Pool	4	5	3	3	4	90
			Significance Post-Mitigation					
			4	3	3	2	3	56
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Stabilisation and rehabilitation where possible of the Open Cast Mining voids (battering back of slopes and fencing off of	Phase of Project	Decommissioning & Closure Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Compaction from vehicle movement during material replacement	4	5	4	3	4	99
			Significance Post-Mitigation					
			4	3	3	2	3	56
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Stabilisation and rehabilitation where possible of the Open Cast Mining voids (battering back of slopes and fencing off of	Phase of Project	Decommissioning & Closure Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Contamination by dirty water and hydrocarbon spills	4	5	4	2	3	81
			Significance Post-Mitigation					
			4	3	3	1	3	49
Project Activity	**Soils**		**Likelihood**			**Consequence**		
Stabilisation and rehabilitation where possible of the Open Cast Mining voids (battering back of slopes and fencing off of	Phase of Project	Decommissioning & Closure Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Cumulative Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Reduction in area of impact and return of soil utilisation potential	4	5	4	2	5	99
			Significance Post-Mitigation					
			4	3	3	2	3	56
Air Quality								
Project Activity		**Air Quality**	**Likelihood**			**Consequence**		
Matambo Pit 1- Increased PM10, PM2.5 and NOx Concentrations at Sensitive Receptor Locations	Phase of Project	Construction and Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from	Air Quality Impacts	5	5	4	3	3	100
			Significance Post-Mitigation					

	Activity		3	2	2	2	2	30

Project Activity		Air Quality	Likelihood			Consequence		
Matambo Pit 1- Increased Dust Fallout at Sensitive Receptor Locations	Phase of Project	Construction and Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Dust Fallout Impacts	5	5	1	2	3	60
			Significance Post-Mitigation					
			3	2	1	2	2	25

Project Activity		Air Quality	Likelihood			Consequence		
Matambo Pit 2 & 3- Increased PM10, PM2.5 and NOx Concentrations at Sensitive Receptor Locations	Phase of Project	Construction and Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Air Quality Impacts	4	3	2	2	2	42
			Significance Post-Mitigation					
			3	2	2	2	2	30

Project Activity		Air Quality	Likelihood			Consequence		
Matambo Pit 2 & 3- Increased Dust Fallout at Sensitive Receptor Locations	Phase of Project	Construction and Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Dust Fallout Impacts	4	3	1	2	2	35
			Significance Post-Mitigation					
			3	2	1	2	2	25

Noise

Project Activity	Noise		Likelihood		Consequence			
Mining and hauling operations, construction of surface infrastructure, and decommissioning	Phase of Project	Construction, Operational Decommissioning	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Noise impacts generated may impact on the social environment, especially villages adjacent to the mining areas	5	5	3	2	3	80
			Significance Post- Mitigation - Relocation of Bangoma, 24hr mining					
			3	4	1	2	3	42
			Significance Post- Mitigation - Relocation of Bangoma, mining limited to daytime					
			3	2	1	2	2	25

Blasting

Project Activity	Blast-induced ground vibration risk to buildings and sensitivity of		Likelihood			Consequence		
Blasting in Pit 1	Phase of Project	Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Increasing risk from zero of threshold damage to buildings. Risk of heightened sensitivity and complaints from people living in the areas	4	3	2	1	4	49
			Significance Post-Mitigation					
			4	1	1	1	4	30

Project Activity	Blast-induced ground vibration risk to artisanal workers and operations nearby the mine		Likelihood			Consequence		
	Phase of Project	Operational Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
Blasting in Pits 1, Pit 2, Pit 3	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Possible removal of artisanal workers during blasing events	4	1	1	3	4	40
			Significance Post-Mitigation					
			4	1	1	1	4	30

Project Activity	Blast-induced ground vibration risk to sensitivy of people living in the mine camp		Likelihood			Consequence		
	Phase of Project	Operational Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
Blasting in Pits 1, Pit 2, Pit 3	Impact Classification	Direct Impacts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Risk of heightened sensitivity and complaints from people living in the the mine camp	4	1	1	3	4	40
			Significance Post-Mitigation					
			4	1	1	1	4	30

Project Activity	Fly Rock- Damage to structures and serious or fatal injury to people		Likelihood			Consequence		
	Phase of Project	Operational Phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
Blasting in Pits 1, Pit 2, Pit 3	Impact Classification	Direct Imapcts	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Projectiles from blasting causes serious damage to buildings and structures and serious injury to	4	3	4	3	4	77
			Significance Post-Mitigation					
			4	1	1	1	4	30

Project Activity	Fly Rock- Risk of damage to mine structures and serious or fatal injury to		Likelihood			Consequence		
	Phase of Project	Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
Blasting in Pits 1, Pit 2, Pit 3	Impact Classification	Direct Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Projectiles from blasting causes serious damage to mine buildings and structures in close proximity to	4	3	4	3	4	77
			Significance Post-Mitigation					
			4	3	3	2	3	56

Project Activity	High air blast levels causing vibration response of structures		Likelihood			Consequence		
	Phase of Project	Operational Phase	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
Blasting in Pits 1, Pit 2, Pit 3	Impact Classification	Cumulative	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Irritation to people inside buildings	4	4	1	3	4	64
			Significance Post-Mitigation					
			5	1	1	1	4	36

CHAPTER 9
BIOLOGICAL IMPACTS

TABLE OF CONTENTS

9 BIOLOGICAL IMPACTS 9-1

9.1 TERRESTRIAL BIODIVERSITY 9-1

9.1.1 Key Potential Impacts 9-1

9.2 BIOLOGICAL IMPACT MATRIX 9-7

LIST OF TABLES

TABLE 9-1: IFC PS6 TRIGGERS AND RELEVANT HABITATS FOR ALL CONCESSIONS (ADAPTED FROM ENVIRO-INSIGHT 2021) 9-1

LIST OF FIGURES

FIGURE 9-1: CRITICAL HABITAT 9-2

LIST OF APPENDICES

APPENDIX 9-1: BIOLOGICAL IMPACT MATRIX 9-8

APPENDIX 9-2: BIODIVERSITY IMPACT ASSESSMENT 9

9 BIOLOGICAL IMPACTS

The following sections are summarised from the Biodiversity Environmental Impact Assessment report (Enviro-Insight, 2024) to provide a description of the primary impacts of the Project activities on biological environmental aspects terrestrial biodiversity.

The impact ratings before and after mitigation measures are implemented are provided in APPENDIX 9-1. Mitigation measures are discussed in detail in Chapter 14 of the ESIA Report.

9.1 TERRESTRIAL BIODIVERSITY

9.1.1 Key Potential Impacts

9.1.1.1 Habitat Sensitivity

Critical Habitats were delineated in Enviro-Insight (2021) as Lowland Forest, Hillslope Forest, Swamps, Forested Rivers and Streams due to the triggers summarised in TABLE 9-1. These Critical Habitats are illustrated for Matambo in FIGURE 9-1. As seen in FIGURE 9-1 total of approximately 31.89 ha of CH is affected by the mine development footprint.

TABLE 9-1: IFC PS6 TRIGGERS AND RELEVANT HABITATS FOR ALL CONCESSIONS (ADAPTED FROM ENVIRO-INSIGHT 2021)

TRIGGER SPECIES	IFC PS6 CH CRITERION	HABITAT/S
Flora		
Placodiscus pseudostipularis	1	Hillslope Forest, Lowland Forest
Herpetofauna		
Sclerophrys taiensis	1	Lowland Forest
Kinixys homeana	1	Hillslope Forest, Lowland Forest
Mecistops cataphractus	1	Forested Rivers and Streams (medium-large) buffered 30-100 m (based on 2017 RSPO guidelines[1])
Avifauna		
Psittacus timneh (Timneh's Parrot)	1	Hillslope Forest, Lowland Forest, Swamps (not mappable).
Mammals		
Pan troglodytes verus (West African Chimpanzee)	1	Hillslope Forest and Lowland Forest (following mitigation)
Choeropsis liberiensis (Pygmy Hippopotamus)	1	Forested Rivers and Streams (medium-large) buffered 30-100 m (based on 2017 RSPO guidelines[2])
Piliocolobus badius (Upper Guinea Red Colobus)	1	Hillslope Forest, Lowland Forest?

[1] waterbodies: 100 m; <5 m wide streams: 30 m; 3-10 m wide rivers: 70 m; >10 m wide rivers: 200 m.
[2] waterbodies: 100 m; <5 m wide streams: 30 m; 3-10 m wide rivers: 70 m; >10 m wide rivers: 200 m.

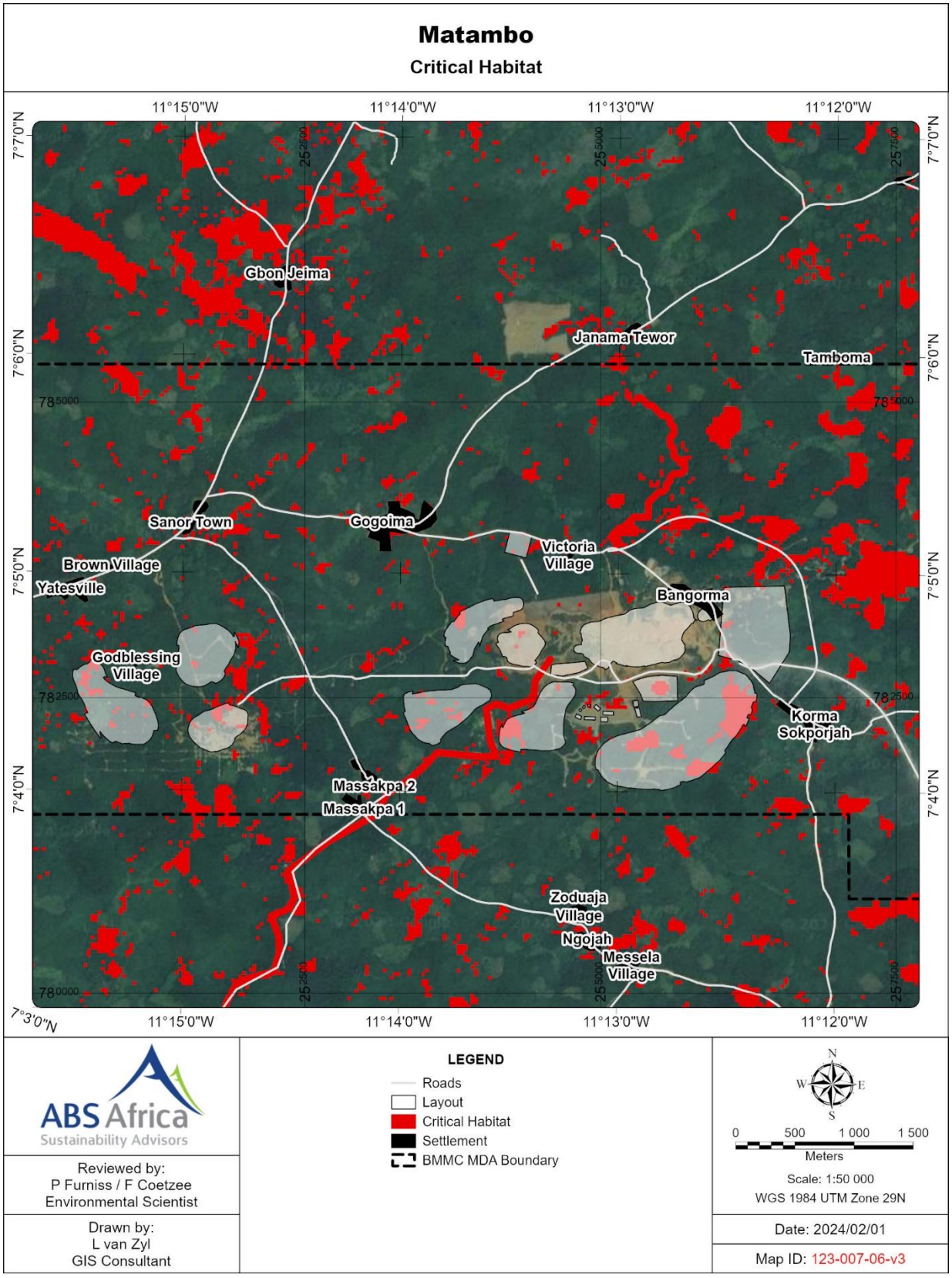


FIGURE 9-1: CRITICAL HABITAT

9.1.1.2 Loss of Existing Habitat

The existing natural habitats (including IFC PS 6 Critical Habitat), support populations of flora and fauna, allowing them to perform their biological functions and persist through time. The removal of these habitats disrupts these biological functions and, for the majority of species, results in local extirpation either from increase mortality, immigration or avoidance.

- Specific project activities that will have a direct impact will be:
  - Clearing and grubbing of vegetation for infrastructure (Construction & Operation)- the removal of vegetation will directly result in the loss of suitable habitat required by various species of conservation concern (SCC), and these habitats are replaced by necessary infrastructure that persists for the life of the mine or longer;
  - Temporary laydown areas and construction infrastructure [Construction] – Habitats are removed or transformed for construction activities only and are no longer required for operational activities. The remaining habitat is often heavily transformed/disturbed and no longer compatible with the habitats required by various species of conservation concern (SCC); and
  - Associated mining activities and general construction [Construction & Operation] – Stochastic events such as fire (cooking fires or cigarettes of workers) where embers are blown into surrounding vegetation may cause runaway fires to temporarily transform habitat (especially dry–season secondary vegetation).
- Secondary impacts associated with the loss of habitat and removal of vegetation:
  - Displacement/loss of fauna (including SCC) [Construction and Operation] – due to the removal of natural habitat, in particular vegetation. This removal of vegetation will indirectly affect fauna reliant on this vegetation for foraging and/or refugia;
  - Erosion from wind and water in places where vegetation has been removed (addressed in separate impact) – reduction of available habitat due to loss of topsoil. In addition, siltation and sedimentation from eroded runoff likely to accumulate in streams and other aquatic habitats which will negatively influence submerged or partially submerged aquatic vegetation, by coating the leaves with sediment and reducing light for photosynthesis, leading to die off;
  - Habitat fragmentation & disruption of habitat corridors removed (addressed in separate impact) – cleared vegetation by the proposed development and supporting infrastructure will likely act as barriers to plant and animal dispersal due to restriction of movement from pollinator agents which will ultimately prevent genetic exchange and the ability to escape to more favourable environments, leading to a reduction in population viability; and
  - Establishment of alien and invasive vegetation removed (addressed in separate impact) – areas cleared of vegetation provide ideal habitat for many pioneer alien and /or invasive species. Disruption in standing biomass (such as primary forest), disturbance of soil and introduction through human related vectors due to human in–migration all increase the likelihood of establishment of alien and invasive vegetation.
- Residual impacts:
  - It is not possible to completely avoid habitat loss due to the proposed development footprint. However, providing protection for the surrounding vegetation of the project area will ensure the persistence of sensitive habitat types as well as the ecosystem services associated with these habitats.

9.1.1.3 Direct Mortality

Description of impact: fauna populations persist within the environment if the fecundity and mortality are balanced. Increased mortality rates can result in the decline of a population and its eventual extirpation.

- Project components that can cause direct mortality of fauna include:
  - Clearing and grubbing of vegetation [Construction & Operation] – The clearing of vegetation with machinery followed by the preparation of ground surfaces for construction and

maintenance is expected to result in the direct mortality of fauna by mechanical action (cutting, grinding and crushing), especially for slow–moving or burrowing fauna.

- Collisions from vehicles (hauling of ore and transport of personnel and equipment) [Construction & Operation] – Direct mortality due to collisions with vehicles resulting from increased traffic. Reptiles and amphibians are particularly prone to collisions with fast moving vehicles as they do not move out of the way upon approach by a vehicle. Many mammals are also highly susceptible to impacts from vehicles (e.g. mongooses). Vehicle drivers rarely see small fauna on the road surface and cannot avoid collisions with these animals while travelling at high speeds or hauling heavy loads; and
- Intentional killing and poaching of animals by construction and mine staff – Staff or contractors poaching and hunting for bushmeat (such as pangolins, primates, birds, antelope, tortoises, crocodiles and pythons) or the intentional killing of fauna (such as snakes) considered to be dangerous.

- Secondary impacts associated with direct mortality of fauna:
  - Changes in fauna population dynamics (e.g. rodent population explosion) – for example, increased human activity, poor waste management, artificial refugia (provided by housing) prolonged mortality of predatory species such as snakes could significantly reduce the population density of these predators and allow prey species to undergo localised population explosions. This in turn can have additional negative impacts, for example rodent population explosions will result in reduced crop yields of local inhabitants and may also spread disease to humans; and
  - Potential loss of species of conservation concern – SCC that occur in low densities or are particularly susceptible to direct mortality may be entirely eradicated from the local area if the impacts described above are not mitigated appropriately.
- Residual impacts:
  - It is not possible to avoid all fauna deaths, but proper mitigation will reduce the residual impacts to acceptable levels; and
  - Given appropriate implementation of the mitigations, there could be a significant net positive impact on faunal populations that could be protected under the auspices of the formalised mine operations.

9.1.1.4 Restriction of Species Movement

Description of impact: movement is an important aspect for most fauna species and is required for foraging, breeding, migration and other vital activities. The restriction of movement is likely to negatively affect the success of these activities, resulting in the increased mortality and potential population decline in these areas.

- Project components that can cause disruption/alteration of ecological lifecycles:
  - Linear barriers and traps (fences and drainage infrastructure) [Construction and Operation] – Fences will represent dispersal barriers for some larger fauna and drainage structures can also trap certain species;
  - Infrastructure and transformed habitats [Operation] – Some transformed areas (e.g. houses, pits, rock dumps) are impassable to certain species, hindering the movement of fauna.
- Secondary impacts associated with disruption/alteration of ecological lifecycles:
  - Reduced population viability [Construction] – Restriction of movement and trapping of certain animals prevents genetic exchange and the ability to escape to more favourable habitats, ultimately leading to a reduction in population viability.
- Residual impacts:
  - It is not possible to completely mitigate against the impact of restriction of faunal movement.

9.1.1.5 Disruption due to Noise, Dust and Lighting

Description of impact: fauna are not accustomed to loud noises, dust and night–time lighting and these disturbances may affect their ecological life cycles, causing them to be less active, less successful at foraging, vocalising for mates or detecting predators. These disturbances may cause higher mortality rates of the affected fauna species or result in their displacement. Flora requires light and gaseous exchange for photosynthesis, but dust can smother leaves and greatly reduce metabolic activity.

- Project components that can result in increased noise, dust and lighting:
  - General construction activities [Construction] and mine operation (machinery and blasting) [Operation] – Lighting at night may disrupt flight paths of migrating birds and bats foraging at night which could cause disorientation and collisions of these animals with infrastructure. Noise generated at night (especially from blasting) could disrupt nocturnal faunal activities. Dust from the actual mining operation will settle on the adjacent vegetation which will reduce photosynthesis which may have indirect effects on fauna (loss of vegetation and / or reduction in nutritional content of vegetation); and
  - Hauling of ore from the temporary ore stockpile [Operation] – Noise, dust and lighting generated from moving vehicles operating on access roads and servitudes can disrupt fauna populations by interfering with their movements and/or breeding activities. In particular, lighting at night is expected to attract insects which will attract geckos and amphibians which in turn can attract snakes (which might be venomous). Lighting at night may also disrupt flight paths of migrating birds and bats foraging at night which could cause collisions of these animals with infrastructure and / or moving vehicles.
- Secondary impacts associated with Disruption/alteration of ecological life cycles:
  - Increased probability of interaction with reptiles – As described above, snakes may be attracted to higher prey densities, which represents a potential health and safety hazard. In addition, snakes attracted by to the site are likely to be killed by staff on site.
- Residual impacts:
  - Blasting may disrupt breeding populations within close proximity to the study area. Although it will not be possible to completely prevent the disruption of ecological life cycles of some fauna, the mitigation measures proposed along with best practice standards should result in negligible residual impacts.

9.1.1.6 Erosion and Watercourse Siltation/Sedimentation

Description of impact: increased rainwater runoff and exposed bare earth can result in the rapid erosion of surface material that is carried into watercourses and wetlands, resulting in changes to hydrological flow, high sedimentation, siltation and unnaturally high nutrient loads (potentially leading to eutrophication) or toxic chemicals. Aquatic habitats can become transformed and no longer suitable for some aquatic species.

- Project components that can cause severe sedimentation of watercourses:
  - Clearing and grubbing of vegetation and construction of infrastructure [Construction and Operation] – removal of vegetation exposes bare soil to the elements and impermeable artificial surfaces increases runoff causing erosion and resulting in topsoil removal, hydrological changes, and siltation and sedimentation of watercourses.
  - Removal and stockpiling of topsoil AND construction and operation of the WRD [Construction and Operation] – Rainwater runoff from the bare surfaces of topsoil and waste stockpiles will result in eroded material that will require storm water management. Rainwater runoff from these stockpiles may contain additional pollutants that should not enter the natural watercourses.
- Secondary impacts associated with contamination of watercourses:
  - Fauna and flora deaths [Construction and Operation] – Sedimentation (and pollution) of water has negative consequences for flora and fauna including habitats far downstream of the pollution source. Vision and gas exchange of aquatic organisms is negatively affected due to suspended

sediment particles. This negative effect is particularly severe for eggs and young of aquatic organisms that often are unable to survive due to this impact, causing rapid population declines;

- Health Concerns [Construction and Operation] – Health issues for surrounding human communities from drinking water from heavily sedimented (and potentially polluted) watercourses.

- Residual impacts:
  - Not all the eroded runoff will be trapped and a degree of sedimentation can be expected. The severity of this sedimentation and its effect on biodiversity should be monitored through regular water sampling (to calculate indices of sedimentation) and regular biodiversity monitoring (to assess the magnitude of this residual impact on aquatic fauna [especially diatoms, macro–invertebrates, fish and amphibians]).

9.1.1.7 Watercourse Hydrocarbon Contamination

Description of impact: hydrocarbons originating from oils and fuels used in vehicles and machinery have negative effects on the environment. Of greatest concern is when hydrocarbons enter aquatic systems where they can spread out and contaminate a large area. Hydrocarbons take a long time to break down naturally and are toxic to plants and animals, smother breathing apparatus of aquatic fauna and effect thermoregulatory properties of features and fur.

- Project components that can cause contamination of watercourses:
  - Hydrocarbon spillage from Hauling and Delivery and storage of vehicles, equipment, machinery, and materials [Construction and Operation] – this can occur from storage yards/facilities, or trucks and vehicles which can severely contaminate the watercourses and other aquatic habitats in the project area. Serious spills can dramatically affect mortality rates of avifauna, mammals and herpetofauna species utilising the watercourses as breeding and foraging habitat. Standing vehicles and machinery may leak hydrocarbons which can be washed into the surrounding watercourses during rainfall events. Similarly, the spillage of hydrocarbons during the servicing of construction vehicles on site can lead to the pollution of watercourses and surrounding habitats.

- Secondary impacts associated with contamination of watercourses:
  - Migration disruption [Construction and Operation] – Contaminated watercourses will lose their effectiveness as migratory corridors and may therefore act as dispersal and migration barriers;
  - Fauna and flora deaths [Construction and Operation] – Pollution of water has negative consequences for flora and fauna including habitats far downstream of the pollution source. Numerous susceptible species may rapidly die followed by other potential long–term effects, such as reduced fecundity etc. It is possible that fauna (and humans) consuming the dead aquatic fauna (e.g. fish) are also be negatively affected;
  - Health Concerns [Construction and Operation] – Health issues for surrounding human communities from drinking contaminated water or eating fish from contaminated aquatic habitats.

- Residual impact – None.

9.1.1.8 Introduction of Alien and/or Invasive Fauna Affecting Native or Natural Flora and Fauna Assemblages

Description of impact: fauna species that are introduced from other parts of the world have the potential to become very successful due to lack of predators, untapped resources and local fauna and flora not being familiar or adapted to the foreign species. These species can disrupt the food chain, introduce novel pathogens and parasites, outcompete or eat local species.

- Project components that can result in increased densities of alien fauna:
  - Delivery and storage of vehicles, equipment, machinery, and materials [Construction and Operation] – Stowaway fauna in transported materials and equipment (especially commensal species) can be introduced to the study area. Once a few individuals are introduced they are able to rapidly multiply and become an established population;

- Transformation of habitat from general construction [Construction] – local fauna communities are disrupted when natural habitats are transformed, making it easier for alien species to become established in these in these habitats. Commensal species are adapted to transformed habitats and attractants such as human living quarters, infrastructure, waste areas, food preparation and storage areas) and the lack of natural predators (see above discussion on the killing of snakes) further facilitate the establishment of these species. Building materials may also facilitate the transportation and establishment of some alien fauna species, such as cockroaches and termites.

- Secondary impacts associated with increased densities and diversity of alien fauna species:
  - Direct mortality of native species (e.g. rats consuming bird's eggs and fledglings);
  - Mortality of native species due to competition with alien fauna; and
  - Disease and / or infection spread to human population from alien animals (e.g. dogs/ rats).
- Residual impacts:
  - Once established, invasive species are often extremely difficult to eradicate and must be continuously controlled.

9.1.1.9 Introduction of Alien and/or Invasive Flora Affecting Native or Natural Flora and Fauna Assemblages

Description of impact: flora species that are introduced from other parts of the world have the potential to become very successful due to lack of predators, untapped resources and local fauna and flora not being familiar or adapted to the foreign species. Invasive plants typically smother other vegetation and can change the vegetation characteristics and fire regimes, transforming the habitat structure and food availability for fauna species.

- Project components that can result in the spread and increased densities of alien flora:
  - Clearing and grubbing of vegetation [Construction & Operation] – exposed soil due to recently cleared vegetation is highly susceptible to colonisation of alien and invasive flora. In addition, dormant alien seeds can germinate after soil disturbance;
  - Delivery and storage of vehicles, equipment, machinery and materials AND Hauling of ore [Construction & Operation] – vehicles and machinery can spread alien plant seeds throughout the study area which could potentially spread into the adjacent (natural) areas. Alien plants can cause alterations to the environment which could affect local flora;
  - Intentional planting of unsuitable species for landscaping or rehabilitation [Construction & Operation & Decommissioning] – Decorative plants surrounding offices, accommodation facilities and other infrastructure may be selected for their rapid growth and hardiness which would make them potentially invasive to the surrounding environment. Similarly, using alien plant species for soil stabilisation/restoration may result in 'escaped' individuals that would colonize the surrounding habitats.
- Secondary impacts associated with increased alien flora species:
  - Alteration and loss of fauna assemblages – Animals species reliant on particular habitat types and /or micro–niche conditions are excluded from dense stands of alien and invasive species, which therefore effectively reduce the available habitat for fauna; and
  - Dense stands of alien and invasive flora species can act as barriers to dispersal for certain fauna, which increases habitat fragmentation.
- Residual impacts:
  - Once established, invasive species are often extremely difficult to eradicate despite mitigation measures and must be continuously controlled to limit the degree and spread of infestation.

9.2 BIOLOGICAL IMPACT MATRIX

All biological impacts associated to the project can be found in APPENDIX 9-1.

APPENDIX 9-1: BIOLOGICAL IMPACT MATRIX

Environmental & Social Impact Risk Assessment

Biological

Fauna & Flora

Project Activity			Likelihood		Consequence			
Clearing and grubbing of vegetation for infrastructure	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	*Significance Pre-Mitigation*					
	Resulting Impact from Activity	Loss of existing habitat	5	5	5	2	5	120
			Significance Post-Mitigation					
			4	4	5	2	4	88

Project Activity			Likelihood		Consequence			
Temporary laydown areas and infrastructure	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Loss of existing habitat	5	5	4	2	4	100
			Significance Post-Mitigation					
			3	5	3	1	3	56

Project Activity			Likelihood		Consequence			
Associated mining activities and general construction	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Loss of existing habitat	3	3	3	2	3	48
			Significance Post-Mitigation					
			3	3	2	2	3	42

Project Activity			Likelihood		Consequence			
Clearing and grubbing of vegetation	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Direct fauna mortality	3	4	5	2	3	70
			Significance Post-Mitigation					
			3	3	4	2	3	54

Project Activity			Likelihood		Consequence			
Collisions with vehicles	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Direct fauna mortality	5	4	3	3	4	90
			Significance Post-Mitigation					
			4	3	3	3	4	70

Project Activity			Likelihood		Consequence			
Intentional killing and poaching of animals by construction and mine staff	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Direct fauna mortality	4	5	4	2	4	90
			Significance Post-Mitigation					
			4	2	4	2	4	60

Project Activity			Likelihood		Consequence			
Linear barriers and traps	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from		5	3	2	1	4	56

	Resulting Impact from Activity	Restriction of fauna movement	Significance Post-Mitigation					
			4	2	2	1	4	42
Project Activity			**Likelihood**		**Consequence**			
Infrastructure and transformed habitats	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Restriction of fauna movement**	5	5	3	3	4	100
			Significance Post-Mitigation					
			5	3	2	3	4	72
Project Activity			**Likelihood**		**Consequence**			
Construction works and mine operations	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Fauna disruption due to noise, dust and lighting**	5	5	4	3	4	110
			Significance Post-Mitigation					
			5	3	3	2	4	72
Project Activity			**Likelihood**		**Consequence**			
Hauling of ore	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Fauna disruption due to noise, dust and lighting**	5	5	3	3	4	100
			Significance Post-Mitigation					
			5	3	2	3	4	72
Project Activity			**Likelihood**		**Consequence**			
Removal of vegetation and construction of infrastructure	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Erosion and watercourse siltation/sedimentation**	4	5	4	4	5	117
			Significance Post-Mitigation					
			3	5	3	2	4	72
Project Activity			**Likelihood**		**Consequence**			
Mining operations (waste rock)	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Erosion and watercourse siltation/sedimentation**	5	5	4	4	5	130
			Significance Post-Mitigation					
			3	5	3	2	4	72
Project Activity			**Likelihood**		**Consequence**			
Spillage from haul trucks, transport and storage of vehicles and fuel storage	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Watercourse hydrocarbon contamination**	5	2	5	4	4	91
			Significance Post-Mitigation					
			5	1	4	4	4	72
Project Activity			**Likelihood**		**Consequence**			
Transport and introduction of alien fauna	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Alien fauna**	4	3	4	4	5	91
			Significance Post-Mitigation					
			4	2	3	2	5	60
Project Activity			**Likelihood**		**Consequence**			

Habitat transformation	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Alien fauna**	5	5	3	3	4	100
			Significance Post-Mitigation					
			5	3	2	3	4	72
Project Activity			**Likelihood**		**Consequence**			
Clearing of vegetation and earthworks	**Phase of Project**	**Construction and Operational phases**	**Frequency of Activity**	**Frequency of Impact**	**Severity**	**Spatial Scope**	**Duration**	**Significance Rating**
	Impact Classification	**Direct Impact**	Significance Pre-Mitigation					
	Resulting Impact from Activity	**Alien flora**	3	5	2	3	4	72
			Significance Post-Mitigation					
			3	5	2	2	4	64

Project Activity			Likelihood		Consequence			
Transport and spread of alien flora propagules	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Alien flora	3	3	5	4	5	84
			Significance Post-Mitigation					
			3	3	3	4	4	66

Project Activity			Likelihood		Consequence			
Planting of alien flora	Phase of Project	Construction and Operational phases	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Alien flora	5	4	5	3	5	117
			Significance Post-Mitigation					
			4	1	3	3	4	50

APPENDIX 9-2: BIODIVERSITY IMPACT ASSESSMENT

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Enviro INSIGHT
environmental impact assessments

Environmental Impact Assessment (EIA)

Proposed Matambo Gold Mine

For

Bea Mountain Mining Corporation

ABS

AVESORO MINING INC.

Bea Mountain Mining Corporation

PREPARED BY

Enviro-Insight CC

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Table of contents

Table of contents 2

List of Figures 3

List of Tables 3

Glossary 4

1 Introduction 5

1.1 Project Details and Background 5

1.1.1 Previous and Current survey 5

1.1.2 Upper Guinean forests 5

1.1.3 Timing and Location of the Survey 5

1.2 Study Area 6

1.3 Study Limitations 7

1.4 Project team 8

2 Methods 8

2.1 Habitat delineation 8

2.2 Field Surveys 10

2.3 Impact Assessment 11

2.3.1 Identification and Definition of Impacts 11

2.3.2 Impact Significance Rating 11

3 Results 14

3.1 Habitats 14

3.2 Habitat Sensitivity 15

3.3 Activities 18

3.3.1 Construction Phase Activities 18

,

3.3.2 Operational Phase Activities....18
3.3.3 Closure and Decommissioning Phase Activities....18
4 Impact Assessment....19
4.1.1 Loss of existing habitat....19
4.1.2 Direct mortality....21
4.1.3 Restriction of species movement....23
4.1.4 Disruption due to noise, dust and lighting....24
4.1.5 Erosion and watercourse siltation/sedimentation....26
4.1.6 Watercourse hydrocarbon contamination....28
4.1.7 Alien fauna....29
4.1.8 Alien flora....31
5 References....35

List of Figures

Figure 1: African forest zones reproduced according to Poorter et al. 2004....6
Figure 1-2 Location of the proposed development areas in relation to the Bea Mountain Mining Corporation Mining Development Area and existing gold mines....7
Figure 3-1 Major habitats of the proposed development areas and Bea Mountain Mining Corporation Mining Development Area....15
Figure 3-2 Critical Habitat in relation to the proposed Matambo Gold Mine infrastructure and exploration areas....17
Figure 3-3 Critical Habitat in relation to the proposed Matambo Concession showing terrain contours and large rivers....**Error! Bookmark not defined.**

List of Tables

Table 1: Classification of aquatic habitats 9

Table 2: Landsat 8 scenes with less than 10% cloud cover obtained from the USGS 10

Table 2-3: Criteria for assessing the significance of impacts arising from the proposed project activities 12

Table 2-4: Impact significance rating matrix 13

Table 2-5: Positive / negative mitigation recommendations in relation to the significance of the anticipated impact 14

Table 6. IFC PS6 triggers and relevant habitats for all concessions (adapted from Enviro-Insight 2021) 15

Table 4-1: The pre-mitigation (pre-m) and post-mitigation (post-m) impacts and significance assessment for the proposed development on fauna and flora. 33

Glossary

CH: Critical Habitat

EIA: Environmental Impact Assessment

MDA: Mineral Development Agreement

1 INTRODUCTION

1.1 PROJECT DETAILS AND BACKGROUND

1.1.1 Previous and Current survey

Enviro-Insigth was commissioned by ABS Africa, on behalf of Avesoro Mining Inc to perform an Environmental Impact Assessment for the Matambo Concession withn the Mining Development Area (MDA), in Grand Cape Mount County, Liberia. Enviro-Insight has completed surveys over 10 years within the Mining Development Area (MDA) and delivered 20 previous reports. This rapid baseline verification incorporates data obtained from the previous 2021 surveys. However, significant developments from the Company (Avesoro) as well as significant current impacts unrelated to the development (in migration of artisanal miners) took place in the years between 2017/2018 and 2021. Thus, the baseline is a highly complex comparative verification of conditions within the MDA, although significantly accurate conclusions and predictions can be generated given the understanding of the survey over a long period of time. Due to an acceleration in development activities, the Company has requested Enviro-Insight CC (hereafter referred to as Enviro-Insight) to undertake a rapid verification in order to subsequently formulate the Environmental Impact Assessment (EIA) of the Company's Matombo Concession, so that "key biodiversity values" can be identified in accordance with the Equator Principles lender criteria for natural and critical habitat in accordance with a future Impact Analysis.

1.1.2 Upper Guinean forests

The Upper Guinean Forests (UGF) extends from Senegal to Togo and are regarded as one of the biodiversity hotspots of the world. Woodland savanna stretching from the Sahel to the Gulf of Guinea, known as the Dahomey Gap, separates the UGF from the rest of the African forests (Figure 1) and consequently, the UGF have a high degree of plant and animal endemism (Poorter et al., 2004).

1.1.3 Timing and Location of the Survey

This assessment was conducted over two-season (wet and dry) in 2021 in order to inform and guide the development of the gold resources within targeted areas within the Avesoro MDA, Grand Cape Mount Country, Liberia. The resource deposits have been split into distinct study areas namely Gondaja, Leopard Rock, Matambo, Silver Hills and Weaju and West Mafa. The Matambo concession was the target of this survey.

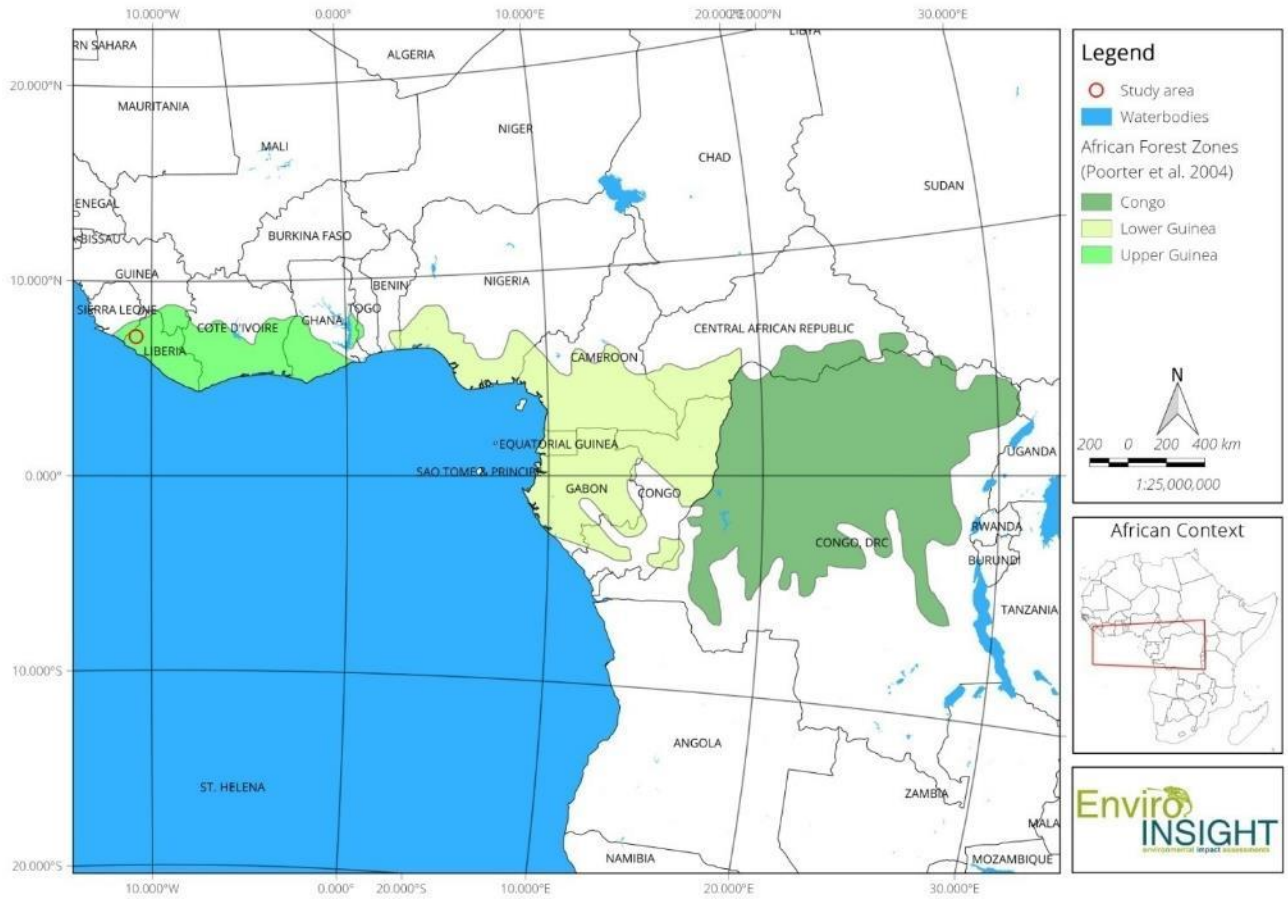


Figure 1: African forest zones reproduced according to Poorter et al. 2004

Guinean Moist Forest (analogous to UGF), one of the World Wide Fund for Nature's (WWF) *Global 200* Ecoregions, which represents 238 global Ecoregions selected for their "exceptional levels of biodiversity, such as high species richness or endemism, or those with unusual ecological or evolutionary phenomena" (WWF, 2016). The sub-sections below highlight the importance and rarity of the local biodiversity of the region on a global scale.

1.2 STUDY AREA

The EIA application falls within the BMMC Mineral Development Agreement (MDA) Area. The proposed Matambo Gold Mine is in the west at the previous Bangoma Mine. The study area of influence (PAOI) is defined for each Exploration Area as the area that is affected by the proposed activities and infrastructure, extending beyond the boundary of the proposed infrastructure due

to the nature of the impacts. For example, major negative impacts to fresh-water streams can be expected to occur for some distance downstream of the source of the impact.

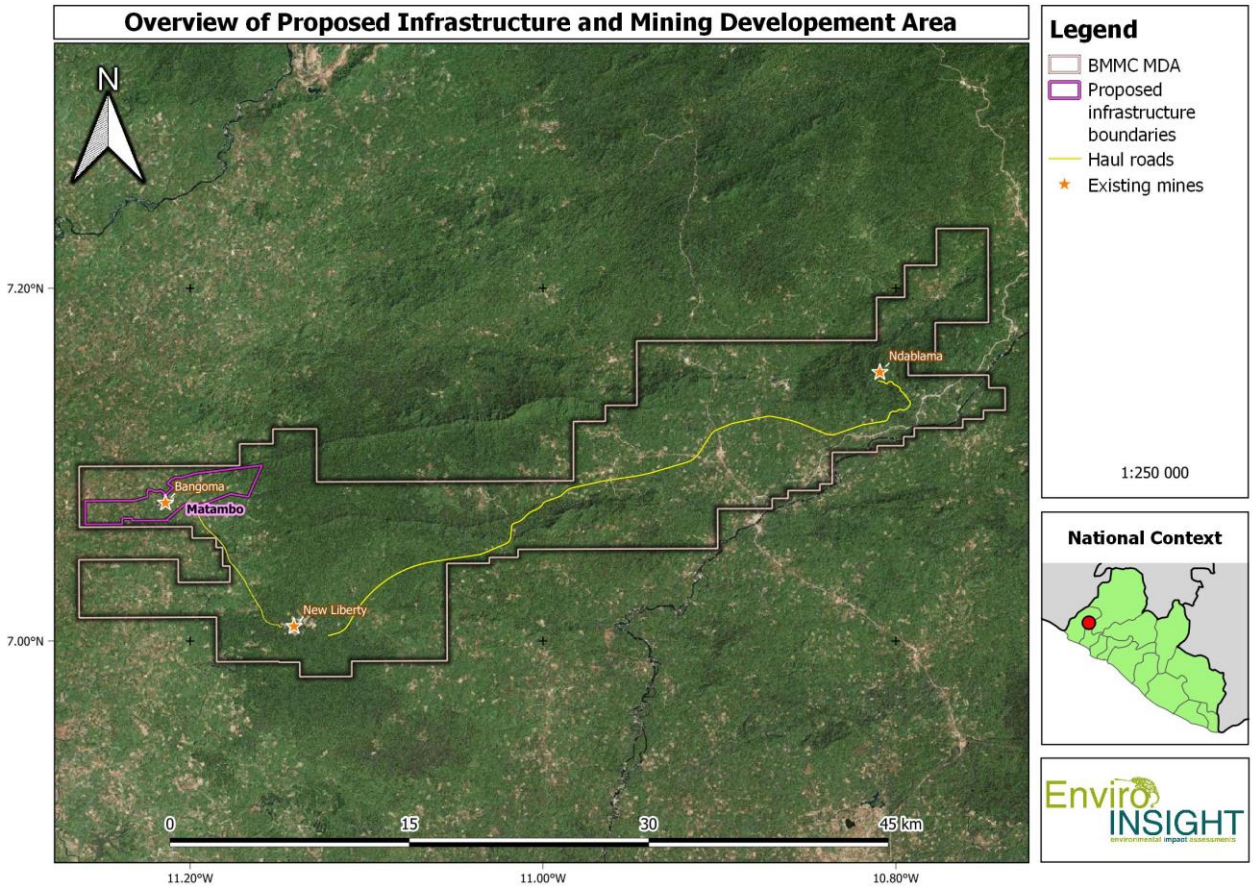


Figure 1-2 Location of the proposed development areas in relation to the Bea Mountain Mining Corporation Mining Development Area and existing gold mines.

1.3 STUDY LIMITATIONS

- It is assumed that all third-party information obtained (e.g. spatial data) and discussed is correct at the time of writing this report;
- Many animals occur at naturally low densities and are cryptic and very difficult to detect, especially predatory animals and animals that are subjected to intensive hunting pressure. This makes it highly unlikely that all species occurring in a region will be detected during a short survey, such as the current study. Therefore, the

current survey provides only a number of ecological "snapshots" of the faunal and floral communities present and are by no means exhaustive;

- Satellite imagery used to delineate habitats was limited to the best freely available Sentinel 2, which is limited to a 10 m resolution. The imagery could not accurately distinguish among some habitat types, such as late-stage secondary forest, mature forests, riparian and swamp vegetation.
- Suitable satellite imagery could not be obtained for a similar seasonality in 2021 due to the frequency and coverage of cloud-cover in the region.
- Similarly, no recent cloudless imagery could be found for later in the 2023 period, resulting in the opportunity for some recent land cover changes observed during the October 2023 being excluded from the analysis.
- There are major limitations regarding the available literature on the flora & fauna of West Africa, specifically regarding the geographic distributions of species, which reduces the confidence of predictions of species occurrence within the Exploration Areas;

1.4 PROJECT TEAM

Enviro-Insight put together a team of highly qualified ecology specialists and assistants for this project (Table 1).

Table 1: Team members and contributions to this project

Team Member	Specialty	Years of Experience
Samuel Laurence	Zoology, Ecology, Fieldwork, Author	16
Alex Rebelo	GIS	6

2 METHODS

2.1 HABITAT DELINEATION

Satellite imagery was obtained and processed for the BMMC MDA so that the main vegetation slopes and habitats could be mapped. The resulting map provided the platform for spatial mapping, survey design and data management. A National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital

Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website[1]. Basic terrain analysis was performed on this DEM using the SAGA[2] GIS software that encompassed a slope and channel network analyses in order to detect ridges and potential drainage lines respectively. The modelled drainage channels produced from the DEM were classified according to their branching complexity or Strahler Order (Strahler, 1957) where a Strahler Order of six was used as the threshold for detecting a channel. The *Add Grid Values to Shapes* module was used to add slope data[3] to the channel network. The resulting channel network was subsequently grouped into four main river / stream habitat types based on river size (Strahler Order of segment) and slope (average slope of segment) (**Table 2**).

Table 2: Classification of aquatic habitats

First division		Second division		
Strahler Order	**Classification**	**Slope (degrees)**	**Slope class**	**Habitat**
1-3	Stream	0-4	1	River or Lowland stream
4-6	River	4-5	2	River or Lowland stream
		5-6	3	Mountain stream or Lowland stream
		>6	4	High velocity mountain stream

Four Landsat 8 imagery scenes[4] were obtained from the USGS (**Table 3**). All scenes with less than 10% cloud cover were selected. Out of the four available scenes with less than 10% cloud cover, the two most recent scenes to the date of the field surveys were selected for further analysis. The Band 9 tiles from each of these imagery scenes were investigated to detect any cirrus clouds over the area of interest. The soft edges of these clouds are not easily detected otherwise without the capability of Landsat 8 that measures within the 1.360–1.390 nanometers spectrum range. A large cirrus cloud was detected over the Yambasei River on the image taken on 2016-01-24. The image taken on 2016-02-09 had no such cloud formation and was selected as the Landsat 8 scene for further analysis.

[1] http://earthexplorer.usgs.gov/
[2] www.saga-gis.org
[3] For lines and polygons average values are calculated from interfering grid cells
[4] Bands 1-7 and 9 have a 30 m resolution; band 8 has a 15 m resolution; bands 10 and 11 have 100 m resolution

Table 3: Landsat 8 scenes with less than 10% cloud cover obtained from the USGS

Landsat scene ID	Acquisition date	Status
LC82000552015005LGN00	2015-01-05	Not used
LC82000552015357LGN00	2015-12-23	Not used
LC82000552016024LGN00	2016-01-24	Not used
LC82000552016040LGN00	**2016-02-09**	**Used**

A false-colour composite image was created with the *RGB*[5] *Composite* module using Bands 6, 5 and 4 as input for red, green and blue respectively. This band combination is suitably for vegetation analysis (Butler, 2013).

- Band 4 - red (0.64-0.67 µm) - Useful to discriminates vegetation slopes;
- Band 5 - Near Infrared (NIR) (085.-0.88) - Useful to emphasize biomass content and shorelines; and
- Band 6 - Short-wave Infrared (SWIR) 1 (1.57-1.65 µm) - Useful to discriminate moisture content of soil and vegetation; penetrates thin clouds.

The *K-Means Clustering for Grids* was used on the resulting false-colour composite to divide the image into six clusters using a "Combined Minimum Distance / Hillclimbing" method. The resulting raster image was vectorised and all polygons with less than 1 ha of area were removed and assigned classification to the neighbouring polygon with the greatest area. This reduced the scale and allowed for more appropriate management unit delineation since habitats smaller than 1 ha cannot be expected to be ecologically functional in the greater sense. The resulting polygons were verified and manually adjusted or merged using satellite imagery (Google Corporation), existing land cover data for the area and more importantly, georeferenced ground-level photography and extensive field notes from numerous transects obtained during the fieldwork surveys. The resulting habitat delineation is intended for use at a scale of 1:50000. The habitat analysis culminated in the delineation of seven distinct structural habitat types.

2.2 FIELD SURVEYS

The field surveys and the methodology undertaken by various specialists are available in the exploration area baseline report (Enviro-Insight, 2021). In October 2023, a rapid ground-truthing assessment was undertaken by a specialist ecologist to document via drone photography, rapid analysis and comparative assessment with the previous surveys, any change in ecology,

[5] Red, green and blue

disturbance and current impacts that would serve to undermine the confidence int eh NDVI analysis or the subsequent EIA document to be produced for the Matambo concession.

2.3 IMPACT ASSESSMENT

2.3.1 Identification and Definition of Impacts

The first phase of impact assessment is the identification of the various project activities which may impact upon the identified environmental aspects. The identification of significant project activities is supported by the identification of the various receiving environmental receptors and resources. These receptors and resources allow for an understanding of the impact pathways and assessment of the sensitivity of the receiving environment to change. The significance of the impact is then assessed by rating each variable numerically, according to defined criteria as provided in

,

Table 2-4.

2.3.2 Impact Significance Rating

The purpose of the significance rating of the identified impacts is to develop a clear understanding of the influences and processes associated with each impact. The severity (magnitude), spatial scope and duration of the impact together comprise the consequence of the impact; and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact and can obtain a maximum value of 10. The significance of an impact is then determined from a matrix which evaluates the likelihood and the consequence of the impact, as shown in Table 2-5 and

Table 2-6.The model outcome of the impacts is then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes are adjusted. Arguments and descriptions for such adjustments, as well as arguments for each specific impact assessments are presented in the text and encapsulated in the assessment summary table linked to each impact discussion.

Activity: a distinct process or task undertaken by an organisation for which a responsibility can be assigned.

Environmental aspect: an element of an organisation's activities, products or services which can interact with the environment.

Environmental impacts: consequences of these aspects on environmental resources or receptors.

Receptors: comprise but are not limited to people or man-made structures.

Resources: include components of the biophysical environment.

Frequency of activity refers to how often the proposed activity will take place.

Frequency of impact refers to the frequency with which a stressor will impact on the receptor.

Severity: refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

Spatial scope: refers to the geographical scale of the impact.

Duration: refers to the length of time over which the stressor will cause a change in the resource or receptor.

Table 2-4: Criteria for assessing the significance of impacts arising from the proposed project activities.

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
SPATIAL SCOPE OF IMPACT	**RATING**
Activity specific	1
Area specific	2
Whole project site / local area	3
Regional	4
National	5
DURATION OF IMPACT	**RATING**
One day to one month	1
One month to one year	2

CONSEQUENCE

One year to ten years	3
Life of operation	4
Post closure / permanent	5
FREQUENCY OF ACTIVITY / DURATION OF ASPECT	**RATING**
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
FREQUENCY OF IMPACT	**RATING**
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

Table 2-5: Impact significance rating matrix

	CONSEQUENCE (SEVERITY + SPATIAL SCOPE + DURATION)														
LIKELIHOOD (FREQUENCY OF ACTIVITY + FREQUENCY OF IMPACT)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 2-6: Positive / negative mitigation recommendations in relation to the significance of the anticipated impact

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-High	76-100	Improve current management	Maintain current management
	Low-Medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very Low	1-25	Maintain current management	Improve current management

3 RESULTS

3.1 HABITATS

The delineated habitats are shown in Figure 3-1Figure 1-2 with an overview of the MDA infrastructure (inc the Matambo Gold Mine). This delineation is relevant at the landscape level only, specifically large patches of connected Hilltop and Lowland Forests, as wells a major rivers and streams. Additional habitats that could not be mapped (primarily due to imagery resolution constraints) are Azonal Swamp Vegetation and Riparian Forests.

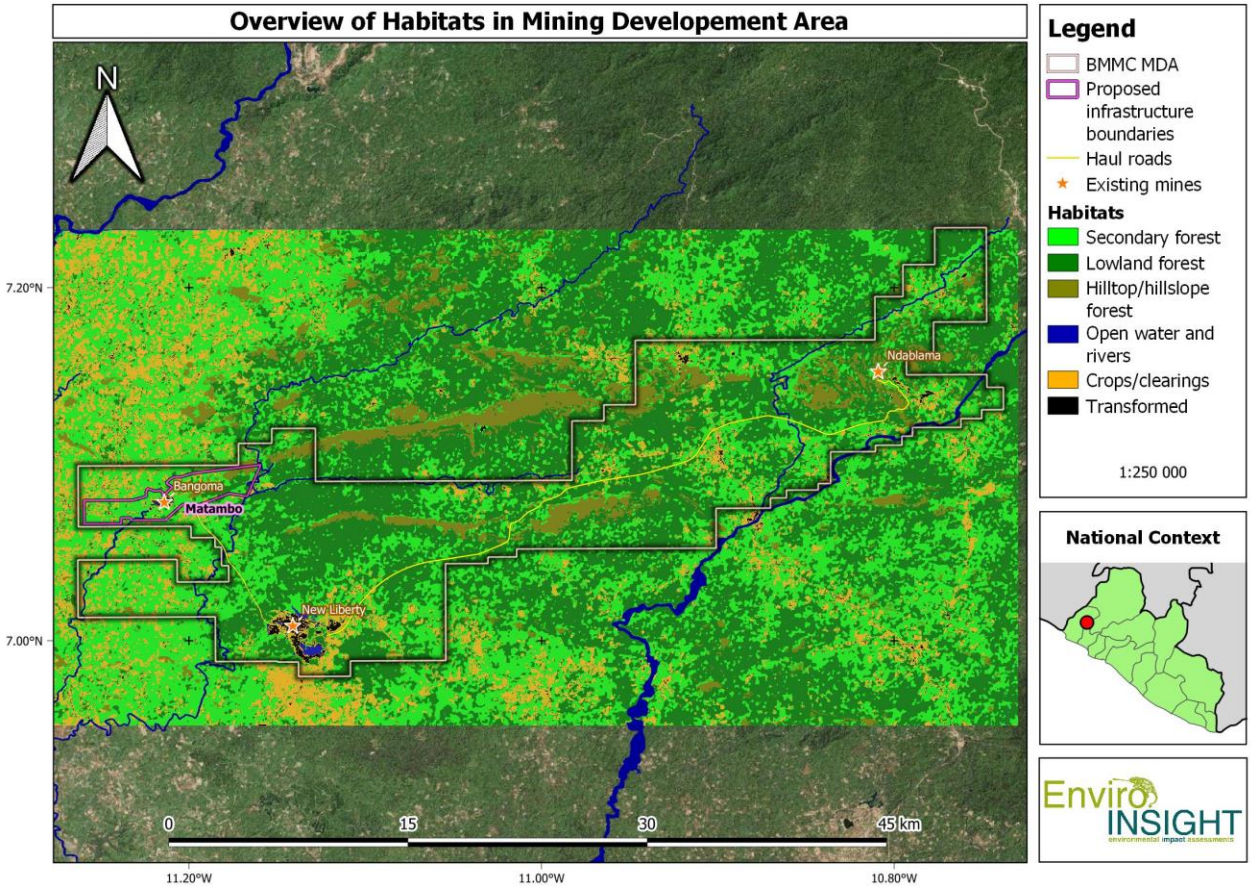


Figure 3-1 Major habitats of the proposed development area and Bea Mountain Mining Corporation MDA Area.

3.2 HABITAT SENSITIVITY

Critical Habitats were delineated in Enviro-Insight (2021) as Lowland Forest, Hillslope Forest, Swamps, Forested Rivers and Streams due to the triggers summarised in Table 7. These Critical Habitats are illustrated for Matambo in Figure 3-2.

Table 7. IFC PS6 triggers and relevant habitats for all concessions (adapted from Enviro-Insight 2021)

Trigger Species	IFC PS6 CH criterion	Habitat/s
Flora		

Trigger Species	IFC PS6 CH criterion	Habitat/s
Placodiscus pseudostipularis	1	Hillslope Forest, Lowland Forest
Herpetofauna		
Sclerophrys taiensis	1	Lowland Forest
Kinixys homeana	1	Hillslope Forest, Lowland Forest
Mecistops cataphractus	1	Forested Rivers and Streams (medium-large) buffered 30-100 m (based on 2017 RSPO guidelines[6])
Avifauna		
Psittacus timneh (Timneh's Parrot)	1	Hillslope Forest, Lowland Forest, Swamps (not mappable).
Mammals		
Pan troglodytes verus (West African Chimpanzee)	1	Hillslope Forest and Lowland Forest (following mitigation)
Choeropsis liberiensis (Pygmy Hippopotamus)	1	Forested Rivers and Streams (medium-large) buffered 30-100 m (based on 2017 RSPO guidelines[7])
Piliocolobus badius (Upper Guinea Red Colobus)	1	Hillslope Forest, Lowland Forest?

[6] waterbodies: 100 m; <5 m wide streams: 30 m; 3-10 m wide rivers: 70 m; >10 m wide rivers: 200 m.
[7] waterbodies: 100 m; <5 m wide streams: 30 m; 3-10 m wide rivers: 70 m; >10 m wide rivers: 200 m.

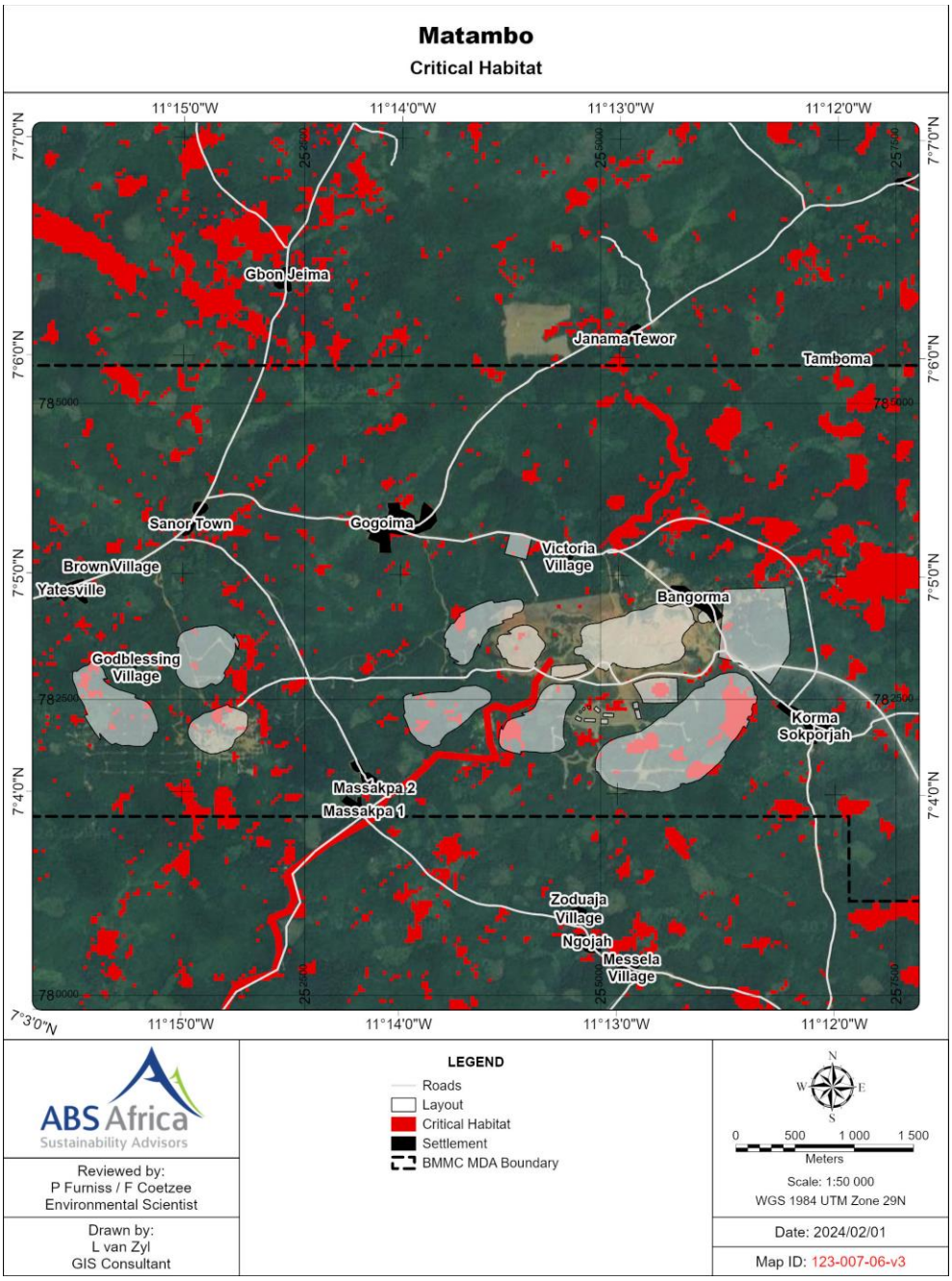


Figure 3-2 Critical Habitat in relation to the proposed Matambo Gold Mine infrastructure and exploration areas.

3.3 ACTIVITIES

3.3.1 Construction Phase Activities

- Clearing and grubbing of vegetation;
- Site perimeter fencing and internal fencing of different sections of the mine;
- Removal and stockpiling of topsoil;
- Delivery and storage of vehicles, equipment, machinery and materials;
- Construction of haul and access roads, platforms and drainage structures;
- Construction and installation of required equipment and machinery;
- Construction of the camp, offices, and explosive magazine; and
- Installation of power and water supply infrastructure.

3.3.2 Operational Phase Activities

- Clearing and grubbing of vegetation;
- Dewatering;
- Open pit mining through a combination of methods;
- Construction and operation of the WRD;
- Hauling of ore from the temporary ore stockpile to the existing New-Liberty process plant;
- Management of clean and dirty water runoff; and
- Delivery and storage of vehicles, equipment, machinery, and materials.

3.3.3 Closure and Decommissioning Phase Activities

- Dismantling and removal of all identified above-ground infrastructure; and
- Rehabilitation of the portal area and associated infrastructure, and placement of topsoil and re-vegetation of exposed areas.

4 IMPACT ASSESSMENT

The objective of this Environmental Impact Assessment (EIA) is to identify the likely significant effects on the environment and people due to the proposed project. Impacts that have been evaluated as being 'high' or 'very high' are significant effects and identified as such in the specialist chapters. Conversely, impacts that are 'low' or 'very low' are not significant.

4.1.1 Loss of existing habitat

Description of impact: existing natural habitats (including IFC PS 6 Critical Habitat), support populations of flora and fauna, allowing them to perform their biological functions and persist through time. The removal of these habitats disrupts these biological functions and, for the majority of species, results in local extirpation either from increase mortality, immigration or avoidance.

a. Project activities that can cause physical removal of vegetation.
    i. Clearing and grubbing of vegetation for infrastructure, stockpiling and dumping of mining material [Construction & Operation] – the removal of vegetation will directly result in the loss of suitable habitat required by various species of conservation concern (SCC), and these habitats are replaced by necessary infrastructure that persists for the life of the mine or longer;
    ii. Temporary laydown areas and construction infrastructure [Construction] – Habitats are removed or transformed for construction activities only and are no longer required for operational activities. The remaining habitat is often heavily transformed/disturbed and no longer compatible with the habitats required by various species of conservation concern (SCC); and
    iii. Associated mining activities and general construction [Construction & Operation] – Stochastic events such as fire (cooking fires or cigarettes of workers) where embers are blown into surrounding vegetation may cause runaway fires to temporarily transform habitat (especially dry–season secondary vegetation).
b. Secondary impacts associated with the loss of habitat and removal of vegetation.
    i. Displacement/loss of fauna (including SCC) [Construction and Operation] – due to the removal of natural habitat, in particular vegetation. This removal of vegetation will indirectly affect fauna reliant on this vegetation for foraging and/or refugia;
    ii. Erosion from wind and water in places where vegetation has been removed (addressed in separate impact) – reduction of available habitat due to loss of topsoil. In addition, siltation and sedimentation from eroded runoff likely to accumulate in streams and other aquatic habitats which will negatively

influence submerged or partially submerged aquatic vegetation, by coating the leaves with sediment and reducing light for photosynthesis, leading to die off;

iii. Habitat fragmentation & disruption of habitat corridors removed (addressed in separate impact) – cleared vegetation by the proposed development and supporting infrastructure will likely act as barriers to plant and animal dispersal due to restriction of movement from pollinator agents which will ultimately prevent genetic exchange and the ability to escape to more favourable environments, leading to a reduction in population viability; and

iv. Establishment of alien and invasive vegetation removed (addressed in separate impact) – areas cleared of vegetation provide ideal habitat for many pioneer alien and /or invasive species. Disruption in standing biomass (such as primary forest), disturbance of soil and introduction through human related vectors due to human in–migration all increase the likelihood of establishment of alien and invasive vegetation.

c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.

d. Mitigation and Enhancement Measures

i. Clearings associated with construction to occur in as small a footprint as possible. Surrounding vegetation outside the development footprint may not be disturbed;

ii. Construction camps & lay down areas should be erected on already disturbed surfaces where no vegetation clearing or soil disturbance is required;

iii. Upgrading of existing roads/servitudes should be preferable and take priority over the construction of new roads/servitudes. In addition, in the event that construction of new roads/servitudes are unavoidable, disturbed areas (e.g. fallow land or secondary forest lands) should be prioritized over ecologically intact areas (primary forests);

iv. Consider layout and site alternatives for the proposed development infrastructure to avoid or limit interaction with sensitive habitat types, which needs to be assessed and compared in order to select the option with the lowest impact;

v. Buffer zones must be allocated to sensitive or important habitat features to alleviate the effect of habitat loss, habitat fragmentation, disturbances, increased isolation and edge effects. No vehicles or personnel are allowed to enter these areas;

vi. Re–vegetation where required after clearance should commence immediately after the construction phase;

vii. Re–vegetation as part of the rehabilitation phase post–mining is critical to attempt re–establish the baseline environment pre–mining conditions;

viii. An environmental induction for all staff members must be mandatory in which specific issues related to the potential of fire are addressed e.g. only smoking in designated areas, no open cooking fires etc. Rules of mine regarding safety should be adhered to at all times.
ix. All environmentally sensitive areas should be demarcated and relayed to personnel as no-go areas;
x. An appropriate Biodiversity Action Plan (BAP) and community–based Ecosystem Services and Corporate Social Responsibility (CSR) project may be implemented in order to both avoid, minimise and mitigate the aforementioned impacts, preferably leading to a net improvement of the ecosystem integrity of the project area of influence; and
xi. Biodiversity Offset Plans (BOP) represent the last resort within the mitigation hierarchy and should be implemented under the auspices of the "net gain" and "like–for–like" principle where it is unavoidable that identified IFC PS6 Critical Habitat will be lost through project activities.

e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.
f. Residual impacts
    i. It is not possible to completely avoid habitat loss due to the proposed development footprint. However, providing protection for the surrounding vegetation of the project area will ensure the persistence of sensitive habitat types as well as the ecosystem services associated with these habitats;
g. Uncertainty – The level and quality of the rehabilitation and/ or the mine closure plan is currently unknown

4.1.2 Direct mortality

Description of impact: fauna populations persist within the environment if the fecundity and mortality are balanced. Increased mortality rates can result in the decline of a population and its eventual extirpation.

a. Project components that can cause direct mortality of fauna include:
    i. Clearing and grubbing of vegetation [Construction & Operation] – The clearing of vegetation with machinery followed by the preparation of ground surfaces for construction and maintenance is expected to result in the direct mortality of fauna by mechanical action (cutting, grinding and crushing), especially for slow–moving or burrowing fauna. The stockpiling and dumping of material is also expected to cause the direct mortality of slow–moving or burrowing fauna by mechanical action (burying and crushing).
    ii. Collisions from vehicles (hauling of ore and transport of personnel and equipment) [Construction & Operation] – Direct mortality due to collisions with vehicles resulting from increased traffic. Reptiles and amphibians are particularly prone to collisions with fast moving vehicles as they do

not move out of the way upon approach by a vehicle. Many mammals are also highly susceptible to impacts from vehicles (e.g. mongooses). Vehicle drivers rarely see small fauna on the road surface and cannot avoid collisions with these animals while travelling at high speeds or hauling heavy loads;

iii. Intentional killing and poaching of animals by construction and mine staff – Staff or contractors poaching and hunting for bushmeat (such as pangolins, primates, birds, antelope, tortoises, crocodiles and pythons) or the intentional killing of fauna (such as snakes) considered to be dangerous;

b. Secondary impacts associated with direct mortality of fauna
   i. Changes in fauna population dynamics (e.g. rodent population explosion) – for example, increased human activity, poor waste management, artificial refugia (provided by housing) prolonged mortality of predatory species such as snakes could significantly reduce the population density of these predators and allow prey species to undergo localised population explosions. This in turn can have additional negative impacts, for example rodent population explosions will result in reduced crop yields of local inhabitants and may also spread disease to humans; and
   ii. Potential loss of species of conservation concern – SCC that occur in low densities or are particularly susceptible to direct mortality may be entirely eradicated from the local area if the impacts described above are not mitigated appropriately.
c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.
d. Mitigation and Enhancement Measures
   i. All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) while within the project area during the construction and operation phases. Speeding fines/penalties must be awarded to offending drivers, or speed restriction bumps should be erected along the access roads to reduce the speed of all vehicles;
   ii. Road mortalities should be monitored by both vehicle operators (for personal incidents only) and the ECO (all road kill on a periodic monitoring basis as well as specific incidents) with trends being monitored and subject to review as part of the monthly reporting. Monitoring should occur via a logbook system where staff takes note of the date, time and location of the sighting/incident. This will allow determination of the locations where the greatest likelihood exists of causing a road mortality and allow mitigation against it (e.g. fauna underpasses, and seasonal speed reductions mentioned above). Finally, mitigation should be adaptable to the onsite situation which may vary over time;

iii. Reduce direct mortalities by allowing for fauna to cross the roads, particularly where the roads cross a sensitive natural habitat (e.g. streams). This can be achieved by constructing fauna underpasses under the roads (large culverts or large open–ended concrete pipes laid into the raised roads). These underpasses should be used in conjunction with "fauna barriers" which prevent the most susceptible small fauna from crossing the roads on the surface by directing them towards the underpasses where they can cross under the roads safely. It is important to note that utilization of underpasses is strongly dependent on animal body size (larger culverts are more successful) and the surrounding habitat;

iv. All staff operating motor vehicles must undergo an environmental induction training course that includes instruction on the need to comply with speed limits, to respect all forms of wildlife (especially reptiles and amphibians), not to transport any wildlife products or civilians carrying wildlife products and, wherever possible, prevent accidental road kills of fauna. Snakes should only be handled after inductions have taken place due to the risks of envenomation. Drivers not complying with speed limits should be subject to appropriate penalties;

v. An environmental induction for all staff members must be mandatory in which the value and importance of biodiversity is communicated and embedded within the working culture; and

vi. BAP and CSR projects must be associated with project activities in order to prevent an imbedded culture if illegal biodiversity exploitation activities and rather promote sustainable ecosystem services.

e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.

f. Residual impacts

i. It is not possible to avoid all fauna deaths, but proper mitigation will reduce the residual impacts to acceptable levels; and

ii. Given appropriate implementation of the mitigatons, there could be a some residualt net positive impact on faunal populations that could be protected under the auspices of the formalised mine operations.

g. Uncertainty– The exact volume of traffic is currently not known.

4.1.3 Restriction of species movement

Description of impact: movement is an important aspect for most fauna species and is required for foraging, breeding, migration and other vital activities. The restriction of movement is likely to negatively affect the success of these activities, resulting in the increased mortality and potential population decline in these areas.

a. Project components that can cause disruption/alteration of ecological lifecycles.
    i. Linear barriers and traps (fences and drainage infrastructure) [Construction and Operation] – Fences will represent dispersal barriers for some larger fauna and drainage structures can also trap certain species;
    ii. Infrastructure and transformed habitats [Operation] – Some transformed areas (e.g. houses, pits, rock dumps) are impassable to certain species, hindering the movement of fauna.
b. Secondary impacts associated with disruption/alteration of ecological lifecycles.
    i. Reduced population viability [Construction] – Restriction of movement and trapping of certain animals prevents genetic exchange and the ability to escape to more favourable habitats, ultimately leading to a reduction in population viability.
c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.
d. Mitigation and Enhancement Measures
    i. Excavated trenches must be left open for as short a time as possible to avoid acting as dispersal barriers or traps;
    ii. All open excavated trenches must have at least one of the slopes with an angle of less than 45° to allow for trapped fauna to crawl out;
    iii. Barriers that restrict fauna from falling into excavated pits or accessing contaminated water should be erected;
    iv. Natural pathways such as watercourses should be left unobstructed such as to serve as a corridor to ensure safe movement of species across the landscape; and
    v. All unnecessary fences and barriers must be removed when the mine is decommissioned.
e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.
f. Residual impacts – It is not possible to completely mitigate against the impact of restriction of faunal movement.
g. Uncertainty – The degree to which disruption of movement may affect some species.

4.1.4 Disruption due to noise, dust and lighting

Description of impact: fauna are not accustomed to loud noises, dust and night–time lighting and these disturbances may affect their ecological life cycles, causing them to be less active, less successful at foraging, vocalising for mates or detecting predators. These disturbances may cause higher mortality rates of the affected fauna species or result in their displacement.

Flora requires light and gaseous exchange for photosynthesis, but dust can smother leaves and greatly reduce metabolic activity.

a. Project components that can result in increased noise, dust and lighting.
    i. General construction activities [Construction] and mine operation (machinery and blasting) [Operation] – Lighting at night may disrupt flight paths of migrating birds and bats foraging at night which could cause disorientation and collisions of these animals with infrastructure. Noise generated at night (especially from blasting) could disrupt nocturnal faunal activities. Dust from the actual mining operation will settle on the adjacent vegetation which will reduce photosynthesis which may have indirect effects on fauna (loss of vegetation and / or reduction in nutritional content of vegetation).
    ii. Hauling of ore from the temporary ore stockpile [Operation] – Noise, dust and lighting generated from moving vehicles operating on access roads and servitudes can disrupt fauna populations by interfering with their movements and/or breeding activities. In particular, lighting at night is expected to attract insects which will attract geckos and amphibians which in turn can attract snakes (which might be venomous). Lighting at night may also disrupt flight paths of migrating birds and bats foraging at night which could cause collisions of these animals with infrastructure and / or moving vehicles;
b. Secondary impacts associated with Disruption/alteration of ecological life cycles.
    i. Increased probability of interaction with reptiles – As described above, snakes may be attracted to higher prey densities, which represents a potential health and safety hazard. In addition, snakes attracted by to the site are likely to be killed by staff on site.
c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.
d. Mitigation and Enhancement Measures
    i. Equipment with reduced noise emissions or mufflers are preferred;
    ii. A dust monitoring system should be implemented during the construction phase to monitor effectiveness and necessity for suppression efforts (see below);
    iii. Water or dust control agents should be used in working areas and roads will be sprayed for dust suppression on a regular basis in designated susceptible areas during periods of heavy dust generation;
    iv. Water abstraction for dust suppression should be made from sustainable sources such as artificial impoundments or designated aquifers. No pollution of these water sources can be tolerated, and

quarterly testing of abstraction sites must take place as part of the EMP. All necessary permits and legislative requirements required for the abstraction of water should be adhered to.

v. Reduce exterior lighting to levels that are necessary for safe operation, and implement operational strategies to reduce spill light. Use non–UV lights where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators;

vi. Keep noise levels suppressed as per best practice or national standards. Do not unnecessarily disturb faunal species, especially during the breeding season and those with juveniles;

vii. All lighting should be orientated away from intact forest and watercourse habitat in order to minimise displacement effects of strong lighting;

viii. Existing barriers should be in place that keep fauna species away from the existing facilities. These fences should be maintained in order to ensure fauna species do not gain access to the construction site unnecessarily where they can be hurt or killed; and

ix. All staff should be subjected to an induction training program where appropriate conservation principles, safety procedures, snake bite avoidance and first aid treatment are taught. Several staff members should complete a snake handling course in order to safely remove snakes from construction areas, and these staff must be onsite and available to respond to calls and safely remove and relocate snakes if necessary.

e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.

f. Residual impacts – Blasting may disrupt breeding populations within close proximity to the study area. Although it will not be possible to completely prevent the disruption of ecological life cycles of some fauna, the mitigation measures proposed along with best practice standards should result in negligible residual impacts.

g. Uncertainty – The magnitude of the noise and vibration from underground blasting, i.e. the affected area. The susceptibility of species to vibration and noise disturbance.

4.1.5 Erosion and watercourse siltation/sedimentation

Description of impact: increased rainwater runoff and exposed bare earth can result in the rapid erosion of surface material that is carried into watercourses and wetlands, resulting in changes to hydrological flow, high sedimentation, siltation and unnaturally high nutrient loads (potentially leading to eutrophication) or toxic chemicals. Aquatic habitats can become transformed and no longer suitable for some aquatic species.

a. Project components that can cause severe sedimentation of watercourses.
    i. Clearing and grubbing of vegetation and construction of infrastructure [Construction and Operation] – removal of vegetation exposes bare soil to the elements and impermeable artificial surfaces increases runoff causing erosion and resulting in topsoil removal, hydrological changes, and siltation and sedimentation of watercourses.
    ii. Removal and stockpiling of topsoil AND construction and operation of the WRD [Construction and Operation] – Rainwater runoff from the bare surfaces of topsoil and waste stockpiles will result in eroded material that will require storm water management.Rainwater runoff from these stockpiles may contain additional pollutants that should not enter the natural watercourses.
b. Secondary impacts associated with contamination of watercourses.
    i. Fauna and flora deaths [Construction and Operation] – Sedimentation (and pollution) of water has negative consequences for flora and fauna including habitats far downstream of the pollution source. Vision and gas exchange of aquatic organisms is negatively affected due to suspended sediment particles. This negative effect is particularly severe for eggs and young of aquatic organisms that often are unable to survive due to this impact, causing rapid population declines;
    ii. Health Concerns [Construction and Operation] – Health issues for surrounding human communities from drinking water from heavily sedimented (and potentially polluted) watercourses.
c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.
d. Mitigation and Enhancement Measures
    i. Implementation of a stormwater management plan with best practice erosion and sedimentation control mechanisms (traps or dams) to prevent unnecessary sedimentation in natural watercourses;
    ii. Appropriate design and maintenance of roads to limit eroded rainwater runoff and / or trap such runoff before it enters natural watercourses;
    iii. Implementation of earthworks and waste rock/soil storage plan where eroded runoff is captured and managed according to best practice standards; and
    iv. Creation of operations management plan for stochastic erosion events as well as ongoing monitoring programs.
e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.
f. Residual impacts – Not all the eroded runoff will be trapped and a degree of sedimentation can be expected. The severity of this sedimentation and its effect on biodiversity should be monitored through regular water sampling (to calculate indices of sedimentation) and regular biodiversity monitoring (to assess the magnitude of this residual impact on aquatic fauna [especially diatoms, macro–invertebrates, fish and amphibians]).
g. Uncertainty – The effective implementation of a stormwater management plan.

4.1.6 Watercourse hydrocarbon contamination

Description of impact: hydrocarbons originating from oils and fuels used in vehicles and machinery have negative effects on the environment. Of greatest concern is when hydrocarbons enter aquatic systems where they can spread out and contaminate a large area. Hydrocarbons take a long time to break down naturally and are toxic to plants and animals, smother breathing apparatus of aquatic fauna and effect thermoregulatory properties of features and fur.

a. Project components that can cause contamination of watercourses
    i. Hydrocarbon spillage from Hauling and Delivery and storage of vehicles, equipment, machinery, and materials [Construction and Operation] – this can occur from storage yards/facilities, or trucks and vehicles which can severely contaminate the watercourses and other aquatic habitats in the project area. Serious spills can dramatically affect mortality rates of avifauna, mammals and herpetofauna species utilising the watercourses as breeding and foraging habitat. Standing vehicles and machinery may leak hydrocarbons which can be washed into the surrounding watercourses during rainfall events. Similarly, the spillage of hydrocarbons during the servicing of construction vehicles on site can lead to the pollution of watercourses and surrounding habitats.

b. Secondary impacts associated with contamination of watercourses
    i. Migration disruption [Construction and Operation] – Contaminated watercourses will lose their effectiveness as migratory corridors and may therefore act as dispersal and migration barriers;
    ii. Fauna and flora deaths [Construction and Operation] – Pollution of water has negative consequences for flora and fauna including habitats far downstream of the pollution source. Numerous susceptible species may rapidly die followed by other potential long–term effects, such as reduced fecundity etc. It is possible that fauna (and humans) consuming the dead aquatic fauna (e.g. fish) are also be negatively affected;
    iii. Health Concerns [Construction and Operation] – Health issues for surrounding human communities from drinking contaminated water or eating fish from contaminated aquatic habitats.

c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.
d. Mitigation and Enhancement Measures
    i. Zero tolerance for hydrocarbon spillage next to the watercourses – all mining activities within 50 m of any aquatic habitat to be prohibited;
    ii. No vehicles or machinery are allowed within the buffer areas (50 m) of the watercourse. Predetermined areas should be indicated where vehicles and machinery are to be stored, repaired and refuelled within a bunded area;

iii. Use of drip trays positioned under stationary vehicles to collect hydrocarbons is mandatory at all times;
iv. Implementation of rapid response emergency spill procedures to deal with spills immediately, including training of staff to deal with such instances; and
v. Ongoing monitoring of presence of hydrocarbons in the watercourses should be done by an aquatic specialist as well as monitoring of the avifauna and herpetofauna assemblages within potentially affected watercourses.

e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.
f. Residual impacts – None.
g. Uncertainty – The location of fuelling stations and vehicle workshops.

4.1.7 Alien fauna

Description of impact: fauna species that are introduced from other parts of the world have the potential to become very successful due to lack of predators, untapped resources and local fauna and flora not being familiar or adapted to the foreign species. These species can disrupt the food chain, introduce novel pathogens and parasites, outcompete or eat local species.

a. Project components that can result in increased densities of alien fauna

i. Delivery and storage of vehicles, equipment, machinery, and materials [Construction and Operation] – Stowaway fauna in transported materials and equipment (especially commensal species) can be introduced to the study area. Once a few individuals are introduced they are able to rapidly multiply and become an established population;
ii. Transformation of habitat from general construction [Construction] – local fauna communities are disrupted when natural habitats are transformed, making it easier for alien species to become established in these in these habitats. Commensal species are adapted to transformed habitats and attractants such as human living quarters, infrastructure, waste areas, food preparation and storage areas) and the lack of natural predators (see above discussion on the killing of snakes) further facilitate the establishment of these species. Building materials may also facilitate the transportation and establishment of some alien fauna species, such as cockroaches and termites.

b. Secondary impacts associated with increased densities and diversity of alien fauna species

i. Direct mortality of native species (e.g. rats consuming bird's eggs and fledglings);

ii. Mortality of native species due to competition with alien fauna; and

iii. Disease and / or infection spread to human population from alien animals (e.g. dogs/ rats).

c. Impact Assessment (Pre–mitigation) – Refer to Table 4-1.

d. Mitigation and Enhancement Measures

i. Alien fauna on site should be subjected to an aggressive and environmentally friendly eradication program prior to construction;

ii. Any remaining alien fauna post–construction should be monitored and eradicated as part of the management plan;

iii. Waste management (especially food and sewerage waste) must be subject to a comprehensive analysis and management plan review. Incineration of food waste is ideal but is subject to appropriate permitting procedures;

iv. Continuous monitoring of the growth and spread of alien fauna coupled with an adaptive management approach to identify suitable control mechanisms, preferably non detrimental to native fauna (other rodents, owls). Eco–friendly control mechanisms such as the lethal and reusable Goodnature A24 rodent traps[8] should be applied as solutions.

v. Chemical control (e.g. fumigation of shipping containers) should take place on products such as wood before they are brought to the project location, to prevent inadvertently introducing alien/invasive invertebrates to the area;

vi. An alien invasive post–mining operations closure plan should be developed and implemented one year prior to mine closure. The site needs to be restored to its previous condition/land–use, which excludes alien and invasive fauna species.

e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.

f. Residual impacts

i. Once established, invasive species are often extremely difficult to eradicate and must be continuously controlled.

[8] https://ecosolutions.co.za/pest-control/non-toxic-rodent-control

g. Uncertainty – the potential invasive species that may be transported into the site (especially in the future) and the severity of their impact on the native assemblages.

4.1.8 Alien flora

Description of impact: flora species that are introduced from other parts of the world have the potential to become very successful due to lack of predators, untapped resources and local fauna and flora not being familiar or adapted to the foreign species. Invasive plants typically smother other vegetation and can change the vegetation characteristics and fire regimes, transforming the habitat structure and food availability for fauna species.

a. Project components that can result in the spread and increased densities of alien flora

   i. Clearing and grubbing of vegetation [Construction & Operation] – exposed soil due to recently cleared vegetation is highly susceptible to colonisation of alien and invasive flora. In addition, dormant alien seeds can germinate after soil disturbance;

   ii. Delivery and storage of vehicles, equipment, machinery and materials AND Hauling of ore [Construction & Operation] – vehicles and machinery can spread alien plant seeds throughout the study area which could potentially spread into the adjacent (natural) areas. Alien plants can cause alterations to the environment which could affect local flora;

   iii. Intentional planting of unsuitable species for landscaping or rehabilitation [Construction & Operation & Decommissioning] – Decorative plants surrounding offices, accommodation facilities and other infrastructure may be selected for their rapid growth and hardiness which would make them potentially invasive to the surrounding environment. Similarly, using alien plant species for soil stabilisation/restoration may result in 'escaped' individuals that would colonize the surrounding habitats;

b. Secondary impacts associated with increased alien flora species

   i. Alteration and loss of fauna assemblages – Animals species reliant on particular habitat types and /or micro–niche conditions are excluded from dense stands of alien and invasive species, which therefore effectively reduce the available habitat for fauna; and

   ii. Dense stands of alien and invasive flora species can act as barriers to dispersal for certain fauna, which increases habitat fragmentation.

c. Impact Assessment (Pre–mitigation) Refer to Table 4-1.

d. Mitigation and Enhancement Measures

i. Alien flora on site should be eradicated prior to construction. Any remaining alien flora post–construction should be monitored as part of the alien and invasive species monitoring and eradication action plan and controlled accordingly;

ii. Disturbance of natural areas should be avoided and the spread of alien flora into natural areas should be monitored and controlled (as per the alien invasive management plan);

iii. Continuous monitoring of the growth and spread of alien flora coupled with an adaptive management approach to identify suitable control mechanisms, preferably mechanical for such a small area. No chemical control should take place within 50 metres of any aquatic habitat;

iv. No planting of alien invasive species as part of landscaping and / or bio control. Only trees indigenous to the vegetation unit and endemic to the area may be planted, even if for visual purposes only. This should be indicated prior to development and approved by the competent authority; and

v. Rehabilitation post–mining operations should include an alien and invasive species monitoring and eradication action plan, in order to ensure that the spread and establishment of alien and invasive species are controlled and monitored (starting from the operational phase of the mine) and that disturbances post–mining are minimal and mitigated where necessary. The site needs to be restored to its previous condition/land–use, which excludes alien and invasive species.

e. Impact Assessment (Post–mitigation) – Refer to Table 4-1.

f. Residual impacts

i. Once established, invasive species are often extremely difficult to eradicate despite mitigation measures and must be continuously controlled to limit the degree and spread of infestation.

Uncertainty – the potential invasive species that may be transported into the site (especially in the future) and the severity of their impact on the native assemblages.

Table 4-1: The pre-mitigation (pre-m) and post-mitigation (post-m) impacts and significance assessment for the proposed development on fauna and flora.

Impact	Activity	Impacts Status	Severity		Spatial scope		Duration		Frequency (activity)		Frequency (impact)		Significance	
Loss of existing habitat				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Clearing and grubbing of vegetation for infrastructure	Neg.	5	5	2	2	5	4	5	4	5	4	**120**	88
	Temporary laydown areas and infrastructure	Neg.	4	3	2	1	4	3	5	3	5	5	100	56
	Associated mining activities and general construction	Neg.	3	2	2	2	3	3	3	3	3	3	48	42
Direct fauna mortality				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Clearing and grubbing of vegetation	Neg.	5	4	2	2	3	3	3	3	4	3	70	54
	Collisions with vehicles	Neg.	3	3	3	3	4	4	5	4	4	3	90	70
	Intentional killing and poaching of animals by construction and mine staff	Neg.	4	4	2	2	4	4	4	4	5	2	90	60
Restriction of fauna movement				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Linear barriers and traps	Neg.	4	3	2	1	4	4	5	4	4	3	90	56
	Infrastructure and transformed habitats	Neg.	2	2	1	1	4	4	5	4	3	2	56	42
Fauna disruption due to noise, dust and lighting				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Construction works and mine operations	Neg.	4	3	3	2	4	4	5	5	5	3	**110**	72
	Hauling of ore	Neg.	3	2	3	3	4	4	5	5	5	3	100	72
Erosion and watercourse siltation/sedimentation				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Removal of vegetation and construction of infrastructure	Neg.	4	3	4	2	5	4	4	3	5	5	**117**	72
	Mining operations (waste rock)	Neg.	4	3	4	2	5	4	5	3	5	5	**130**	72
Watercourse hydrocarbon contamination				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Spillage from haul trucks, transport and storage of vehicles and fuel storage	Neg.	5	4	4	4	4	4	5	5	2	1	91	72

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Impact	Activity	Impacts Status	Severity		Spatial scope		Duration		Frequency (activity)		Frequency (impact)		Significance	
Alien fauna				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Transport and introduction of alien fauna	Neg.	4	3	4	2	5	5	4	4	3	2	91	60
	Habitat transformation	Neg.	3	2	3	3	4	4	5	5	5	3	100	72
Alien Flora				*m*		*m*		*m*		*m*		*m*	*pre-m*	*post-m*
	Clearing of vegetation and earthworks	Neg.	2	2	3	2	4	4	3	3	5	5	72	64
	Transport and spread of alien flora propagules	Neg.	5	3	4	4	5	4	3	3	3	3	84	66
	Planting of alien flora	Neg.	5	3	3	3	5	4	5	4	4	1	**117**	50

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CHAPTER 10
SOCIO-ECONOMIC IMPACTS

TABLE OF CONTENTS

10 SOCIAL AND ECONOMIC IMPACT ASSESSMENT 10-1

10.1 PRE-CONSTRUCTION IMPACTS 10-1
10.2 CONSTRUCTION IMPACTS 10-1
10.2.1 Employment 10-1
10.2.2 Infrastructure, Transportation 10-1
10.2.3 Water Pollution 10-2
10.2.4 Education 10-2
10.2.5 Health 10-2
10.2.6 Socio-Economic Compensation 10-2
10.2.7 Air Pollution, Dust and Noise 10-3
10.3 CONSTRUCTION AND OPERATIONAL PHASES 10-3
10.4 CONCLUSION 10-3

LIST OF APPENDICES

APPENDIX 10-1: SOCIAL IMPACT ASSESSMENT REPORT (PETRA, 2024) 10-5
APPENDIX 10-2: RELOCATION ASSISTANCE PLAN (PETRA, 2024) 10-6

10 SOCIAL AND ECONOMIC IMPACT ASSESSMENT

A Social Impact Assessment and Social Management Plan was compiled by Petra Resources Incorporated (Petra, 2024) for the proposed Matambo Open Pit Mine (the Project) (refer to APPENDIX 10-1). This chapter of the ESIA Report provides a summary of the key social impacts identified. Mitigation measures for identified impacts are provided in Chapter 14 of the ESIA Report.

10.1 PRE-CONSTRUCTION IMPACTS

In the planning or pre-construction stage of the Project, the main activities that are carried out are surveys, engineering design and technical studies that include the following:

- Topographic surveys.
- Preliminary planning and design of the mine and associated infrastructures layout to determine the most optimal layout.
- Pre-environmental impact assessment.
- Soil investigations
- Erosion and Sedimentation Control
- Pre – Social Impact Assessment
- Road and Transportation Assessment

The impact is not very significant, and no mitigations are needed. These are specialist studies involving professional and technical input to conduct sampling and survey works at the Project area and its vicinity, desktop studies, computer simulation and engineering design work. These activities are low-impact activities and do not involve any inflow of migrant workers, non-local or foreign. Therefore, no change in demographic character, liveability, socio-economic wellbeing, etc. is expected.

10.2 CONSTRUCTION IMPACTS

10.2.1 EMPLOYMENT

The Matambo Open Pit Gold Mine will create several employment opportunities, both short-term and long-term. It is expected that during the construction phase many jobs will be available, while a lower number of employments will be available during the operational phase.

The Project is expected to generate jobs during the life of the Project. Approximately 500 people will work at the mine during the peak development, preparation, and production stages of the Project. The Project shall also contribute to economic growth and development with respect to the new employment opportunities and business linkages that can be created with the mine activities. Mitigation measures will consider ways to strengthen the skill set of the local population to ensure that they can participate and benefit from the Project.

10.2.2 INFRASTRUCTURE, TRANSPORTATION

Stakeholders in the Project area raised concerns over road network, connectivity, and accessibility. Issues around the use and maintenance of the existing public access roads within the Project area were raised, especially during the construction phase which was ongoing at the time of field study engagements. The movement and transportation of heavy earthmoving equipment were said to be damaging an already poorly maintained public infrastructure.

As a result of ongoing road construction and uncertainty about the possible future layout, the lack of road connectivity to previously connected nearby communities causes concerns for their continued social cohesion. In addition, lack of access to previous routes is reportedly increasing travel distances, namely to Bangorma where critical social services such as health care, school, voting rights, marriage registration are accessed. The increased associated transportation cost with the extended distances was also noted as a concern.

In mitigating these impacts, the Project is committed to maintaining public access roads, especially during the construction phase of the Project, and working with the national regulatory authorities to ensure that social funding

provided by the proponent as part of its MDA obligations are used directly in the Project areas to address some of these public infrastructure challenges along the public access road.

10.2.3 WATER POLLUTION

During the field studies for this assignment, in accordance with temporary permits granted by the EPA, BMMC was actively undertaking pre-construction activities including vegetation clearing, saprolite removal, stockpiling of soil, building of access and related activities. These simultaneous construction activities manifested in several immediate concerns regarding water quality, particularly for surface waters across Project affected communities. Concerns expressed during stakeholder engagements also considered potential chemical pollution during the operations phase as well as domestic pollution from the company's camp and office locations.

In response to expressed concerns about surface water quality in 4 communities during baseline data collection, an additional round of environmental quality data sampling and analysis was undertaken.

Regarding domestic water pollution from the camp and office at Gogoima, BMMC has already initiated corrective construction works on relevant sewage infrastructure at the camp.

Following completion of pre-construction and construction activities, it is expected the existing disturbances to surface water will reduce significantly. An integral part of the BMMC mitigation measures will arrange for independent environmental specialists to collect water samples from the area of concern, and these will be analysed at an EPA-accredited laboratory and reported to the EPA.

Assistance with the construction of a sanitation facility may be considered by BMMC as part of the community development plan to be implemented during mining.

During field studies, despite water related complaints from upstream communities, namely Saanor and Yatesville, BMMC was not undertaking activities to impact their surface water resources.

10.2.4 EDUCATION

Access to education opportunities is expected to increase with the development of the proposed Project and should consider geographic and transportation-related access constraints. The existing public school at Bangorma has been considered in the proposed relocation design and layout of the New Bangorma town.

To help address the training and educational needs for residents, BMMC has launched a Technical Vocational Education Training [TVET] school in Kinjor. BMMC encourages communities across its MDA area that are interested in TVET programs to attend this institution.

10.2.5 HEALTH

The availability of healthcare services will be maintained with the construction of a public health center considered in the proposed relocation design and layout of the New Bangorma town. The geographic and transportation constraints expressed by catchment area communities regarding their continued convenient access and proximity to the new public facility should be considered. To address this specific concern, BMMC is proposing to engage with MoH to have a health post in Kumah Sorkporjah to provide emergency services.

BMMC has initiated consultations with the Ministry of Health to advise on the design of the new clinic at New Bangorma.

10.2.6 SOCIO-ECONOMIC COMPENSATION

As part of the mitigation measures BMMC has implemented a comprehensive compensation scheme for artisanal miners and farmers whose pits or crops may have been impacted by the construction activities. In addition, a previous Chinese-operated Class B mining operation at Bangorma was engaged directly by BMMC for compensation and support to relocate its assets.

The guiding compensations for artisanal miners and farmers have been based on national regulatory guidance. An artisanal mining report prepared by the Ministry of Mines and Energy and Ministry of Internal Affairs as well as direct negotiations with license holders, informed the compensation schemes for artisanal and small-scale miners, while the Ministry of Agriculture [MoA] 2012 Crops Compensation Listing guided agricultural compensations.

Additionally, for homes and residential properties impacted in the Bangorma Town, a full voluntary relocation assistance program (APPENDIX 10-2) is in place to have the entire community voluntarily relocated approximately 2.0km north of its current location. This voluntary relocation assistance program includes the construction of approximately 224 homes and associated shared social infrastructures and services including a community clinic, school, religious centers of worship for both Muslims and Christians, a marketplace [shops] and burial grounds.

10.2.7 AIR POLLUTION, DUST AND NOISE

It is recognized that the BMMC site preparation activities have changed the levels of noise in the area, particularly for communities within 300 - 400m of the activities. Day-time noise measurements were conducted in the Massakpa area on 2 December 2023. These noise measurements showed that noise levels were at an average of 48.7 dBA. International guideline limits for daytime (07:00 - 22:00) and nighttime (22:00 - 07:00) noise is 55 dBA and 45 dBA respectively. The average daytime noise levels at the time of the measurement were thus within the international guideline limits. The Noise Impact Study Report has recommended additional mitigation measures which BMMC will be considering for implementation.

10.3 CONSTRUCTION AND OPERATIONAL PHASES

The significance ratings of the impacts to the local population and the community are indicated in **Error! Reference source not found.** for the construction and operational phases of the Project. Among the positive impacts that are considered high priority and significant to the local population are:

- Employment and business opportunities from the activities. For example, new businesses under the initiative of the local population may also come on-stream to service the workers during construction and operational phases.
- An opportunity to improve their household income, livelihood, and lifestyle.
- Increased demand for housing and rental accommodation due to the inflow of non-local workers.
- Land use changes from agriculture to a use that enhances the value to the land.

As for the negative impacts, the most significant and high priority impact relates to:

- The livelihood of the full-time farmers and ASM workers and the possibility that their livelihood might not be sustained.
- Risk perception of the Project employees of uncertainty over their future.
- Safety of motorized vehicles and pedestrians on local public road due to an increase in traffic volume and movement.
- Potential to remove community cohesion due to lack of easy access.
- To a lesser extent, some impacts have moderate significance to the community, but which, nonetheless, still require either monitoring or preventive action to minimize their impacts. The variables with moderate significance include:
  - Perceived fear and anxiety over crime, public safety, health, and social conflict – issues usually associated with the presence or proximity of foreign workers.

10.4 CONCLUSION

The findings of this SIA indicate that the construction and the operation of the proposed Matambo Open Pit Gold Mine have both positive and negative impacts. Positive impacts are mainly due to creation of employment opportunities, boosting of the local economy due to increased disposal income and contribution to the overall national revenue of Liberia which ultimately may lead to improved quality of life.

On the contrary, negative impacts may be experienced due to migration of job seekers into the Project area and surrounding towns and village; damage to property and infrastructure because of mining activities; decline in the quality of life due to air, noise, land and water pollution and increased traffic.

As was seen in the preceding chapters, a significant proportion of the population of the Project area is resident in Bangorma Town which has a population of 4,300 residents.

The combined average monthly household income for residents within the Project study area was reported as equivalent to roughly US$590.

The clinic in Bangorma Town operates in a catchment network, servicing nearly 12 communities within and around the Project area. Ensuring continual access to this social service is critical to improving the health access to residents in the Project area.

Given this backdrop, the mine offers an opportunity to contribute to the overall improvement of the socio-economic status of Matambo Corridor. Striking a balance between economic, social, and environmental conservation is often challenging considering the numerous stakeholders and differing motives. A healthy competitive environment needs to be established for the opposing land uses such as mining, agriculture, and human settlement because mining activities lead to large scale destruction of the environment and land disturbance.

To this BMMC is committed to a full-scale rehabilitation of the Project area; a detailed rehabilitation plan is presented in the overall Project closure management plan; these commitments as well as supporting the communities through direct Project initiatives are strong ethical foundations to which BMMC is committed to.

In addressing the negative impacts, the social impact study outlines the following solutions:

- Upgrading and maintenance of the public road network to pre – construction status or better.
- Increasing the level of higher skilled local employees.
- Expanding the domestic water point sources.
- Establishing mining supplier parks to enhance enterprise development in the Project communities.
- Resolving land claims to improve economic growth and improve living conditions.
- Providing comprehensive support to corporate social contributions initiatives so that Project communities can directly benefit from corridor development programs.

Ultimately, if the proposed Matambo Open Pit Mining Project is authorized, every effort must be directed to ensure that it leaves a lasting positive legacy in the Matambo Corridor. This can be done by enforcing the implementation of mitigation measures that are outlined in the Environmental and Social Management Plan [ESMP].

APPENDIX 10-1: SOCIAL IMPACT ASSESSMENT REPORT (PETRA, 2024)



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Contents

LIST OF FIGURES 5
LIST OF TABLES 5
Glossary and Abbreviations 6
APPENDICES 6
CHAPTER 1: INTRODUCTION 7
1.1 Overview 7
1.2 Scope and Objectives of the Social Impact Assessment Study 10
1.2.1 Specific goal 11
1.3 Project Proponent 12
1.4 Social Impact Assessment Study Team 13
1.5 Study Terms of Reference 13
1.6 Study Assumptions, Exclusions and Limitations 14
CHAPTER 2: PROJECT DESCRIPTION 15
2.1 Project Location and Description 15
2.2 Structure of the SIA Report 17
2.3 Project Activities 18
2.3.1 Pre – Construction Phase 18
CHAPTER 3: LEGAL STATUES, GUIDELINES AND REGULATIONS 19
3.1 National Statues 19
3.1.1 The Constitution of the Republic of Liberia [1986] 19
3.1.2 The Environmental Protection and Management Law of Liberia [2003] 20
3.1.3 The Decent Work Law of Liberia [2015] 20
3.1.4 The Forestry Reform Law of Liberia [2006] 21
3.1.5 The Revised Minerals and Mining Law of Liberia [2000] 21
3.1.6 The Revised Public Health Law of Liberia [2019] 22
3.1.7 The Land Rights Law of the Republic of Liberia [2018] 22
3.1.8 National Water Supply and Sanitation Policy [2009] 23
3.1.9 The Independent Human Rights Law of Liberia 23
3.2 Regulatory Institutional Framework 24
3.2.1 The Ministry of Public Works 24
3.2.2 The Ministry of Agriculture 24
3.2.3 The Ministry of Gender, Children and Social Protection 24
3.2.4 The Ministry of Internal Affairs 24
3.3 Guiding Regulations for Impact Mitigations for Compliance 25

CHAPTER 4: STUDY APPROACH AND METHODOLOGY 27
4.1 Study Approach and Scope 27
4.1.1 Baseline 27
4.2 Scoping 28
4.2.1 Site Reconnaissance Survey 28
4.2.2 Project Disclosure 32
4.2.3 Stakeholder Identification 32
4.2.4 Identification of Preliminary Concerns and Opportunities 40
4.3 Social Impact Assessment Methods 41
4.3.1 Primary Data Collection 44
4.3.2 Secondary Data Collection 44
4.4 Risk Management 45
4.4.1 Risk Assessment 45
4.5 Mitigation Measures 48
4.5.1 During Construction 48
Dust Management and Investigation 49
Noise and Vibration Management and Investigation 49
4.5.2 Artisanal and Small-Scale Mining Assessment and Management 49
4.5.3 Agricultural Impact and Crop Compensation 49
4.5.4 Massakpa Community Land Lease for Matambo Pit 2 50
4.5.5 During Operations 50
4.6 Social Impact Management Plan 51
CHAPTER 5: DEMOGRAPHIC PROFILE AND SOCIO – ECONOMIC ENVIRONMENT 52
5.1 Population and Demographic Profile 52
5.2 Socio – Economic Profile 53
5.2.1 Economic and Occupational Status 53
5.2.2 Education 53
5.2.3 Health, Water and Sanitation 54
5.2.4 Land use and Transportation 55
5.2.5 Cultural Traditional and Customary Practices 56
5.2.6 Religious Practices 56
5.3 Key Findings from the Stakeholders Engagement and Consultations 58
5.3.1 Project Awareness and Stakeholder Engagement 58
5.3.2 Response to the Project 58
5.4 Feedback from Focus Group Engagement, Dialogues and Key Informant Interviews 59

5.4.1 Focus Group Engagement 59
5.4.2 Stakeholders' Engagement and Consultations 60
5.5 Conclusions 63
CHAPTER 6: IMPACT ASSESSMENT AND MITIGATION MEASURES 64
6.1 Key Concerns of the Stakeholders 64
6.1.1 Employment 65
6.1.2 Infrastructure, Transportation [Road Network and Connectivity] 65
6.1.3 Water Pollution 65
6.1.4 Education 66
6.1.5 Health 66
6.1.6 Socio-Economic Compensation 67
6.1.7 Air Pollution, Dust and Noise 67
6.2 Significance of the Social Impact 69
6.3 Potential Impacts and Mitigation Measures 73
6.3.1 Potential Impacts During Pre – Construction 73
6.3.2 Potential Impacts During Construction and Operational Phases 74
CHAPTER SEVEN: STUDY CONCLUSION 75

LIST OF FIGURES

Figure 1: Proposed Matambo Open Pit Gold Mine and Supporting Infrastructures 8
Figure 2: Proposed Matambo Open Pit Gold Mine with pre-construction works underway (January 2024) 10
Figure 3: ESIA thematic areas of review....12
Figure 4: Project location map 15
Figure 5: Example of PoI identified_Sande House for female traditional practices in Saanor Community 16
Figure 6: Soil sampling at proposed Pit_1 near existing artisanal pit in Massakpa_2....19
Figure 7: Thematic focus of the social baseline survey and impact assessment....28
Figure 8: Chinese operated machinery at Bangorma in the project area (KBL Company – Chinese Camp)....29
Figure 9: Ongoing and active ASM presence on the outskirts of Bangorma Town (January 2024)....31
Figure 10: Public disclosure and stakeholder engagement and consultation in Kumah-Sorkporjah....32
Figure 11: Stakeholder categories identified during Scoping and engaged through ESIA exercise....33
Figure 12: Map showing the proposed mine infrastructures and extent of social impact assessment. 35
Figure 13: Key informant interview with midwife in Gogoima Community....42
Figure 14: Aerial view of Massakpa_01 53
Figure 15: Handpump in Bangorma 54
Figure 16: Community interviews on road and transportation management in Kumah-Sorkporjah 55
Figure 17: Mosque in Bangorma Community....57
Figure 18: Thematic area and considerations of the focus group discussions.....60
Figure 19: Graphic representation of key stakeholder concerns....68

LIST OF TABLES

Table 1: List of directly and indirectly impacted communities and levels of assessment 11
Table 2: Project proponent contact details.....12
Table 3: SIA study team....13
Table 4: Structure of the SIA Report 17
Table 5: Regulatory gaps and mitigations....26
Table 6: Summary analysis of reconnaissance survey findings of July 2021....30
Table 7: Risk assessment of all communities identified within project's regional influence....39
Table 8: Identification of preliminary concerns and opportunities 40
Table 9: Summary of potential impact and significance 41
Table 10: Data collection methodology used during the project....43
Table 11: Criteria for assessing the significance of impacts. 46
Table 12: Significance rating matrix....47
Table 13: Positive / Negative Mitigation Ratings....47
Table 14: Details of surface water investigations based on community pre-construction complaints 48
Table 15: Population estimates obtained during community socio - economic profile survey....52
Table 16: Focus Group Discussion locations, themes and dates 59
Table 17: Demographics and thematic areas of Focus Group Discussions....60
Table 18: Summary of study-area stakeholder concerns and corresponding mitigations 62
Table 19: Social Impact Risk Assessment 72

Glossary and Abbreviations

Abbreviation	Definition
BMMC	Bea Mountain Mining Corporation
EPML	Environmental Protection and Management Law
ESIA	Environmental and Social Impact Assessment
FGD	Focus Group Discussion
KII	Key Informants Interview
LLA	Liberia Land Authority
MDA	Mineral Development Agreement
MIA	Ministry of Internal Affairs
MME	Ministry of Mines and Energy
MoA	Ministry of Agriculture
MPW	Ministry of Public Works
NLGM	New Liberty Gold Mine
SIA	Social Impact Assessment
TSF	Tailings Storage Facility
WRD	Waste Rock Dump

APPENDICES

Appendix A: Matambo Screening Report (August 2021)
Appendix B: Social Baseline Mapping Report (December 2023)
Appendix C: Socio – Economic Profile of Project Affected Communities
Appendix D: Matambo Stakeholder Engagement Plan
Appendix E: Focus Group Discussion Report
Appendix F: Engagement and Consultation Reports with Suggestion Box Entries
Appendix G: Social Impact Management Plan [SIMP]
Appendix H: Massakpa Land Lease and Agreement
Appendix I: Bangorma Land Lease Agreement and Layout
Appendix J: MoA Crops Compensation Price Listing (2012)
Appendix K: ASM Engagement Report and Compensation

CHAPTER 1: INTRODUCTION

1.1 Overview

Bea Mountain Mining Corporation [**BMMC**] is seeking to develop and mine potential gold resources in the Matambo exploration target area –within its Mineral Development Agreement Area [**MDA]**. Exploration activities within the target area has identified gold mineralization along an east – west strike line, and as such BMMC is seeking to develop an open – pit mine to be known as the Matambo project ["***the Project***"]. The potential ore will be transported to the New Liberty Gold Mine [**NLGM**] for processing, the tailings produced from the processing will be stored at the NLGM Tailings Storage Facility [**TSF**]; other infrastructures to be constructed to support the open pit mine include a private Haul Road, Waste Rock Dumps [**WRD]**, ore stockpiles, offices, ablution blocks, etc.

The proposed Matambo project area is located approximately 10.0km northeast of the NLGM, with scattered farming and ASM mining communities around the proposed mining footprint especially around the western section of the Mafa River.

The proposed open pit mine site design and layout seeks to construct the following supporting mining infrastructures:

- Establishment of two three pits (one large pit northeast and two smaller pits to the west) and associated
- Waste Rock Dumps (WRD);
- Ore stockpiles (including low-grade ore stockpile) and topsoil & saprolite stockpiles;
- Ore transportation to NLGM for further processing at the existing CIL Plant;
- Mine services area;
- Storm water management infrastructure;
- Dewatering infrastructure and equipment;
- Internal access roads;
- Support facilities and infrastructure at the mine site, including water and waste storage facilities;
- Staff accommodation and associated facilities such as a sewage treatment plant;
- General waste landfill site;
- Power and water supply;
- Ancillary facilities and buildings, such as administrative offices, service buildings, hydrocarbon storage,
- workshops, and explosives storage.

Proposed mining design works have identified three pit locations along the east – west strike in the project area. The mine planning suggests that mining begins in the Matambo Pit 2, and then proceed with Matambo Pit 3 and Pit 1. The study has also identified that due to potential risks from mining in the pits nearest the Bangorma, the community must

be relocated prior to Matambo Pit 1 production; as such BMMC is concomitantly advancing the voluntary relocation of the Bangorma community outside of the proposed mine footprint, with the support of national regulators. It is planned that the relocation activities will be completed prior to any mining activity at Matambo Pit 1 closest to Bangorma.

As part of its obligations of ensuring environmental and social protection for both the environment and the community where BMMC operates and in compliance with the EPA's letter dated 14 August 2023 (ED/EPA/01/02864/23/RL); an Environmental and Social Impact Assessment [**ESIA**] was commissioned by BMMC to document the potential environmental and social impacts that may result from the construction or operations of the proposed mine.

Petra Resources, Inc. an independent licensed and certified EPA licensed environmental evaluator, conducted a social impact assessment [**SIA**] for the proposed mine as part of the comprehensive ESIA exercise undertaken alongside ABS Africa, an EPA accredited international firm, on behalf of BMMC . Following the preliminary mine design layout, PRI conducted a site assessment around all the proposed supporting mine infrastructures and documented points of interest [**PoIs**]; these points of interests are related to existing communities' individuals and shared socio – economic infrastructures and/or livelihoods.

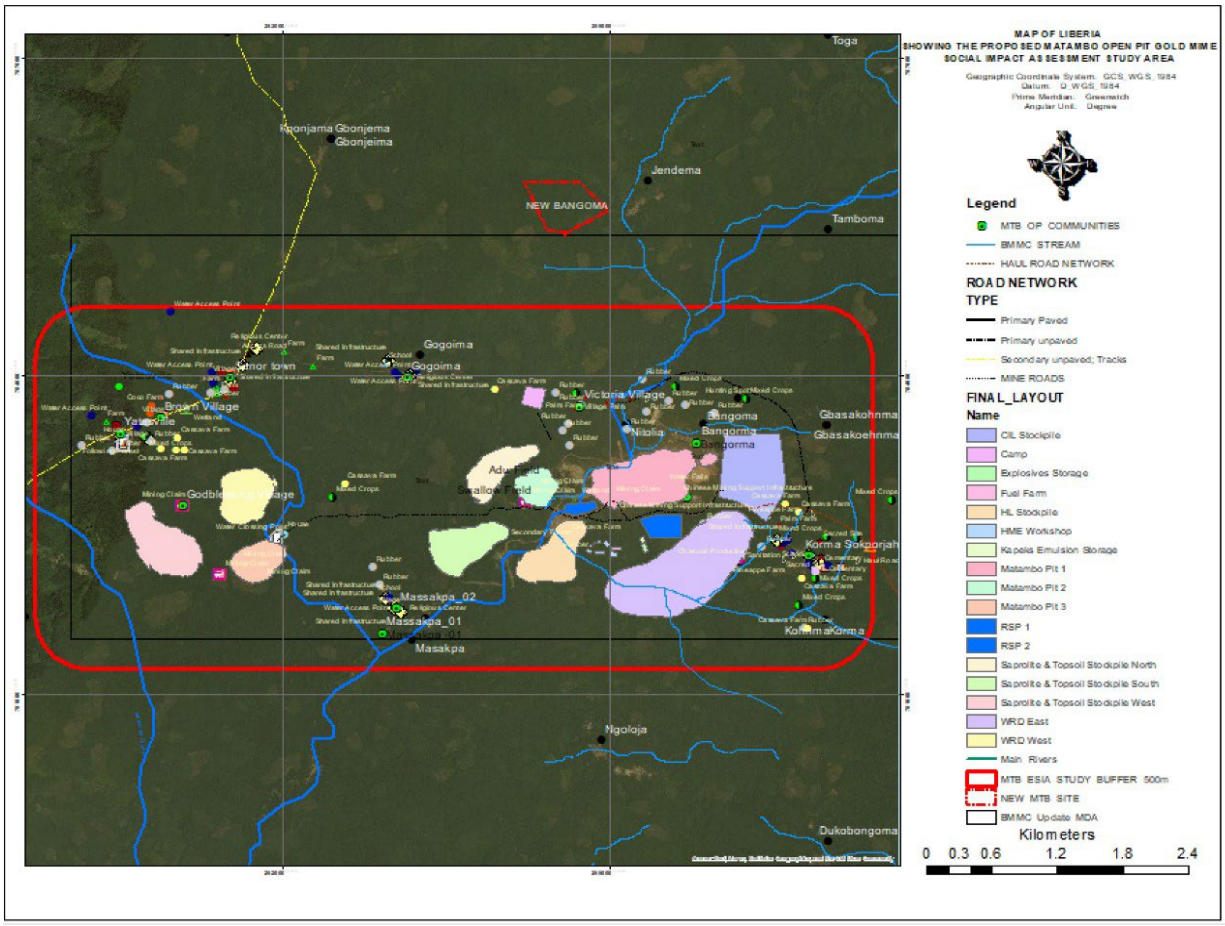


Figure 1: Proposed Matambo Open Pit Gold Mine and Supporting Infrastructures

A study area was designed measuring approximately 1904ha with each cell grid measuring 400m^2; and across this area documented all the potential points of interest, as well directly engaging stakeholders within the study area to provide them information about the proposed project, as well as allowing them the opportunity to voice their concerns and/or support for the project.

In keeping with the Environmental Protection and Management Law [**EPML**] 2003 of Liberia, and international guidelines and statues including the International Finance Corporation Performance Standards [**IFC_PS**] and the Equator Principles [**EP**]; BMMC is seeking to conduct an Environmental and Social Impact Assessment [**ESIA**] to satisfy these legal requirements for projects of such nature.

To deliver a high-quality product that satisfies both the national and international statues, the study was conducted in three distinct phases, to ensure that potential impacts and associated proposed mitigations are realistic and actionable.

- **Phase 1**: Presented a Project Brief to the regulatory authorities to ensure alignment with national and international guidelines. This provided the opportunity for full disclosure with stakeholders and regulatory authorities.
- **Phase 2**: Performed impact assessment including conducting key informant interviews [**KII**] and focus group discussions [**FGD**]. To ensure a fair gender and equitable participation, a direct set of engagements with female residents within the project communities was part of the impact assessment phase. Phase 2 also included the establishment of a project Grievance Redress Mechanism [**GRM**].
- **Phase 3**: Conducted project impact disclosure consultations and presented the findings of the project impacts including potential mitigation measures, so that alignment and agreement with project affected communities is considered.

This report presents the impact assessment and proposed mitigation measures to support the construction and operations of the Matambo Open – Pit Gold Mine.

The image below reflects Bangorma town at the right (East) looking to the West, where historical artisanal miners, a Chinese Class B operator have previously worked and ongoing preconstruction activities. Pre- construction has included access road network, clearing and laydown areas in anticipation of camp construction.



Figure 2: Proposed Matambo Open Pit Gold Mine with pre-construction access road networks and camp clearing underway (January 2024)

1.2 Scope and Objectives of the Social Impact Assessment Study

The Matambo Open Pit Gold Mine Project is seeking to understand the socio-economic environment including livelihoods and supporting infrastructure across 17 villages and settlements identified to be within the zone of influence of the proposed mine and associated infrastructure. These 17 settlements represent those that will be directly impacted as well as those to be indirectly impacted due to existing shared infrastructure and social cohesion with directly impacted communities.

To determine directly impacted communities, a buffer zone of 500m (measured from the center of Pit 1) was applied. Of the 17 total communities, 9 were identified to be directly impacted and assessed in further depth.

The table below outlines the varying levels of impact assessment conducted on the 17 communities based on their level of potential impact.

Community Name	Social Scope and Objectives			
	Socio – Economic Profile	Demographic and Population	Cultural and Customary Practices	Zone of Influence
Ducorborgorma	☐	☐	☐	☒
God Blessing Village	☒	☒	☒	☒
Kumah Sorkorjah	☒	☒	☒	☒
Yatesville	☒	☒	☒	☒
Gondoja	☐	☐	☐	☒
Brown Village	☒	☒	☒	☒
Massakpa_01	☒	☒	☒	☒
Massakpa_02	☒	☒	☒	☒
Sheriff Village	☐	☐	☐	☒
Augustine Village[1]	☒	☒	☒	☒
Kuteh Village	☒	☒	☒	☒
Saanor Town	☒	☒	☒	☒
Gogoima[2]	☒	☒	☒	☒
Jendama	☐	☐	☐	☒
Camp_03	☐	☐	☐	☒
Bangorma[3]	☒	☒	☒	☒
Sembehome	☐	☐	☐	☒

Table 1: List of directly and indirectly impacted communities and levels of assessment

1.2.1 Specific goal

The goal of the social baseline and impact assessment study is to document baseline socio-economic conditions across the proposed project area and identify potential impacts and appropriate related mitigation measures to minimize expected impacts to changes in baseline conditions :

- Project communities' way of life
- Communities cultural, heritage and traditional practices
- Communities' governance and order
- General environment
- Health and wellbeing

[1] Augustine and Kuteh villages were studied as part of a household survey in June 2023
[2] Gogoima currently hosts the exploration camp and as such has witnessed a high influx of people in search of job opportunities.
[3] Bangorma is currently engaged with BMMC and GoL for a voluntary relocation process, therefore residents' expectations are high.

- Personal property, rights, and livelihood
- Fears and aspirations



Figure 3: ESIA thematic areas of review

1.3 Project Proponent

Avesoro Resources Inc. (Avesoro) is a privately-owned gold production subsidiary of Avesoro Jersey Limited. Avesoro explores for, develops, and operates gold assets in West Africa. The company primarily owns interests in the New Liberty Gold Mine (NLGM) located in Liberia.

Bea Mountain Mining Company (BMMC) is a wholly owned in-country subsidiary of Avesoro. BMMC signed a Mineral Development Agreement (MDA) with the Government of the Republic of Liberia on 28 November 2001 to conduct exploration for gold within the MDA area boundary for a period of 25 years, with an option to extend this term for additional terms of 25 years. The parties entered into the Restated and Amended Mineral Development Agreement on the 7th day of September 2013 and first amendment to the Restated and Amended Mineral Development Agreement was approved by the President of the Republic of Liberia on 14 September 2023 for 25 years commencing from the first Amendment Effective Date. BMMC hold a class A mining license for the MDA area, which was issued by the Liberian Ministry of Mines and Energy (MME) on 29 July 2009 and amended on October 23, 2023. The entire MDA property covers an area of 537 km^2.

Project Proponent	**Bea Mountain Mining Corporation**
Point of Contact	Mr. Debar Allen
Name / Title	General Country Manager
Contact Information	+231.777.533.039 || Debar.Allen@avesoro.com
Address	18th Street/Payne Avenue. Sinkor, Monrovia. Liberia

Table 2: Project proponent contact details.

1.4 Social Impact Assessment Study Team

The SIA survey was conducted by Petra Resources, Inc. an independent EPA licensed and certified environmental evaluation firm bringing a unique experience with local technicians merging and managing the complexities of local statues, laws, regulations, customs, traditions, cultural heritage, and social nuances that must all satisfy both national and international guidelines and statues.

Name	Title / Role
Mrs. Monique Cooper – Liverpool	Project Director - Overall Project Lead – Quality Assurance / Quality Control
Mr. Catfish Brownell	Technical Director – Lead Technical Design and Analysis
Ms. Teagbae Poindoe	Environmental Scientist – Overall Field Lead
Mr. Mohammed Massaley	Field Geologist – Community Profile Assessor
Ms. Roseline Joseph	Geologist – Field Documentation
Mr. Trokon Davis	Forester – Field Documentation
Mr. Emmanuel Wonkpah	Sociologist – Traditional / Cultural / Heritage Assessor
Mr. Marvin Kpeh	Field Technician / Logistical Support
Mr. Anthony Bindah	Geologist – Field Documentation
Mr. Kelvin Wright	Project Administrator

Table 3: SIA study team

1.5 Study Terms of Reference

The terms of reference for the ***social impact assessment*** for the Matambo Open Pit Gold Mine is as follows:

- Define the aerial extent of the study area and document social points of interests.
- Document socio – economic profile for each community within the defined study area.
- Document prior notices for all disclosures and engagements in the project area with stakeholders.
- Document established grievance redress mechanisms and maintained a register of all complaints, issues, concerns, and perceptions including proponents' mitigations, and responses that addresses each complaint, issue, concern, or perception.
- Document disclosure consultations and stakeholders' engagement with specific thematic areas of concern including health, education, and cultural heritage.
- Conduct impact analysis and present findings in open disclosure format to all stakeholders.
- Present mitigation measures that are appropriate, agreeable, and actionable. Ensure there is alignment with stakeholders on proposed mitigation measures.

1.6 Study Assumptions, Exclusions and Limitations

- The 9 communities studied as part of the SIA were within a maximum of 500m^2 only of the project area. While an additional 8 communities have social connections and influence outside of the defined study area, these communities have been noted, but were not included in the study.
- Cultural and traditional practice impacts were mitigated and managed directly between the proponent and the impacted communities. It is understood that copies of receipts and records have been maintained by the proponent related to this mitigation.
- Discussions around impacts and mitigation measures on artisanal and small-scale mining were led by the Ministry of Mines and Energy with support from the Ministry of Internal Affairs. The compensation payments to artisanal license holders were completed in January 2024. The report of the Ministry of Mines and Energy is included as an Appendix to this report.
- It is understood that shared public infrastructures were designed based on the approved infrastructures which the Company previously constructed for social development of the communities at Kinjor for the New Liberty Gold Mine. In December 2023, the Company received a building construction permit from Ministry of Public Works on the construction of new Bangorma Village houses and shared infrastructures. The Company also communicated with the corresponding regulatory authorities, specifically for health and education, to participate in the process. Copies of communications to both the Ministry of Education and the Ministry of Health have been included in the Appendices. No response had been received at the time of reporting.
- The construction of the haul road from the Matambo Project to NLGM was permitted in 2022 with the area from NLGM to Bangorma studied as part of that exercise. It is recommended that all proposed mitigation measures and buffer zones for the haul road as per the previous assessment be implemented.
- Some social impacts mitigations are already addressed in other project documents, specifically the MDA which includes prescriptions for social investment funds.
- The Matambo Project is a proposed operation, and therefore all calculations and simulations were based on design information and layout plans presented by the proponent at the time of analysis.
- There will always be issues associated with social influxes into an area, all of these cannot be managed directly by the project's mitigation activities.

CHAPTER 2: PROJECT DESCRIPTION

2.1 Project Location and Description

The study area is located within the BMMC MDA area in Grand Cape Mount County which also hosts the New Liberty, Ndablama and Weajue gold mines. The proposed Matambo project area is located approximately 10.0km northeast of the New Liberty gold mine at Kinjor. Income generating activities of the residents within the project area are predominantly artisanal mining and farming activities.

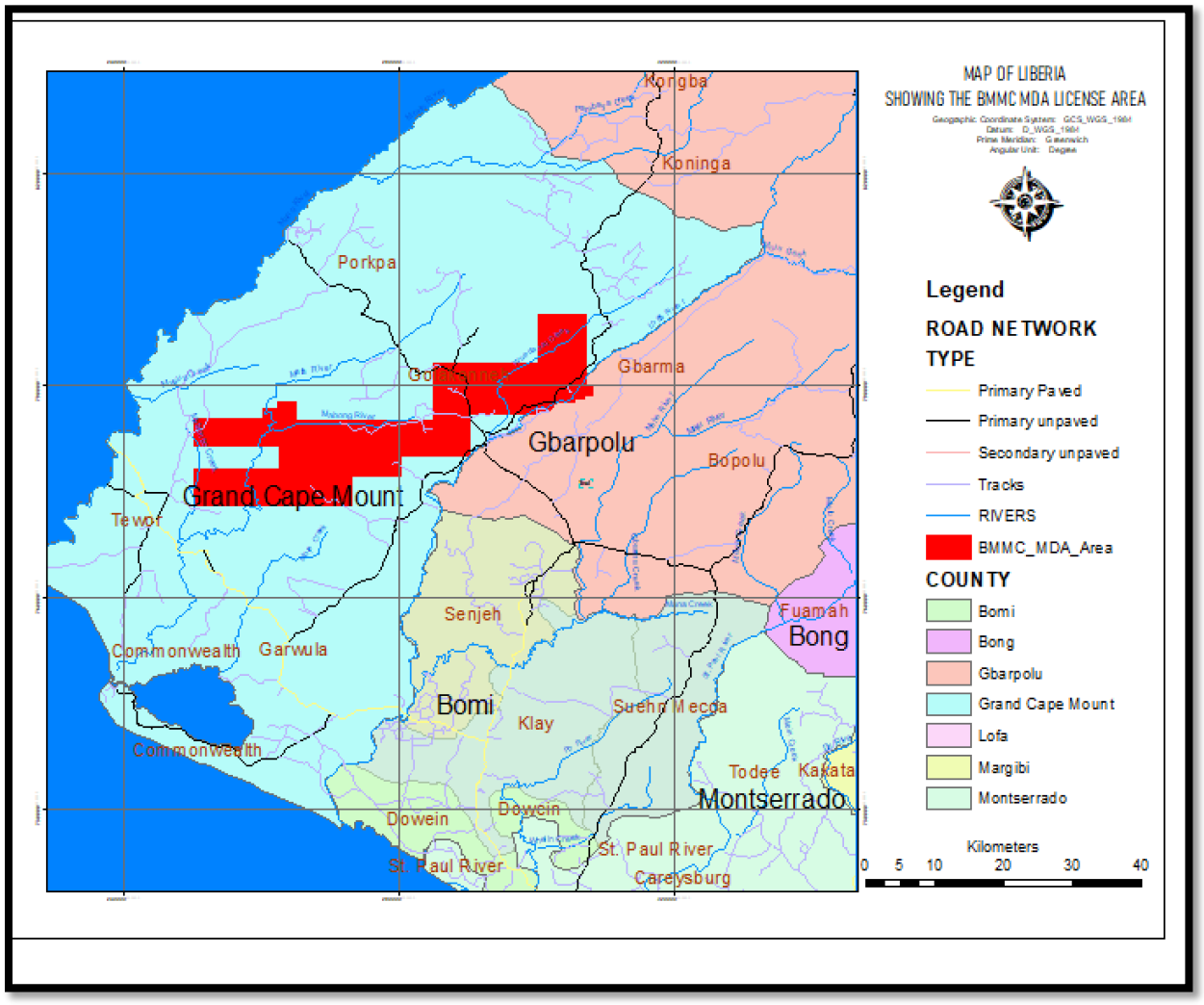


Figure 4: BMMC MDA Area

Project details are given in introduction chapter 1.1. To help characterize and document the social baseline of the study area; a detailed social baseline mapping exercise was conducted in December 2023. This was to document the points of interests [PoIs] such as nature and type of structures, size, and extent of communities' assets within the project study area.

During the survey a total of 146 points of interest [**Appendix B**] were documented spatially and a physical description of each was documented.



Figure 5: Example of PoI identified_Sande House for female traditional practices in Saanor Community

2.2 Structure of the SIA Report

This SIA report is structured into 7 Chapters:

Chapter Number	Title	Focus
One	Introduction	▪ Brief introduction and background to the Project ▪ Scope and objectives of the SIA study including assumptions, limitations, and expectations. ▪ Project proponent ▪ Study team and structure of the report
Two	Project Description	▪ Overall description of the project including location and settings. ▪ Overall project schedule and activities
Three	Legal Statues, Guidelines and Regulations	▪ Conformance with national and international guidelines ▪ International guidelines and policies
Four	Study Approach and Methodology	▪ Study Approach ▪ Methodology [identification of the project study area / zone of influence]. ▪ Social points of interests. ▪ Shared infrastructures both public and private ▪ Socio – Economic Profile and Livelihood Survey ▪ Identification of key stakeholders, stakeholder engagements, key informant interviews, grievance redress mechanisms and method for impact analysis.
Five	Community Socio – Economic Profile	▪ Socio-demographic profile of study communities ▪ Livelihood, trade, and commerce ▪ Education, civil union, religion, governance ▪ Cultural, traditional and heritage
Six	Social Impacts and Mitigation Measures	▪ Identification and Assessment of Significant social impacts to the local population and stakeholders during the construction and operations phases of the project. ▪ Recommend mitigation measures for all potential adverse impacts during construction and operational phases.
Seven	Conclusion	▪ Conclusion drawn from the Study

Table 4: Structure of the SIA Report

2.3 Project Activities

2.3.1 Pre – Construction Phase

The pre – construction phase of the Project involved the undertaking of technical design studies and obtained two temporary environmental permits from the EPA specifically for saprolite removal, construction of infrastructures and ore stockpiling and a letter from the Agency authorizing vegetation clearing.

The pre-construction phase included other activities such as:

- **Topographic Surveys**: These surveys are undertaken to identify the land elevations and boundaries of the existing soil terrain and orientation. This helps in identifying the amount of overburden required for stripping and clearing.
- **Vegetation Clearing**
- **Construction of Access Roads**: This is the construction of access roads across the footprint of the proposed mine to connect key infrastructure, the mines and haul road. The conduct of impact assessments including water, air, soil, noise, and other required sampling prior to the start of operations were facilitated by the existence of these access roads.
- **Construction of Mine Infrastructures**
- **Saprolite Removal**
- **Social Impact Assessment [SIA]:** The SIA was carried out firstly to determine the status of the existing social landscape, as well as social interactions and reliance on the physical environment and to identify sensitive social receptors that may be impacted by the anticipated project activities. The study then identifies the key social issues and the main impacts likely to arise from the project development and provides recommendations for mitigation measures to avoid or minimize the potential impacts of the project.

The SIA encompasses other studies that are relevant to the project as described below and were all conducted during the pre-construction phase of the project:

  - Socio – Economic Profile of the Communities
  - Population and Demographic Assessment
  - Health, Water, Education and Sanitation Assessment
  - Livelihood, commerce, and trade assessment.
  - Cultural, traditional, and customary assessment.



Figure 6: Soil sampling at proposed Pit_1 near existing artisanal pit just outside Bangorma

CHAPTER 3: LEGAL STATUES, GUIDELINES AND REGULATIONS

This chapter presents a review of the existing laws and policies related to the environmental and social dimensions of the Matambo Open Pit Gold project. The Matambo ESIA has conformed to national regulations as outlined in the EPA's Revised Environmental and Social Impact Assessment Procedural Guidelines (2021). Along with providing a summary of the relevant legislations and policies and presents the projects approach and commitment to compliance.

3.1 National Statues

3.1.1 The Constitution of the Republic of Liberia [1986]

The Constitution of Liberia **[CoL]** provides for the protection and management of the environment and natural resources of Liberia, this is the highest decision-making instrument in the nation. It is from this instrument that the powers and

authority is handed to the EPA through the National Environmental Policy **[NEP]** – which provides a broad framework for the implementation of national objectives and plans.

The constitutional basis for environmental law is provided in Article 7 of the Constitution (1986). The Article:

- Provides for environmental protection as a fundamental rule.
- Provides for public participation of all citizens in the protection and management of the environment and natural resources; and,
- Binds state organizations to adopt and activate environmental policy and formulate national development plans that are environmentally sustainable.

3.1.2 The Environmental Protection and Management Law of Liberia [2003]

The Environment Protection and Management Law **[EPML]** contain rules, regulations, and procedures for environmental impact assessment, auditing, and monitoring. It establishes regulations for environmental quality standards; pollution control and licensing; guidelines and standards for the management of the environment and natural resources. It also addresses the protection of biodiversity and national heritage. Other areas covered include environmental restoration orders; inspections; international obligations; and information access, education, and public awareness.

- Resource efficiency management including:
    - Green House Gases emission
    - Water consumption
- Pollution prevention
    - Waste
    - Hazardous materials management
    - Pesticide use and management.

3.1.3 The Decent Work Law of Liberia [2015]

The Decent Work Law of Liberia [2015] ensures labor and working conditions are aligned to the Constitution of Liberia and does not violate the human rights of employees. The law ensures amongst other things that employees working conditions and management of workers relationship are not in contravention of human rights and dignity. Among other things the DWL [2015] provides that the following are provided for and protected:

- Human resources policies and procedures.
- Working conditions and terms of employment.
- Non-discrimination and equal employment opportunity.

- Employee's retirement and retrenchment.
- Grievance mechanism.
- Protection against child labor or forced labor

3.1.4 The Forestry Reform Law of Liberia [2006]

The National Forestry Reform Law [2006] of Liberia ensures that the management and conservation of the forest resource of Liberia are properly managed. It also defines ownership rights and regulated commercial and other use of forest resources and provides for the protection and conservation of the environment.

The Forestry Reform Law addresses amongst other things:

- Protection and conservation of biodiversity including:
  - Modify habitat.
  - Natural habitat
  - Critical habitat
  - Legally protected and internationally recognized areas
- Management of ecosystem services.
- Sustainable management of living natural resources.

3.1.5 The Revised Minerals and Mining Law of Liberia [2000]

The Revised Minerals and Mining Law [2000] states that minerals on the surface of the ground or in the soil or subsoil, rivers, streams, watercourses, territorial waters, and continental shelf are the property of Liberia. Section 3.4 allows for the establishment of a Minerals Technical Committee consisting of: Minister of Mines and Energy, Ministry of Justice, Ministry of Finance, Ministry of Planning and Economic Affairs, National Investment Commission, Ministry of Labor, Council of Economic Advisors, and Central Bank of Liberia. This committee has the power to negotiate agreements for Class A Mining Licenses. The Law, which is administered by the Ministry of Mines and Energy, has a clearly defined exploration and licensing system. It is worth noting that at the time of preparation of this report, the law is undergoing review and may require reconsideration of the relevant sections if a new law is passed.

3.1.6 The Revised Public Health Law of Liberia [2019]

The New National Public Health Law of Liberia [2019] ensures that authorization, operations, and systems are always designed to protect individual and community health and safety without compromise. The law guides that regulation of accountability of the health and safety of the nation, building program structures and establishes roadmaps that guide the protection of the individual and community health and safety.

The law amongst other things, addresses:

- Community health and safety infrastructure including.
    - Hazardous materials management and safety
    - Ecosystem services.
    - Community exposure to diseases
    - Emergency response and preparedness

3.1.7 The Land Rights Law of the Republic of Liberia [2018]

The Land Right Law of Liberia [LRL] 2018 ensures that land classification and ownership is properly defined. The law also clearly establishes processes of sale and transfer of land rights. Most importantly, the LRL outlines the protection of land rights of vulnerable groups including local communities, women, children, and elders.

The LRL ensures that acquisition and involuntary resettlement is properly managed so that adverse impacts are mitigated. To ensure proper management and mitigation measures, the LRL provides provisions on:

- Compensation and benefits for displaced persons
    - Community engagement
    - Resettlement and livelihood restoration planning and implementation
    - Grievance mechanism
- Displacement
    - Physical displacement
    - Economic displacement
    - Private sector responsibility under government managed resettlement

The Liberia Land Authority [LLA] has the statutory mandate to regulate all lands within the Republic of Liberia, including public and private lands. The authority promotes, supports, and ensures the development of land use management plans and zoning schemes and their implementation through counties, districts, and other local government structures.

This includes land tenure, land policy, land reform, land use, planning, and other aspects of land administration. The LLA maintains the mandate to ensure that the rights of all landowners within the project area are protected.

3.1.8 National Water Supply and Sanitation Policy [2009]

The provision of safe and improved drinking water, sanitation, and hygiene [WASH] services in Liberia is managed by the National Water, Sanitation & Hygiene Commission. The Commission's mandate includes the duty to ensure that development projects recognize that WASH services are fundamental human rights, and that results of mining activities and other human induced activities including logging, and unhealthy farming practices do not undermine the provision and access to WASH facilities and services. This policy helps to ensure that sustainable natural resource management can therefore be a key to the success of WASH activities in Liberia.

3.1.9 The Independent Human Rights Law of Liberia

The law establishes the framework upon which complaint of the violation of the human rights of persons can be received and investigated. The Commission is authorized to review existing national legislation and recommend provisions to ensure that they are harmonized with international human rights standards and instruments. The Commission is also authorized to draw to national attention, the violation of the human rights of persons in any part of the country. It states that the right to own and enjoy is a fundamental right to be protected.

3.2 Regulatory Institutional Framework

3.2.1 The Ministry of Public Works

The Ministry of Public Works [MPW] has the statutory responsibility to issue approval for the design and construction of all public infrastructures, as well as provide architectural and engineering supervision of such infrastructure, including public buildings and other civil works. Additionally, it is also responsible to carry out urban and town planning and establish the right-of-way of all roads within the country. MPW will be responsible to issue approval for the construction of the infrastructure under this project.

The Ministry of Public Works provides technical guidance to all governmental agencies in preparation of development programs and projects. The Ministry also sets the standard for the valuation of structures to be demolished for developmental projects.

3.2.2 The Ministry of Agriculture

The Ministry of Agriculture [**MOA**] is the statutory entity of the Government of Liberia responsible for regulating all agricultural activities. The ministry is responsible for declaring the compensation rates to be paid for the expropriation of all crops resulting from the implementation of projects across the country. The Ministry of Agriculture is mandated to ensure that the compensation declared under this project complies with the policy of the Government of Liberia.

3.2.3 The Ministry of Gender, Children and Social Protection

The Ministry of Gender, Children & Social Protection [**MOGCSP**] is the statutory entity of the Government of Liberia responsible for the protection of the rights and social welfare of vulnerable groups, especially women and children. The Ministry is responsible for ensuring the rights of all women, children and elderly affected by the implementation of the project are protected.

3.2.4 The Ministry of Internal Affairs

The Ministry of Internal Affairs [**MIA**] is primarily responsible for executive branch sub-national and local governance by coordinating the affairs of the county and district officials across the country. The Ministry also oversees the cultural traditions and customary practices of the various tribal groups of Liberia. It is the responsibility of the ministry to ensure that the impact of the project does not disrupt the social cohesion and respects the customary practices of the residents of the rural areas.

3.3 Guiding Regulations for Impact Mitigations for Compliance

The table below provides a description of the guiding national statues and regulations against the corresponding proposed project mitigations.

Theme	National Legislation / Statues	Project Mitigation
Impacts	The Land Rights Law recognizes the involuntary loss of land and property attached to land due to state and private acquisition of land for purposes of development of infrastructure for public use	Loss of shelter, loss of income both temporary and permanent will be considered through housing and shared infrastructure replacements
Displaced persons	The Land Rights Law does not necessarily define displaced people, but Article 4 elaborates that it is applicable to all persons that own or seek to own rights or interests in land, including individuals, communities, and legal entities as well as the Government and its agencies.	ASM workers and subsistence farmers will be displaced by this proposed project. BMMC has commence income-generation and economic livelihood compensation for both ASM workers and crops. Ministry of Agriculture (2012) crops compensation listing and MME Matambo Artisanal Miner report used as guides.
Land	The Land Rights Law defines land as the unmovable portion of the earth's surface, which generally consists of the soil and any space above the soil that is needed for the construction and/or use of any building inclusive of attachments by the possessor or occupier of the land	Land-use related mitigations have been developed.
Degree of impact on land and assets	Article 54 section 6 of the Land Rights Act states that if the Government or any of its agencies or subdivisions prays for condemnation in respect of only part of a piece of Private Land or Customary Land and the value of the owner's remaining land is diminished, the land owner shall be entitled to plead such diminution in value of the remaining land and to have the Government either (i) pay fair just and timely compensation for the diminution in value of the remaining land in addition to compensation for the portion condemned; or (ii) expropriate the entire Land and make payment of compensation for the entire land.	Liberia Land Authority has led all negotiations to secure land rights in the Matambo area. Leased lands negotiated by the LLA have considered any diminished values of remaining lands.
Consultations	The Constitution, Chapter 3 Article 15c states that there shall be no limitation on the public right to be informed about the government and its functionaries. In addition, the Land Rights Law advocates for the consultation of communities through an assembly or Community Development Management Association prior to acquisition of customary or community land.	Open, town-hall styled consultations with clustered communities were conducted across the project area during each phase of the project – beginning from the social impact baseline to the social impact statement; BMMC has directly led community engagements to consult and provide clarity on compensation implementation.
Eligibility	The Land rights law provides for compensation for both registered or nonregistered customary land and also payment to all with interests on the land as long as ownership or use can be confirmed orally	Liberia Land Authority has led classifications of customary land and negotiated between the Company and community for appropriate land leases and compensation.
Cut-off-date	The law is silent on the cut-off-date	The effective date of the land lease agreement covering the Bangorma community dated 26 May 2023 is considered as the Cut-Off date.
Grievance redress	Article 37 Section 8 advocates for the resolution of all disputes involving Customary Land to be pursued through customary law and dispute	Accessible grievance mechanism will be set up at community level and project level.

	resolution mechanism at the level within and between communities. The Government pledges to support the communities to resolve all disputes involving Customary Land at the community level.	Aggrieved will have opportunity to appeal and may choose to go through formal courts.
Valuation of property	Compensation based on market value, including legal fees and relocation costs	Ministry of Agriculture price compensation listing (2012) shall apply for crop compensation
Resettlement instruments	There is no national recommendation on resettlement instruments.	No resettlement shall be required; however economic compensation
Livelihood restoration	No requirement for livelihood restoration beyond fair compensation. However, Chapter II, Article 8 implies that the Republic shall direct its policy towards ensuring for all citizens, without discrimination, opportunities for employment and livelihood under just and humane conditions, and towards promoting safety, health, and welfare facilities in employment.	Livelihood restoration for the project is via economic compensation – not beyond those crops that will be impacted during the project construction and operational activities.
Vulnerable groups	The Land Rights Law and the Constitution advocate for the protection of the youth women and other disadvantaged persons	Individual rights of women and youth have been considered in the ESIA exercise
Relocation Assistance	The Land Rights Law article provides for relocation costs only, no other impacts are included	The project recognizes the voluntary relocation of Bangorma Town; this process considers compensation eligibility and implementation.

Table 5: Regulatory gaps and mitigations

CHAPTER 4: STUDY APPROACH AND METHODOLOGY

4.1 Study Approach and Scope

4.1.1 Baseline

In characterizing the social baseline of the area, reference is made to the status of the livelihood, social services, and shared infrastructures within the project area. To ensure a thorough assessment around all the proposed infrastructures and community assets, a grid of 400m^2 was established to methodically guide a comprehensive study of the area. The social baseline survey involved documenting any socio-economic assets within each grid. The documentation included:

- Demographics
- Leadership
- Natural Hazards
- Cultural Heritage
- Nutrition & WASH Services / Infrastructures
- Community & Gender Equality Issues
- Community and Shared Infrastructures
- Religion / Traditional Practices
- Health
- Trade and Commerce
- Education
- Security



Figure 7: Thematic focus of the social baseline survey and impact assessment

For the legislative and regulatory context, reference is made to Liberian legislation, national policy, and regulatory guidance, as well as the International Finance Corporation Performance Standards for Environmental and Social Sustainability.

4.2 Scoping

4.2.1 Site Reconnaissance Survey

In July 2021 a site reconnaissance was conducted to document the early status of the environmental and social context of the Matambo exploration targeted area. During the reconnaissance exercises it was documented that ASM activities were widespread in the proposed target area notably around [Abu Field; Swallow Field, Kaikweh Field and Yatesville]. During the site reconnaissance, the ASM fields had approximately 200 persons, mostly men, according to interviews with them during the field screening exercise – they started operating their ASM activities in the area over 50yrs ago.



Figure 8: Chinese operated machinery at Bangorma in the project area (KBL Company – Chinese Camp)

The other surrounding settlements identified during the 2021 scoping exercise were predominantly involved in artisanal mining for income-generation with subsistence farming supplementing their livelihoods. A dilapidated laterite road traversed the license area connecting the larger communities of Bangorma, Yatesville and Kumah – Sorkorjah, while smaller communities were connected via smaller paths accessible via motorcycle and walking – the predominant forms of transportation for residents.

The table below highlights high-level socio-economic findings from the scoping exercise of July 2021.

No	Indicator	Description
1	Settlement / Community / Village	There are 8 established residential settlements (2 abandoned) - 4 large artisanal mines and other small hamlets within the survey area.
2	Education	There are 2 formal elementary schools in the survey area. One of the schools is situated on the outskirts of Bangorma and the other is at the entrance of Massakpa_02. Many residents reported having no formal education.

3	Health	One public health facility (clinic) with about 14 (TTM)[4] in the survey area. Most of the interviewed respondents stated that the most common illnesses amongst them were malaria and cold. Pregnant women seek services of the TTMs the most.
4	Water & Sanitation	In the project area, there are 12 hand pumps (5 inactive), 4 open wells (1 inactive). Other source of domestic water supply is a flowing stream (the Matambo River) which runs through the survey area.
5	Livelihood / Economic / Trade / Commerce	A significant majority of the residents here indicated they depend on the ASM sector for income-generation. A few mentioned also being involved in subsistence farming of rice and cassava to supplement their livelihoods.
6	Shared/Communal Assets	The shared assets are town halls and palava huts. No public market structure or recreational infrastructure was recorded.
7	Religious Practices / Infrastructures	Most of the residents indicate their allegiance to the Islamic faith. There are 7 worship centers across the reconnaissance area which includes 5 mosques, and 2 churches.
8	Cultural / Tradition / Heritage / Artifacts	The area is well noted for its cultural and traditional societies; it is believed that the women's customary society is the most powerful of the societies and there are 3 – of such Sande bushes, while there is 1 poro bush for the men. Bangorma is said to be the birthplace of the Vai script – one of Liberia's few written languages
9	Grave / Commentary	There are 7 – *graveyards*/ burial grounds spread across the communities of the study area
10	Mode of Transportation	The primary mode of transportation is walking or motorcycle via a dilapidated laterite road that cuts through the survey area; however, the road is pliable by 4-wheel drive vehicles also. A network of footpaths also exists between the communities
11	General Forest / Vegetation	The general forest vegetation is low - secondary forest vegetation; the average elevation of the area is 42 - 60m (ASL); most of the canopies are opened, with patches in forested areas, which indicates a history of disturbance.

Table 6: Summary analysis of reconnaissance survey findings of July 2021

The Scoping activities conducted in 2021 were aimed at achieving the following:

- Identifying the key stakeholders that would be affected by the Project.
- Identifying and prioritizing preliminary social issues and concerns that are likely to arise from the implementation of the Project in the exploration targeted area; and
- To identify the appropriate survey methodology and impact analysis methods to be used for the SIA study.

Particularly defining the main social impact variables that are often correlated with adverse social impacts of such projects such as:

- Demographic change, e.g. change to the size and profile of the local population, influx of temporary or foreign migrant workforce [i.e. factors that may affect the cohesion of the local community], etc.
- Livelihood and economic change, e.g. new patterns and sources of employment and income, factors that affect the livelihood of the local community, land, and property value, etc.

[4] TTM are licensed traditional mid-wives that are responsible for child delivery services.

- Socio – economic wellbeing e.g., access to community services and facilities, housing, community lifestyle, traffic congestion, public road safety, etc.
- Environmental change, e.g. loss of natural habitat or changes to the hydrological regime, water and air quality which could lead to loss of livelihood in a resource dependent community, risk of flooding, etc.
- Health and safety change, e.g., public health, deterioration of environmental quality, crime, and public safety, and
- Contribution to land use change.



Figure 9: Ongoing and active ASM presence on the outskirts of Bangorma Town (January 2024)

Informal interviews were also held with representatives from the communities in the area during 2021 reconnaissance exercise. Interviews were held with ASM workers active across the communities, farmers, and community leadership across the project area.

The July 2021 reconnaissance exercise served as the foundation for the full ESIA process launched in November 2023.

4.2.2 Project Disclosure

Following BMMC's formal application for an environmental permit to govern the operations of an open-pit gold mine at Matambo in July 2023, the EPA's response of 14 August 2023 outlined the regulatory requirement to conduct an ESIA for the proposed project.

In keeping with the EPML 2003, the project study team notified the EPA on the launch of the ESIA process by submitting an environmental project brief and a notice of intent [**NoI**] in November 2023.

4.2.3 Stakeholder Identification

Guided by information gathered from interviews conducted during the site scoping activities in July 2021 at least five (5) stakeholder groups were identified to potentially be affected, either directly or indirectly and in varying degrees, by the Project. These five stakeholder groups were the initial target of the stakeholder engagement plan developed to guide the full ESIA exercise which commenced in November 2023.



Figure 10: Public disclosure and stakeholder engagement and consultation in Kumah-Sorkporjah

Stakeholder categories identified during the scoping exercise and engaged during the ESIA based on potential levels of impact are as follows:

- Communities within 500m^2 of the proposed project boundary [ESIA study area].
- Communities to a maximum extent of 2500m^2 of the proposed project area; [considered the maximum extent of local area];
- Statutory local authorities and leadership (both appointed and elected), including customary and traditional leadership, women, elders, and youth community leaders.
- Statutory and regulatory authorities.
- Private sector and other interested parties including non-governmental organizations.



Figure 11: Stakeholder categories identified during Scoping and engaged through ESIA exercise

The study defined stakeholders as individuals, communities, groups, and institutions who:

1. Are most likely to experience, at significant levels, any potential negative and / or positive impacts of the proposed project.
2. Are vulnerable members of the communities within the proposed project area; and
3. Have the mandate [such as statutory / regulatory and customary authorities] over the various elements of the project's activities.

While a 500m^2 buffer area around the proposed project boundaries was used to identify potential directly impacted stakeholders, given the social affiliations amongst these rural communities, the stakeholder identification process also considered a wider geographical scope. Nearby communities beyond the 500m^2 buffer zone which have socio-economic, customary, or ancestral connections to communities within the project buffer zone were also considered as they may be indirectly impacted due to changes in their connected communities.

Communities within 500m^2 of the mine infrastructures and pit areas were considered as the 'local community'. An increased zone to a maximum radius of 2500m^2 was considered as the regional extent of the project influence.

To ensure thorough identification of stakeholders – a risk assessment matrix was developed based on the community proximity to the proposed project, the potential impact resulting from the project's activities; the social influence of the community on the project area; the impact risk resulting from no mitigation measures, and a proposed mitigation including a risk reduction level.

Table 7 below captures the risk assessment matrix of the 29 communities identified across the 2500m2 sphere of influence.

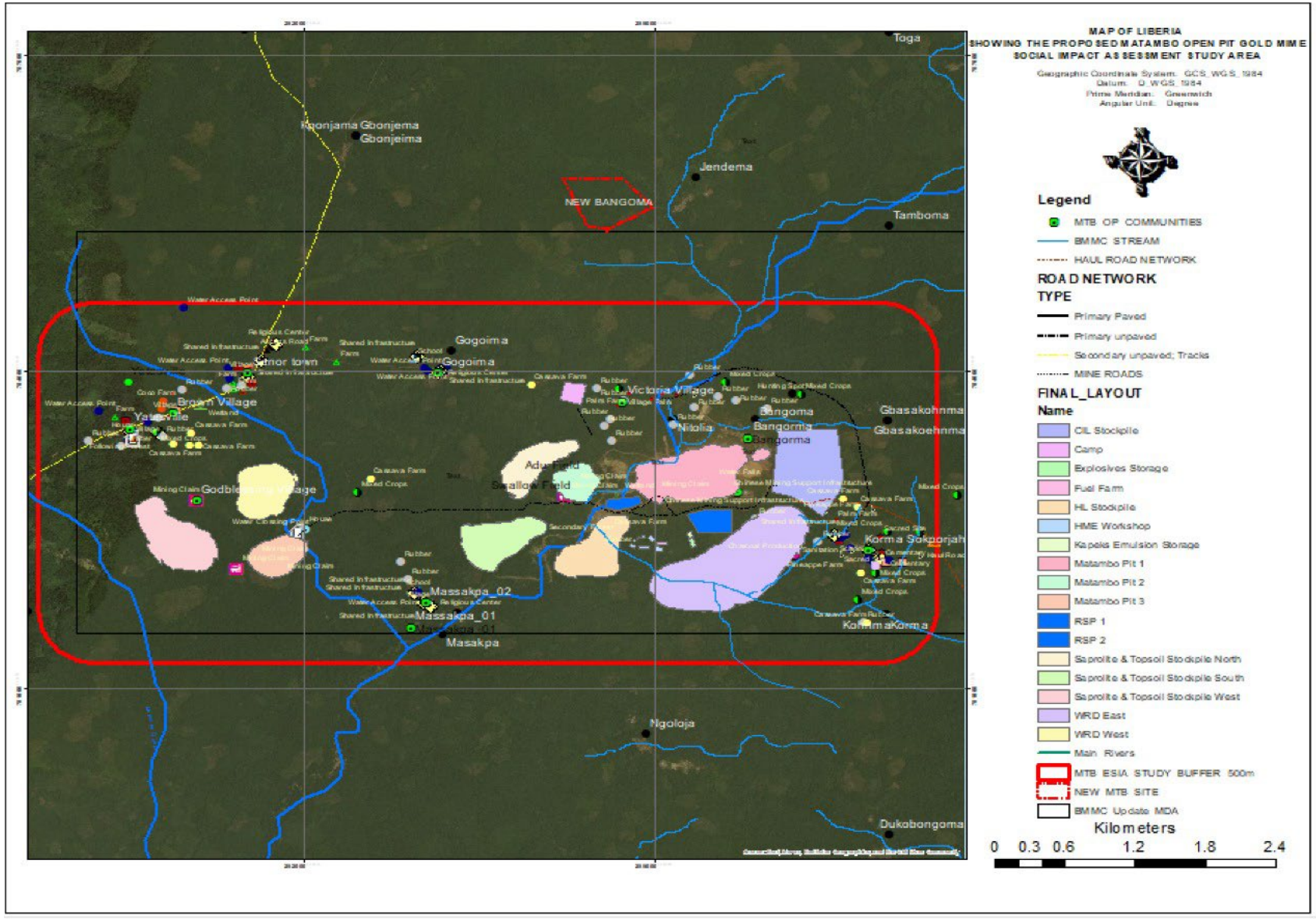


Figure 12: Map showing the proposed mine infrastructures and extent of social impact assessment.

No	Community Name	Distance to Mine / Infrastructures [m²]	Potential Impact	Social Influence	Impact Risk [Pre - Mitigation]	Proposed Mitigation	Reduced Risk [post-mitigation]
1	Adu Field	500.0	ASM field immediately located in Pit_01	Primary source of income-generation for residents in the project area	Critical	BMMC compensating licensed Class_C operators to relocate; Compensation also includes non - licensed holders whose livelihood is directly linked to the ASM in the area	Very Low
2	Augustine Village	2500.0	Social influx	Predominantly subsistence farming settlement	Low	Residents might seek employment with mining operations	Very Low
3	Bangorma	500.0	Community located in the proposed Pit_01 area	Currently seat of major social support services including infrastructures for project communities. Including clinic; civil obligations - voting registration;	Critical	Community is planned for relocation and better housing facilities. It also planned that supporting social infrastructures and services will be constructed and provided in the New Bangorma Housing Community. Commitment of recruitment priority and majority employment of all community employment quotas.	Low
4	Bo_02	2000.0	Social influx of people from NE of project area	Currently mostly farming community	Very Low	Residents might seek employment with mining operations	Very Low
5	Dukobongoma	1500.0	Land use scarcity; as ASM workers compensated from the project area are seeking to continue their livelihood in this community.	Currently mostly ASM community	Moderate	Encourage regulators and local authorities to support ASM workers to legally access claims in the area.	Low
6	Fofana Village	2500.0	Social influx	Currently mostly farming community	Low	Residents might seek employment with mining operations	Very Low
7	Gbasakorma	1000.0	Social influx of people from East of project area	Currently mostly farming community. Given proximity to Pit1 likely to host job seekers from surrounding towns looking to be closer to the mines.	Moderate	Residents might seek employment with mining operations. Notification and publication of hiring practices and job quotas	Low
8	Gbonjeima	1500.0	Social influx	Currently mostly farming community; due to its closeness to the proposed New Bangorma; potential for some social conflicts; both outward and inward migration	Moderate	Notification and publication of hiring practices and job quotas	Low

9	God Blessing Village	500.0	Currently located approximately 200m from the Matambo pit 3 saprolite stockpile. High potential of water, noise, and dust impact from mining operations	Currently mostly farming community	High	Ensure proper drainage control around exposed mine and construction surface area. Strengthen noise, vibration, and dust monitoring including soil stability for the stockpile. **Highly recommended for BMMC to consider negotiations with community to voluntarily vacate given proximity to ore stockpile.**	Moderate
10	Godiani	2500.0	Increased traffic on major public access road west of the project area. Increase traffic could result in road damage	Major trading and marketing center for project communities	Very Low	Essential that project uses its influence with engaging with regulatory authorities to ensure funding support for road maintenance and road safety in delivered	Low
11	Gogoima	500.0	Loss of livelihood; currently host the exploration camp and provides employment for most of the residents.	Historically a ASM community; since the establishment of the project's exploration camp; it has become a strong center of commercial and trading influence in the area	High	Since the establishment of the exploration camp; residents who are employed have some training and skills that can be applied to other roles either in the mining project or elsewhere. Some jobs will continue to be available at the exploration camp in Gogoima.	Moderate
12	Goneba	2500.0	Predominantly a fishing community located downstream [confluence] of the Matambo Creek. Potential runoffs from the mining operation might impact water quality and aquatic life	Source of livelihood for residents in the project area	High	Installation of drainage control around exposed mine surface areas including supporting infrastructures to reduce run-offs and siltation.	Low
13	Jendema	1500.0	Social influx. With the establishment of the New Bangorma community; this will add some social pressure to the resources of Jendema. Potential land use will be a high point of contention as the New Bangorma community lands are owned by Jendema. Also critical to watch is leadership and governance [Ex: will the people of New Bangorma be subjects to the leadership of Jendema or will they have their own leadership and not be subjected to Jendema?]	Major trading and commercial post in the north of the project area.	Moderate	Strengthen social institution services to be able to withstand some of the potential social pressures from the relocation of Bangorma community. Training center for potential mine services support. Security support to reduce potential crimes in the area	Low

14	Jenewonde	1000.0	Social influx. One of the largest commercial centers in the area. Most residents in the project communities seek advancement here in education [High - school]; health care [bigger clinic with more resources] and a major selling point for gold [ASM]	Major trading and commercial post in the north of the project area.	Moderate	Ensure some support to help maintain the access road to the project area; especially during the operations of the Matambo Pit 3	Low
17	Kumah Sokporjah	500.0	Mine haul road passes close to community [school]. Dust and noise impact is high in this area	Center of cultural heritage and traditional practices in the project area	High	Improve the dust monitoring regime; slow project vehicles speed in the area [speed restriction strictly enforced]. Strictly respect **FRIDAYS** as this is prayer day	Low
18	Kuteh Village	2500.0	Social influx	Currently mostly subsistence farming community	Low	Residents might seek employment with mining operations	Low
19	Mafala	2500.0	Mine haul road passes close to the community. Potential vehicle / pedestrian interaction. Dust impact from haul road usage.	Current mostly farming community	Moderate	Improve dust management measures along the road. Slow vehicles speed and improve road safety [post - signs / reduce speeds],etc.	Low
20	Massakpa_01	500.0	Located in the confluence of the Matambo Creek and the Mafa River; high siltation and run-offs from the mining operations might impact the water quality and aquatic life. Noise and dust from the mine construction activities will also impact the community.	Currently ASM activities in the area are the primary livelihood supplemented by subsistence farming. Resources from these activities are also used to support shared social infrastructures and services	High	Increased erosion and sediment control measures around surface water bodies; Routine dust suppression spraying along the public access road. Water quality monitoring	Low
21	Massakpa_02	500.0	Located in the confluence of the Matambo Creek and the Mafa River; high siltation and run-offs from the mining operations might impact the water quality and aquatic life. Noise and dust from the mine construction activities will also impact the community. Public school proximity to access road for pedestrian safety and dust management.	Currently mostly farming and ASM activities in the area are the primary livelihood. Resources from these activities are also used to support shared social infrastructures and services.	High	Increased erosion and sediment control measures around surface water bodies; Routine dust suppression spraying along the public access road. Water quality monitoring	Low

22	New Bangorma	1000.0	Within the Zone of Influence; as inhabitants will still have links to the project.	Proposed new community, relocated from the proposed Pit_01 area.	Low	Priority employment amongst communities; Majority employment quota; Access to TVET training programs	Low
23	Ngoloja	1000.0	Likely population influx	Located along access route towards mine from South of Massakpa 1 & 2	Moderate	Notification and publication of hiring practices and job quotas	Low
24	Saanor	500.0	Social influx	Job aspirants seeking better chance at work.	High	Notification and publication of hiring practices and job quotas	Moderate
25	Swallow Field	500.0	ASM field immediately located in Pit_01	Source of livelihood for residents in the project area	Critical	BMMC has compensated licensed Class_C operators to relocate; Compensation also includes non - licensed holders whose livelihood is directly linked to the ASM in the area	Very Low
26	Tamboma	1000.0	North of Pit1 along MDA boundary	Likely population influx	Low	Notification and publication of hiring practices and job quotas	Very Low
27	Tewor	500.0	At SW boundary of the study area and near Pit 3 and public access road. Likely population influx.	Noise and vibration. Possible increased sedimentation. Population influx from jobseekers from the SW	High	Notification and publication of hiring practices and job quotas	Moderate
28	Victoria Village	500.0	Abandoned residential area. Will be included in Pit 1.	Bangorma community continue to insist on desire to not "lose" this land	Very Low	Abandoned. No residents, but need to continue engaging Bangorma residents	Very Low
29	Yatesville	500.0	Along public access road. Closest town on north of Pit3.	High influx of jobseekers already underway. Those who are not hired will likely settle in communities such as this in the hopes of eventual employment or other income-generation activities.	High	Notification and publication of hiring practices and job quotas for Yatesville	Moderate

Table 7: Risk assessment of all communities identified within project's regional influence

4.2.4 Identification of Preliminary Concerns and Opportunities

The preliminary concerns and opportunities discerned through the interface with the stakeholders during the scoping and baseline exercises are summarized in categories and thematic areas in the table below.

No	Social Impact Variables	Identification of Preliminary Concerns and Opportunities
1	Livelihood and economic change	▪ Threats to aquatic species for fishing communities ▪ Longer travelling distance and incurrence of high transportation costs for social services. ▪ Safety of pedestrians [mine vehicles / human] interactions within increase traffic in project area. ▪ Alternative income-generation and livelihood for residents and reduction in the traditional way of livelihood [ASM activities/subsistence farming] ▪ Jobs and business opportunities for the locals ▪ Positive spillover effects, e.g. demand for food, housing, etc. from project actives ▪ Improvement to household income and disposable income.
2	Environmental Change	▪ Loss of wildlife and hunting ▪ Decline in marine resources. ▪ Changes in watercourse of major rivers – Matambo and Mafa rivers ▪ Reduced water quality [discharges from mining operations] ▪ Impact to air quality from dust ▪ Loss of tranquility due to increase in noise levels.
3	Livability and social wellbeing	▪ Increased volume and movement of traffic and its impact on public road safety ▪ Influx of non – local and foreign migrant workers and demand on social and infrastructure facilities and services. ▪ Increase in housing demand, land, and rental value.
4	Health and Safety	▪ Noise and air pollution ▪ Crime and personal safety
5	Demographic change	▪ Inflow of foreign migrant workers ▪ Inflow of non – local, Liberian migrant workers from other parts of the country
6	Culture and Heritage	▪ Trespassing in cultural heritage and sacred customary land areas ▪ Chance finds management and practices
7	Land use	▪ Competing land use management ▪ Further clearing of forested lands for development

Table 8: Identification of preliminary concerns and opportunities

The preliminary concerns and opportunities that were identified in the baseline exercise allowed certain assumptions to be made to the various social impact variables with respect to potential impacts and their significance.

Table 9 below summarizes the preliminary potential impacts, their anticipated significance, and likelihood of impact and consequence of impact. These assumptions were useful in framing the impact assessment tool to the local communities and in the interviews with key informants.

Potential Impact	Significance of Impact	Likelihood of Impact	Consequence of Impact
Water pollution	Negative / Moderate	Likely	Moderate
Road Safety	Negative / Moderate	Likely	Moderate
Dust and Noise Pollution	Negative / Moderate	Likely	Moderate
Recreational Facilities [Shared Infrastructures]	Negative / Moderate	Likely	Moderate
Employment of local residents	Positive / Moderate	Likely	High
Local business opportunities	Positive / Moderate	Likely	High
Housing demand	Positive / Moderate	Likely	High
Land Value	Positive / Minor / Moderate	Likely	Minor

Table 9: Summary of potential impact and significance

4.3 Social Impact Assessment Methods

A triangulation methodology was used to validate socio-economic baseline data collected. This involves using more than one method to gather and verify data. The triangulation methodology is a combination of qualitative and quantitative approaches to develop a comprehensive understanding of a complex situation such as the socio-economic landscape of the project area. Data triangulation also increases data validity through cross verification from more than one source.



Figure 13: Key informant interview with midwife in Gogoima Community

A combination of qualitative and quantitative methods was used for this SIA, specifically informant interviews, observations, survey questionnaires, focus group engagements, dialogues, meetings, and inputs from regulatory authorities. Data and information regarding the study area were obtained from both primary and secondary sources.

Secondary sources were directly from regulatory authorities' studies, data, reports, and documentations relevant in this study to understand the perception and acceptance of the local communities towards the proposed project. Table 10 summarizes the various data collection methods undertaken for the study.

Data Collection Method	Approach / Target	Date
Site reconnaissance visit	Documented the early status of the environmental and social context of the Matambo exploration targeted area	July - 2021
Household Survey [Bangorma]	Conducted a household survey on Bangorma community, documenting 344 structures. 211 completed and 133 in-completed	June – 2023

Prior Notice & Identification of Points of Interest	Project introduction and documenting all social points of interest across the project area. These points of interest included personal properties, livelihood sources, and shared infrastructures	Nov - Dec - 2023
Socio – Economic Survey of the communities	Conducted socio – economic profile of all communities within the project study area and 500m^2 buffer zone	Dec - 2023
Establishment of Grievance Redress Mechanism	Deposited 5 suggestion boxes within the project communities during initial prior notice and study launch to gather early project concerns or support for the project across the communities. Boxes remained in communities throughout the study exercise and were emptied in early January 2024 ahead of feedback consultations. A total of 32 entries were obtained from the 5 suggestion boxes and concerns integrated into feedback consultations disclosing potential impacts and proposed mitigation measures,	Nov - 2023
Focus Group Discussions **Key Informant Interviews**	A total of 4 focus group discussions were held across the project communities. The FGDs enabled a deeper understanding of key social considerations such as health, education, and cultural heritage given their shared communal infrastructure across communities. To understand how these thematic areas impacted the lives of females in the project area, specific focus group discussions were held with women regarding health access and services as well as cultural heritage. The FGDs recorded 55 number of participants over the 4 – days of engagements.	Jan - 2024
Stakeholders Engagements and Consultations	A total of 9 communities engaged and consulted bringing together over 150 participants from the project study communities	Jan - Feb- 2024
Relocation Committee Meetings (Bangorma)	A twice-monthly meeting that brings direct representatives from Bangorma and BMMC together to discuss the ongoing voluntary relocation process of their town. Meetings enable discussions on implementation of the relocation assistance program that is targeted construct the New Bangorma Housing Units that will host the Bangorma community.	August 2023 - Present

Table 10: Data collection methodology used during the project.

4.3.1 Primary Data Collection

Primary data comprises socio-economic data collected through direct interviews conducted during the household survey as well as the feedback obtained from the survey and engagement with the stakeholders pertaining to the perceived impacts and concerns towards the Project. Primary data were obtained through a combination of qualitative and quantitative methods that include:

- Quantitative Method
  - Questionnaire surveys
- Qualitative Method
  - Focus Group Discussion [FGD]
  - Key Information Interviews [KIIs]
  - Suggestion Boxes
  - Meetings
  - Dialogue Sessions

4.3.2 Secondary Data Collection

Secondary information and data were collected from the project proponent who in agreement with the regulatory authorities supervised the data collection for select thematic areas:

- Artisanal and Small – Scale Mining [ASM]: Directly supervised by the Ministry of Mines and Energy.
- Housing Design and Construction: Directly supervised by the Ministry of Public Works.
- Crops Compensation: Directly supervised by the project proponent.
- Cultural Heritage / Graves: Directly supervised by the Ministry of Internal Affairs.
- Land lease / ownership: Directly supervised by the Liberia Land Authority.
- Road Construction: Directly supervised by the Ministry of Public Works.
- Construction of public clinic: Directly supervised by the project proponent.
- Construction of public schools: Directly supervised by the project proponent.

In the study design, the project proponent outlined their leadership role in engaging with the various regulatory agencies and authorities, sharing the results of these engagements and associated approvals with the project team for incorporation into this final report. Specific thematic activities outlined above as led directly by the project proponent have been included as appendices as shared by the proponent.

4.4 Risk Management

4.4.1 Risk Assessment

A detailed risk assessment was conducted for the project. The social impact risk assessment considered the set of preliminary impacts [both positive and negative] identified after overlaying proposed mine design and infrastructure layout over Points of Interest and social baseline data gathered during the various rounds of field activities. This involves impacts during the construction and operational phases of the project in terms of the types of impacts, likelihood the impacts that will occur and the magnitude of the impacts.

A matrix system was developed by the project study team to be used as a guide to qualitatively establish the cause-and-effect relationship, where the social impact issues are considered as variables against established socio-economic baseline data of the communities living within the project study area.

To identify and assess potential impacts associated with or resulting from project activities, the project team used professional judgment and desktop analysis of technical studies undertaken for this Project to identify potential impacts and predict their significance and severity on the communities. Identification of issues and concerns raised by the stakeholders and evaluation of the significance of impacts shall be undertaken for the construction and operation phases.

The significance of the impact is dependent on its severity and probability of occurrence. Severity is a measure of the seriousness of the identified impact upon the stakeholder. It can be quantified using a numerical value scale by assigning a value to each perceived impact. Values range from Very High; High; Medium – High; Low – Medium; Low; and Very Low.

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
SPATIAL SCOPE OF IMPACT	**RATING**
Activity specific	1
Area specific	2
Whole project site / local area	3
Regional	4
National	5
DURATION OF IMPACT	**RATING**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5
FREQUENCY OF ACTIVITY / DURATION OF ASPECT	**RATING**
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
FREQUENCY OF IMPACT	**RATING**
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

CONSEQUENCE

LIKELIHOOD

Table 11: Criteria for assessing the significance of impacts.

A glossary of definitions guiding the risk assessment are as follows:

Activity: a distinct process or task undertaken by an organisation for which a responsibility can be assigned.

Environmental aspect: an element of an organisation's activities, products or services which can interact with the environment.

Environmental impacts: consequences of these aspects on environmental resources or receptors.

Receptors: comprise but are not limited to people or man-made structures.

Resources: include components of the biophysical environment.

Frequency of activity refers to how often the proposed activity will take place.

Frequency of impact refers to the frequency with which a stressor will impact on the receptor.

Severity: refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

Spatial scope: refers to the geographical scale of the impact.

Duration: refers to the length of time over which the stressor will cause a change in the resource or receptor.

CONSEQUENCE (SEVERITY + SPATIAL SCOPE + DURATION)															
LIKELIHOOD (FREQUENCY OF ACTIVITY + FREQUENCY OF IMPACT)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 12: Significance rating matrix

Color Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-High	76-100	Improve current management	Maintain current management
	Low-Medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very Low	1-25	Maintain current management	Improve current management

Table 13: Positive / Negative Mitigation Ratings

4.5 Mitigation Measures

4.5.1 During Construction

Appropriate mitigation measures shall be implemented for the construction and operation phases of the Project. During pre-construction, issues relating to increased traffic movement, water pollution, dust, noise, vibration and transportation of heavy equipment and machinery, etc. were key concerns, including public safety along public roads. These concerns are likely to continue into the full construction phase. Additionally, housing of foreign migrant workers will also need to be addressed to minimize potential social conflict between the residents and the foreign workers. With respect to health and safety of the public and workers, adequate security measures to prevent accidents and injury should be addressed during pre-construction and in the full construction phase when transporting construction equipment and materials along public roads.

4.5.1.1 Potential Environmental Impacts During Construction

Communities and residents raised concerns of potential environmental impacts resulting to pollution including water, noise, vibration, and dust. To ensure that these pre-construction concerns were thoroughly investigated and addressed specific environmental sampling was conducted at four locations for specific environmental media of concern; samples were then sent to an independent 3rd party EPA accredited laboratory for analysis.

Surface Water Investigation

During social baseline studies while pre-construction was ongoing, residents complained that their surface waters were polluted due to the impact from the by-pass road, haul road and general construction activities. Four communities reported specific water-related complaints locations were sampled to determine the water quality at these locations. The laboratory findings were used to inform the level and scale of the mitigation measures by BMMC. Sample analyses were compared with the Liberia Water Quality Standards [**LWQS**] Class II to determine any level of potential exceedances.

Community	Sample_Media	Sample_ID	X_Coord	Y_Coord
Kumah-Sorkporjah	Surface Water	MTB_OPC_SW_01	257293	782296
Kumah-Sorkporjah	Surface Water	MTB_OPC_SW_02	257009	782256
Gogoima	Surface Water	MTB_OPC_SW_03	253290	784136
Massakpa_1	Surface Water	MTB_OPC_SW_04	253083	781486
Massakpa_2	Surface Water	MTB_OPC_SW_05	253200	781724

Table 14: Details of surface water investigations based on community pre-construction complaints

Dust Management and Investigation

During baseline data collection and impact disclosure consultations, the communities of Kumah Sorkporjah, Massakpa_1 and Massakpa_2 complained of dust pollution resulting from the ongoing construction works.

In response to these expressed concerns, BMMC indicated that watering of the road was ongoing during the construction works and committed to increase the frequency to minimize the existing impact of dust pollution and poor air quality.

Noise and Vibration Management and Investigation

The communities of Kumah Sorkporjah, Massakpa_1 and Massakpa_2 also expressed concerns about ongoing noise and vibration resulting from construction and clearing activities in their communities. Their outlined concerns are also related to anticipated vibrations from blasting once mining operations commence.

In response to these concerns, BMMC confirmed that noise levels may be elevated due to construction activities underway, however these are expected to reduce significantly once construction is completed.

During operations, BMMC has committed to provide adequate notice through alarms and sirens ahead of blasting to alert nearby residents of upcoming, temporary noise and vibration disturbances.

4.5.2 Artisanal and Small-Scale Mining Assessment and Management

Compensation for artisanal miners was informed by a verification exercise led by the Ministry of Mines and Energy with support from the Ministry of Internal Affairs to identify valid license holders operating Class-C (manual artisanal license category) licenses in pits across the Project area. The Ministry provided guidance on artisanal miner compensations adopted in other mining locations in Liberia and led negotiations with artisanal license holders. Individual license owners were then engaged directly by BMMC through a signed MoU to confirm receipt of payments and acknowledge responsibility for vacating their existing mining claims along with their respective pit workers. Given the scale of artisanal mining and its significance as a source of income-generation, unlicensed miners were compensated to vacate their respective claims along with workers.

4.5.3 Agricultural Impact and Crop Compensation

As pre-construction was ongoing during the time of field studies, the baseline exercise was not able to capture pre-construction information regarding crops on respective farms. Where crops-related complaints arose, they were documented and conveyed to BMMC for direct company engagement as part of their ongoing crops compensation

exercise. These complaints were also captured and discussed during impact disclosure and feedback community consultations where BMMC had an opportunity to further engage individual farmers on their respective complaints. Crops compensations have been made for perennial crops and non-perennial crops based on expropriation resulting from ongoing access road network construction and site clearing at New Bangorma town. Further crops compensation associated with the residents of Bangorma town currently farming awaiting relocation will be undertaken closer to completion of construction at New Bangorma. The Ministry of Agriculture Crops Compensation Price List (2012) was used to determine compensation values. Crops counting was conducted jointly by the farmer and BMMC community relations representatives to calculate crops to be impacted.

BMMC has directly led the ongoing crops compensation and details regarding the regulatory guidance and agricultural compensation scheme are included as Appendix J.

4.5.4 Massakpa Community Land Lease for Matambo Pit 2

The Company and the People of Massakpa have begun negotiations for a land lease. The negotiations can only be concluded after the Liberia Land Authority has issued the Customary Land Deed, which is expected to be done by end of February 2024.

4.5.5 During Operations

The preliminary findings show that the mining-related activities are located primarily within the ESIA study area. Except for the proposed relocation of Bangorma, closure of Abu Field, and Swallow Field, as well as location of God Blessing close to the Pit 3 and associated saprolite stockpile and West Waste Rock Dump, surrounding communities will not be directly impacted but indirectly impacted by the mining operations.

Because of the extensive mining activities required by the project, existing income-generation, and livelihood activities [**ASM / Agriculture**] in the project area will be impacted. Baseline studies established an average monthly household income of US$586.00[5]. This monthly average income will be important to consider when assessing income-generation and livelihoods of project affected communities during operations to determine the net impact of the project on their household earnings.

From the Bangorma household survey conducted in June 2023 residents questioned the possibility of getting jobs in the proposed project as few have the required skill sets. With respect to the proposed Project, it is envisaged that

[5] Reported aggregated monthly average household income across study area communities was LRD108,966. The foreign exchange rate at the time of reporting was LRD186=USD1

positive benefits will be generated for the local communities, for example, direct and indirect job creation, and enhancement of the local economy by increasing business with local suppliers and service providers. The project's direct employment and contracting opportunities will create pathways for up-skilling amongst the project-affected communities' labor force.

4.6 Social Impact Management Plan

In parallel to this Social Impact Assessment, the project has prepared a Social Impact Management Plan [**SIMP**]. The SIMP establishes the roles and responsibilities of the Project Proponent, government, stakeholders, and communities throughout the life of the Project, in mitigating and managing social impacts and opportunities during pre-construction, construction, operation and the decommissioning of the Project.

The SIMP for the proposed Project:

- Reflects the findings and recommendations of the Project's social impact assessment, including feedback from engagement with stakeholders.
- Presents a concise summary of the findings of the social, economic, and demographic character of the zone of impact and the potential positive and negative impacts.
- Provides a summary for all stakeholders regarding the potential positive and negative impacts of the Project, proposed mitigation and management strategies and implementation actions. The actions nominated to resolve issues shall be accompanied by progress measures and time frames in the monitoring plan and be reported on as Project implementation proceeds.
- Identifies the roles and responsibilities of the Project Proponent and key stakeholders, i.e. relevant government agencies and departments, service providers and communities through pre-construction, construction, operation, and decommissioning of the Project.

In preparing the plan, discussion, and collaboration with stakeholders, particularly the local government, government agencies, and specific service providers is crucial.

The Social Impact Management Plan is included as **Appendix G**.

CHAPTER 5: DEMOGRAPHIC PROFILE AND SOCIO – ECONOMIC ENVIRONMENT

5.1 Population and Demographic Profile

Nine communities were engaged during the Social Impact Assessment, all of whom have a total estimated population of approximately 8,884. The most populated community is Bangorma while the least populated community is Brown Village. Victoria village has been abandoned and no population was encountered while God Blessing Village is a mining camp and the occupants originate from surrounding communities such as Yatesville and Brown Village.

The population of the area is dominated mostly by children and women coming next in terms of gender dominance. The table below describes the population demography of the communities:

No	Community Name	Ave. Population
1	Yatesville	200
2	Saanor	450
3	Brown Village	50
4	Kumah Sokporjah	1615
5	Bangorma	4300
6	Massakpa-1	500
7	Massakpa-2	500
8	Victoria Village[6]	0
9	Gogoima	1250
10	Godblessing Village	19
	Total	**8,884**

Table 15: Population estimates obtained during community socio - economic profile survey

[6] Victoria Village is abandoned with no current residents



Figure 14: Aerial view of Massakpa_01 (left) and Massakpa_02 (right) communities

5.2 Socio – Economic Profile

5.2.1 Economic and Occupational Status

The main source of income generation in the area is mining, specifically Artisanal and Small – Scale Mining [ASM] classified in Liberia as Class C mining license. Men are the main workers in the mine while most women are involved with petty trading. None of the 9 directly impacted communities engaged in the assessment have a designated market site for communal trade. Jennehwonde is the only market site in the west of the project area with each Friday as the dedicated market day. Traders, farmers, and residents from nearby communities visit the town on Fridays to buy produce as well as domestic, non-perishable items such as clothing and shoes. Communities who are involved with subsistence farming of food crops, vegetables, and fruits also bring their farm produce for sale.

5.2.2 Education

There are 2 elementary schools, no junior high school, no senior high school, and no vocational training school in the area. Most of the school buildings in the area were constructed by resources mobilized by residents of the communities which access these schools. All two elementary schools are being run as public schools staffed by teachers under the mandate of the Ministry of Education.

5.2.3 Health, Water and Sanitation

There is only 1 clinic in the study area, located in Bangorma. There is no hospital facility, however communities reported also accessing healthcare services from 2 herbalists and 16 traditional midwives operating across the study area. The main illnesses reported to affect adults are malaria, bone sickness, and cold. Children were reported to suffer most commonly from cold, diarrhea, and cough.



Figure 15: Handpump in Bangorma

Domestic water access is mainly through hand pumps and hand dug wells. As identified during the 2021 screening, during the November 2023 baseline studies, many of the hand pumps in the study area were reported as not operational. Well dysfunctions were attributed to mechanical breakdown (particularly for hand pumps) and seasonal drop in the water table for hand dug wells.

5.2.4 Land use and Transportation

Significant tracts of the land were recorded to be used for mining and agriculture. The Mafa is the main river in the study area and several tributaries run across the proposed project area. Despite the presence of the large river, fishing was not reported as a significant income-generation or livelihood activity. Pit sawing operations were recorded within the primary forest East of the proposed mine area.

The predominant means of transportation is walking, and via motorbikes for motorized transport, moving commuters between the project area and the Ibrahim Babangida Highway, connecting Klay Junction to the international border with Sierra Leone. Motorcycle transport costs for the longest distance along the route to the project area is charged at LD500[7] a distance of approximately 20km.



Figure 16: Community interviews on road and transportation management in Kumah-Sorkporjah

[7] During the time of the assessment the exchange rate was $185LD = $1.00 United States Dollars

5.2.5 Cultural Traditional and Customary Practices

The Poro and Sande customary societies were recorded to be deeply entrenched in project area communities and wield great social influence as a significant majority of respondents engaged indicated they were initiated into their respective gender's customary groups. The customary leader (Traditional Head) of Grand Cape Mount County resides in Bangorma, where he is sought out by customary leaders from towns across the county.

It is noteworthy that customary societies practices operate in parallel with established religions such as Islam and Christianity and members of both Poro and Sande groups often also practice their religions. Given the significance of these customary practices in the nearby communities, shared infrastructure used by customary leaders and for practices were identified in Bangorma and Kumah Sorkporjah.

In artisanal mining camps within the study area, some respondents indicated conducting animal sacrifices to support their beliefs in supernatural interventions.

5.2.6 Religious Practices

The area is mostly dominated by Muslims with a significantly less presence of Christians. There were 13 religious infrastructures identified across the study area, representing 8 mosques and 3 churches. Some residents also indicated subscribing to their ancestral spiritual and religious practices rather than either of the organized religions present in the study area.



Figure 17: Mosque in Bangorma Community

5.3 Key Findings from the Stakeholders Engagement and Consultations

5.3.1 Project Awareness and Stakeholder Engagement

In addition to ESIA study launch and early project awareness notifications, two distinct rounds of open-invite, town-hall styled stakeholder consultations on ESIA study feedback were held with residents in the project area. The consultations engaged directly with nearly 300 stakeholders across the 9 communities.

These public consultations were organized in clusters, bringing together communities based on physical proximity, shared history and relationships, ethnicity, language, and social construct.

The community consultations were aggregated as follows:

- Cluster One: Bangorma / Gogoima
- Cluster Two: Kumah Sorkporjah
- Cluster Three: Yattesville / Saanor / Brown Village
- Cluster Four: Massakpa_01 and Massakpa_02 and God Blessing Village

Feedback consultations were conducted in an open forum where Petra's independent study team fully disclosed the potential impacts of the project, as well as presented to the participants the proposed mitigation measure (s), associated with each identified potential environmental and social impact.

Two rounds of feedback consultations with all four clusters of communities were conducted between 25 January 2024 and 01 February 2024.

5.3.2 Response to the Project

During the two rounds of community stakeholder consultations across the project communities, a total of 97 issues / concerns were raised. These community queries and concerns were summarized along thematic areas and BMMC through their participation in the sessions, provided their responses directly to the participants.

Consultation participants in these project affected communities were also directly asked whether the response(s) and proposed mitigation measures satisfied their questions / concerns. After two rounds of impact disclosure and feedback consultations, no outstanding concerns regarding proposed mitigation measures were expressed by any of the communities.

5.4 Feedback from Focus Group Engagement, Dialogues and Key Informant Interviews

5.4.1 Focus Group Engagement

As part of the ongoing works to support the finalization of the Environmental and Social Impact Assessment [**ESIA**] studies for the construction and operations of the proposed Matambo Open Pit Gold Mine, a series of thematic focus group discussions [**FGDs**] were held during the socio-economic baseline data collection. These consultations sought out additional qualitative and contextual information on three priority thematic areas, namely:

- Education
- Health, and
- Cultural Heritage

These three topics were identified through earlier rounds of stakeholder engagements, PoI identification exercise, and during the scoping study of the proposed area in July 2021. The focus group discussions generated a more nuanced and in-depth knowledge on these various social topics. The targeted discussions also enhanced the understanding of the perception and prioritization of these activities through the unique lenses of both women and men within the project communities. The discussions illuminated existing challenges to, and opportunities for women and men's participation in these areas across the Project Area.

The FGDs were held in the following locations and dates:

Location	Thematic Area	Discussion Date
Massakpa_01 and Massakpa_02	Health and Education	11 – Jan - 24
Kormah Sorkojah	Health, Education, and Cultural Heritage	11 – Jan -24
Gogoima	Health and Education	12 – Jan - 24

Table 16: Focus Group Discussion locations, themes, and dates

A report on the Focus Group Discussions has been included as an appendix to this report and presents the results of the focus group discussions carried out for the Matambo Open Pit Gold Project located in Tewor District, Matambo, Grand Cape Mount County Liberia in January 2024. The discussions aimed to explore how women and men within the project area are individually and collectively consider education, health, and cultural heritage in the context of their broader lives and existence.

The thematic areas were considered given its significance as a socio-economic factor for residents in and around the study area:

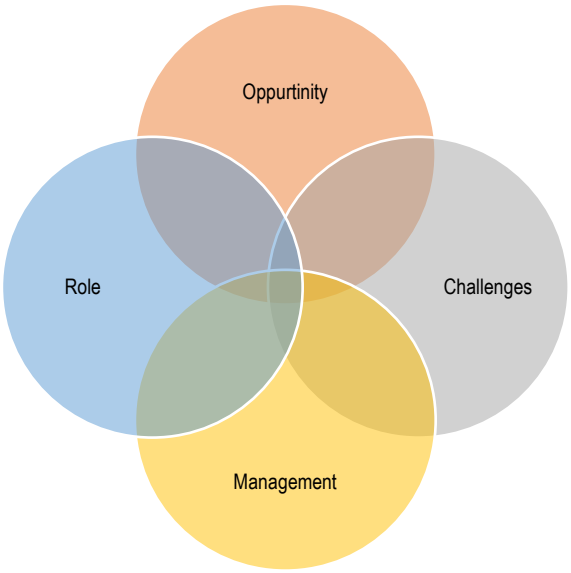


Figure 18: Thematic area and considerations of the focus group discussions.

The focus group discussions were designed to help understand the roles, responsibilities, challenges, and opportunities of women's and men's participation in the project area communities and their livelihoods. The FGDs documented the participation of 31 women and 24 men during the sessions, which were held in separate locations simultaneously.

Location	Thematic Area	Number of Participants	Population's Ave Age [Years]
Massakpa_01 and _02	Health and Education	12.0	49.2
Kormah Sorkporjah	Cultural	7.0	50.0
Kormah Sorkporjah	Health and Education	17.0	52.4
Gogoima	Health and Education	19.0	43.2

Table 17: Demographics and thematic areas of Focus Group Discussions

5.4.2 Stakeholders' Engagement and Consultations

A detailed stakeholder engagement plan was developed to guide the community stakeholders and engagement management throughout the project. The plan layout the mode, schedule and duration of engagements and consultations with stakeholders in the project area.

Two rounds of impact disclosure and feedback consultations were conducted in the project area between 25 January – 1 February 2024. A total of 9 communities totaling 297 individuals participated in the engagements and discussions. During the engagements the project design, impacts from specialists' studies were presented to the participants. Proposed mitigation measures to address the impacts were also included in the discussions.

Following the presentation, participants were solicited for direct comments, concern, support, rejections, or recommendations by the independent consultants. All expressed queries and concerns were documented and presented to BMMC who in some cases provided clarity on the scale and extent of the mitigation measures or took the concerns back to their management for improvement or modification where necessary.

During the engagements are total of 97 concerns were raised and responded to directly by BMMC representative. Thematic concerns raised and address included:

Thematic Area / Concern	BMMC's Response
When mining activities are completed, will communities have access to the mine area to be able to use the land for farming purposes?	The rehabilitation plan for the project area is based on returning most of the mine development area to productive agriculture use [grazing and/or cultivation]. Certain areas, namely the pits and WRD, will however be permanent and farming at these locations may not be possible.
How many pits will there be in the project area?	Based on the current project design, it is expected that the project will have 3 pits..
After decommissioning, will communities be able to work in the pit area? Will the operations of the pit impact communities?	The pits are expected to be flooded post – mining. Several studies including air quality, water, noise, and blasting have been completed to determine the impact of mining on surrounding communities. These studies have indicated that with the mitigation measures implemented, the pit activities are unlikely to affect the communities.
Bangorma is the center point for most of our social activities and services including the clinic; now relocating Bangorma will impact other residents?	For health care, BMMC has informed and is engaging directly with the MoH for the relocation of the clinic to the New Bangorma community; to help fill the gap; BMMC is equally engaging with MoH to have a health post in Kumah Sorkporjah to provide emergency services so that communities in the south will still have access to health care.
Will blasting, noise and vibration especially in Pit_01 impact residents of Kumah Sorkporjah?	Blasting can affect water quality, noise, vibration and has risks from fly rock. These impacts were investigated by a specialist and the study concluded that with the blasting mitigation measures implemented, there is expected to a very low impact from blasting at Pit_01.
Will the company minimize dust pollution?	The frequency of dust suppression on roads near communities will be increased to reduce dust levels especially in the dry season.
Augustine and Kuteh Villages were included in the Household Survey; and since then, no further engagement with these communities.	Following the mine design, it was indicated that Augustine and Kuteh Villages were outside of the direct impact zone; however these communities are still in the project zone of influence; and as such engagements will always be ongoing.
The youths are not satisfied with the hiring process.	BMMC has encouraged the communities to ensure equal and fair distribution of jobs, especially amongst the youths and women demographics within the project area.

It is understood that ASM in Bangorma have been compensated what is the plan for miners in Kumah Sorkporjah?	BMMC has compensated license holders and not individual members working in the ASM sector; if you're in Kumah Sorkporjah and owns a license area that was impacted by the construction activities; you also would be compensated.
BMMC has stopped rehabilitation the road since the construction of the haul road.	BMMC is currently in pre – construction activities and thus utilizing all its equipment and resources towards this purpose. After mining stats some equipment will be available to help support maintenance works.
Community members are asking BMMC to give support to people that are involved in agriculture / farming	BMMC has brought in agriculture technicians to begin working with those in farming to improve crop production as well as marketing and finance.
How will communities get safe drinking water?	BMMC shall pay into the Matambo Corridor Development Fund and the Community Development Fund in the MDA to help address some of these social issues.
Why should residents of Tewor District go to Gola Konneh for training?	BMMC has set up a training resource center in Kinjor; BMMC encourages communities across its MDA area that are interested in TVET programs to attend the institution; as it is not practical to set up an institution in each and every district across the MDA area.

Table 18: Summary of study-area stakeholder concerns and corresponding mitigations

Appendix F presents the full consultation reports along with the register of concern and responses.

5.5 Conclusions

The Project is perceived to generate positive and negative impacts during the pre-construction, construction and operational phases.

Potential positive impacts are:

- New employment and business opportunities,
- Increase in property and rental value, revitalization of abandoned housing and commercial projects,
- Stimulus for the development of idle or underutilized land in the project zone of influence,
- Local economic growth in the zone of influence and the surrounding areas and improved infrastructure and public amenities.

Potential negative impacts are:

- Loss and degradation of forested areas and habitats, threat to the livelihood of the farmers and ASM workers, increased traffic movement, and public road safety.

Overall, the local community's perception of the Project is very favorable. They perceive that the benefits would be greater than the adverse impacts. While a section of the ASM and farming communities were opposed to the Project, the majority of the project affected communities were uncertain about their support/opposition. Irrespective of their expressed positions on the proposed project, all communities had residents who were open to assistance from the Project Proponent to support them in securing employment at the mines operations or to be trained in other skills that will allow them to move from ASM and farming to alternative employment.

It is also clear that to mitigate the potential adverse impacts, the role of certain regulatory authorities, including local leadership, are particularly important. Their active participation will be required to ensure that annual social development funds are used in the project communities, and that residents can begin to benefit directly from funds paid.

Lastly, a mechanism or platform needs to be formed to receive, address, and resolve stakeholder concerns. Throughout the life cycle of the Project, queries and grievances related to the project activities are bound to arise from community and stakeholders, and which are to be addressed and resolved in an appropriate manner. The mechanism serves as a platform for interfacing and communication between the community and the Project Proponent, identification, and resolution of concerns early and in an expeditious manner. The formation of such a mechanism should be a collaborative effort between the Project Proponent, representatives of the stakeholder groups and the relevant regulatory agencies.

CHAPTER 6: IMPACT ASSESSMENT AND MITIGATION MEASURES

Social impacts will likely occur to communities and social groups living and working within the 2.5km zone of influence and different groups will experience different impacts, both positive and negative while Project activities are underway. Impacts may not occur simultaneously during implementation; rather, their occurrence may vary over time. Some impacts may be short-term occurring during the construction phase of the Project and often cease upon completion of construction or because of mitigation measures or natural recovery.

In contrast, long term impacts often arise during operation and are potentially more significant due to the extended period of impact exposure; others may persist even after the Project is completed. The SIA has identified impacts as changes to the social, cultural and livelihood aspects of the communities.

These changes are grouped into different social variables:

- Demographic character,
- Socio-economic wellbeing,
- Livability, community values and lifestyle,
- Health and safety, and economic development of the area.

These variables will invariably affect the community, either directly or indirectly. In addition, this section of the report also discusses the necessary mitigation measures to overcome or minimize the negative impacts while maximizing the positive impacts arising from the Project. The mitigation measures have taken into consideration several factors such as acceptability of the project by the communities, supporting their economic wellbeing, addressing road safety issues, minimizing socio-cultural changes, improving livability, and encouraging economic development to the project area and surrounding region.

6.1 Key Concerns of the Stakeholders

The main stakeholders are the residents within the project study area. Table 18 has identified the issues and concerns raised by the stakeholders with respect to the Project during the construction and operational phases of the Project. Throughout the engagement process – issues and concerns of the stakeholders were registered so that appropriate mitigation measures could be derived, thus making the mitigation practical and implementable.

At the time of field studies between November 2023 and January 2024, BMMC was actively engaged in discussions for properties in the Matambo area for land use rights. At the time of this report preparation, the company was still awaiting feedback from the Liberia Land Authority to conclude a land agreement so that further engagement can then take place with affected landowners.

The ensuing section provides further insight into the nature of these community concerns.

6.1.1 Employment

The Matambo Open Pit Gold Mine will create several employment opportunities, both short-term and long-term. It is expected that during the construction phase many jobs will be available, while a lower number of employments will be available during the operational phase.

Approximately 500 people will work at the mine during the peak development, preparation, and production stages of the project. The project shall also contribute to economic growth and development with respect to the new employment opportunities and business linkages that can be created with the mine activities. Mitigation measures will consider ways to strengthen the skill set of the local population to ensure that they can participate and benefit from the Project.

6.1.2 Infrastructure, Transportation [Road Network and Connectivity]

Stakeholders in the project area raised concerns over road network, connectivity, and accessibility. Issues around the use and maintenance of the existing public access roads within the project area were raised, especially during the construction phase which was ongoing at the time of field study engagements. The movement and transportation of heavy earthmoving equipment were said to be damaging an already poorly maintained public infrastructure.

As a result of ongoing road construction and uncertainty about the possible future layout, the lack of road connectivity to previously connected nearby communities causes concerns for their continued social cohesion. In addition, lack of access to previous routes is reportedly increasing travel distances, namely to Bangorma where critical social services such as health care, school, voting rights, marriage registration are accessed. The increased associated transportation cost with the extended distances was also noted as a concern.

In mitigating these impacts, the project is committed to maintaining public access roads, especially during the construction phase of the project, and working with the national regulatory authorities to ensure that social funding provided by the proponent as part of its MDA obligations are used directly in the project areas to address some of these public infrastructure challenges along the public access road.

6.1.3 Water Pollution

During the field studies for this assignment, in accordance with temporary permits granted by the EPA, BMMC was actively undertaking pre-construction activities including vegetation clearing, saprolite removal, stockpiling of soil, building of access roads and related activities. These simultaneous construction activities manifested in several

immediate concerns regarding water quality, particularly for surface waters across project affected communities. Concerns expressed during stakeholder engagements also considered potential chemical pollution during the operations phase as well as domestic pollution from the company's camp and office locations.

In response to expressed concerns about surface water quality in 4 communities during baseline data collection, an additional round of environmental quality data sampling and analysis was conducted as reported above in Table 14.

Regarding domestic water pollution from the camp and office at Gogoima, BMMC has already initiated corrective construction works on relevant sewage infrastructure at the camp.

Following completion of pre-construction and construction activities, it is expected the existing disturbances to surface water will reduce significantly. An integral part of the BMMC mitigation measures will arrange for independent environmental specialists to collect water samples from the area of concern, and these will be analyzed at an EPA-accredited laboratory and reported to the EPA.

Assistance with the construction of a sanitation facility may be considered by BMMC as part of the community development plan to be implemented during mining.

During field studies, despite water related complaints from upstream communities, namely Saanor and Yatesville, BMMC was not undertaking activities to impact their surface water resources.

6.1.4 Education

Access to education opportunities is expected to increase with the development of the proposed project and should consider geographic and transportation-related access constraints. The existing public school at Bangorma has been considered in the proposed relocation design and layout of the New Bangorma town.

To help address the training and educational needs for residents, BMMC has launched a Technical Vocational Education Training [**TVET**] school in Kinjor. BMMC encourages communities across its MDA area that are interested in TVET programs to attend this institution.

6.1.5 Health

The availability of healthcare services will be maintained with the construction of a public health center considered in the proposed relocation design and layout of the New Bangorma town. The geographic and transportation constraints expressed by catchment area communities regarding their continued convenient access and proximity to the new public facility should be considered. To address this specific concern, BMMC is proposing to engage with MoH to have a health post in Kumah Sorkporjah to provide emergency services.

BMMC has initiated consultations with the Ministry of Health to advise on the design of the new clinic at New Bangorma.

6.1.6 Socio-Economic Compensation

As part of the mitigation measures BMMC has implemented a comprehensive compensation scheme for artisanal miners and farmers whose pits or crops may have been impacted by the construction activities. In addition, a previous Chinese-operated Class B mining operation at Bangorma was engaged directly by BMMC for compensation and support to relocate its assets.

Artisanal miner compensations have been completed with the support of the Ministry of Mines and Energy which led negotiations with licensed and unlicensed miners. Compensation payments were made to both categories of artisanal miners through a Memorandum of Understanding where miners confirmed receipt of their compensation payments and committed to vacate current mining claims along with their pit workers and laborers.

The Ministry of Agriculture Crops Compensation Price List (2012) has guided crops compensation value determinations. Crops were counted by company teams alongside the farm owners and compensated based on the level of maturity as outlined in the regulatory price listing guide.

Additionally, for homes and residential properties impacted in the Bangorma Town, a full relocation assistance program is in place to have the entire community relocated approximately 2.0km north of its current location. This voluntary relocation assistance program includes the construction of approximately 224 homes and associated shared social infrastructures and services including a community clinic, school, religious centers of worship for both Muslims and Christians, a marketplace [shops] and burial grounds.

6.1.7 Air Pollution, Dust and Noise

It is recognized that the BMMC site preparation activities have changed the levels of noise in the area, particularly for communities within 300 - 400m of the activities. Day-time noise measurements were conducted in the Massakpa area on 2 December 2023. These noise measurements showed that noise levels were at an average of 48.7 dBA. International guideline limits for daytime (07:00 - 22:00) and nighttime (22:00 - 07:00) noise is 55 dBA and 45 dBA respectively. The average daytime noise levels at the time of the measurement were thus within the international guideline limits. The Noise Impact Study Report has recommended additional mitigation measures which BMMC will be considering for implementation.

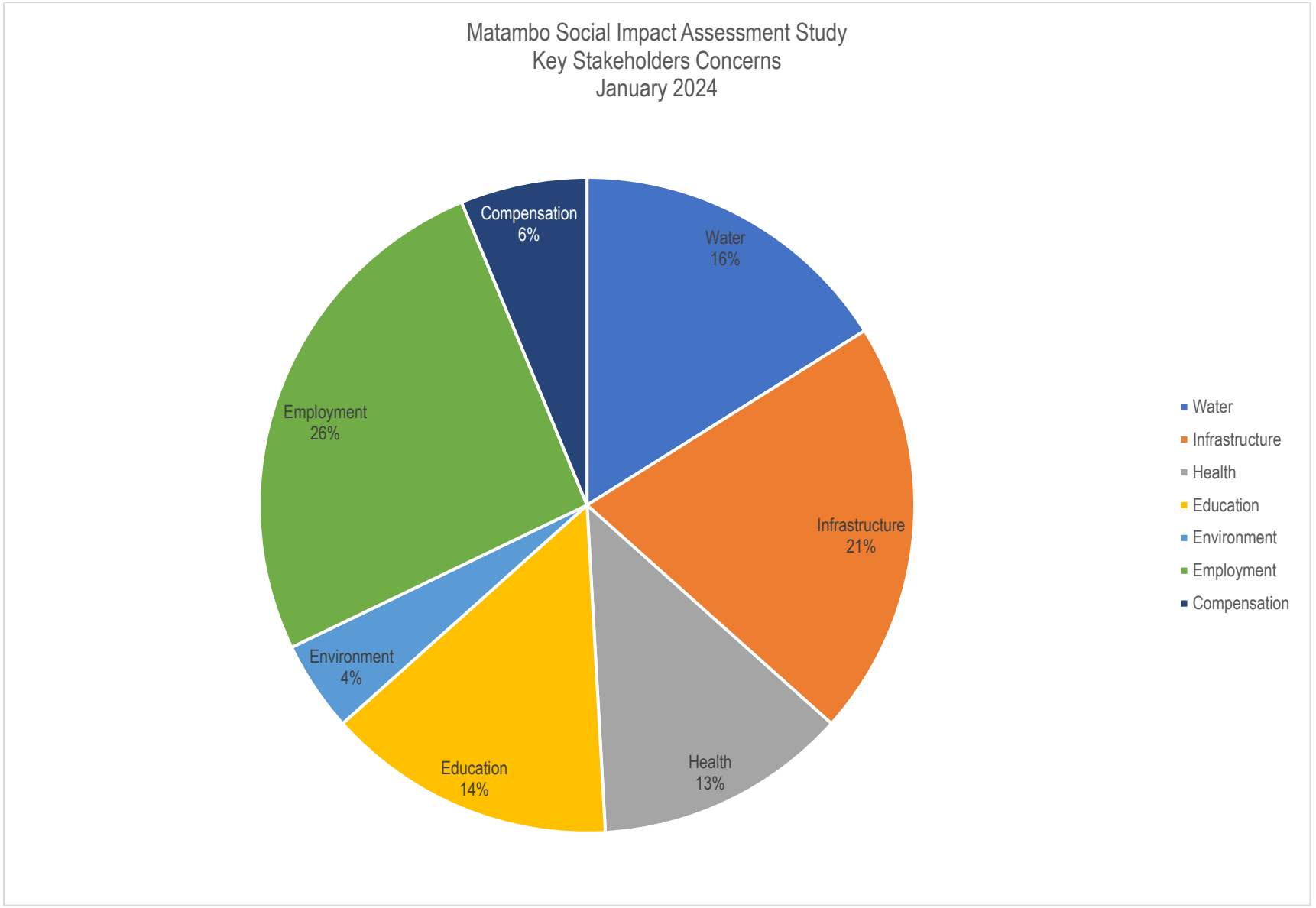


Figure 19: Graphic representation of key stakeholder concerns

6.2 Significance of the Social Impact

Social Impact [Construction Phase]	Impact Ranking Pre - Control	Post Risk Control [Risk Reduction]	Post Impact Management [Score]
A. Changing in the demography of the project area			
Change in Demographic	Medium - High	Develop a hiring management plan that documents the skills level and residents in each community. Ensure plan includes measures to target women, and physically challenged persons to have an opportunity to work and earn a living	Low - Medium
Employment and Business	Very High	Develop a supply chain management plan; ensure local purchases and expenditures are documented to track the amount spent locally during the construction period. Ensure at least over 40% of construction budget is spent on local supply.	Very Low
Livelihood	Medium - High	Residents employed will have a steady inflow and increase in income; training and development in small - scale business and financial management should be part of the training and scales development for employees. Develop a financial training program for local employees.	Low - Medium
ASM	Medium - High	Develop a compensation management plan for exiting ASM pit / owners and workers. Ensure the plan clearly documents ownership including mining assets.	Low - Medium
Housing Demand	High	Ensure adequate accommodation for employees, especially foreign migrant workers, so as not to put pressure on existing housing need in the project area	Very Low
B. Access to Infrastructure, Utilities, Community Services and Amenities			
Community	Medium - High	Ensure adequate domestic water sources are provided in each of the directly impacted communities through Matambo Corridor fund. Water access program should be based on the WASH Commission Guidelines of accessibility to determine number of water access point for each of the project impacted communities.	Low - Medium
C. Environmental Changes			
Community	High	Develop a blasting management plan; develop a dust mitigation measure including watering of exposed surfaces. Ensure a robust dust monitoring plan, which should include speed reduction on roads around communities.	Low - Medium
	High	Develop a robust environmental management plan that includes spill management and prevention. Establish a detailed water sampling and monitoring plan for the project area, especially around communities' water access points. Ensure a detailed erosion and sedimentation management plan is developed; especially around exposed surfaces during construction to reduce runoffs into surrounding surface water bodies. Environmental management plan should also identify and locate areas for waste management.	Low - Medium

		Where farmland, crops are impacted during construction and relocation ensure fair compensation for damaged crops based on the Ministry of Agriculture Crop Compensation Listing	
D. Crime and Safety			
Community	High	Ensure to develop a security management plan; this plan should include emergency contact details for all site personnels. Plan should ensure security patrols and fencing or access restriction to mine areas and assets.	Medium - High
E. Cultural Heritage and Traditional Practices			
Community	Very High	Ensure strict adherence to local customary laws, practices, and traditions. Ensure traditional ceremonies are completed and approved by local leadership prior to construction so as not to destroy shrines or sacred sites. Develop a Chance Find Management Plan to support the construction phase.	Medium - High
F. Health			
Community	Medium - High	Work along with national authorities to ensure payments from social development fund can be used to help properly resource the clinic in the area. Ensure in the proposed relocation plan the clinic has continuous water and energy supply. Energy should be via renewable energy; this will ensure clinic hours are extended for service delivery.	Low - Medium
	High	Encourage MoH to develop a plan to improve the operating schedule of the clinic to about 10 - 12hrs daily and ensure it is adequately stocked through funding from the Matambo Corridor Development Fund. . . Ensure consultation for the construction and relocation of the clinic is done with both the health regulators and the communities that helped to construct the clinic. Communicate with MoH to have health post in the south of the project area so that communities in the south can have easy access, which communities in the north will have access to the relocated clinic.	Low - Medium
G. Public Road Safety			
Community	Medium - High	Ensure a strong and robust Traffic Management Plan is developed; establish road signs, and speed reduction as appropriate. During construction phase, readjust travel times to ensure very minimal impact to public movements along public roads.	Low - Medium
	High	Develop a traffic management plan that ensures general community use and safety; especially where footpaths leading to livelihood source or community cohesion has been swallowed by construction or mine asset; establish alternative routes for community; use radios communication or flagging to control community uses during the construction phase.	Low - Medium
H. Land use			
Community	High	Where farmland, crops are impacted during construction ensure fair compensation for damaged crops based on the Ministry of Agriculture Crop Compensation Listing	Low
	Low - Medium	Ensure a detailed land use management plan for the project, so that need for supporting infrastructure (s), do not include additional land clearing for construction. Design a Project Land Use Management Plan	Low

Social Impact [Operational Phase]	Impact Ranking Pre - Control	Post Risk Control [Risk Reduction]	Post Impact Management [Score]
A. Changing in the demography of the project area			
Change in Demographic	Medium - High	Job availability and recruitment will occur continuously throughout the life cycle of the Project. Ensure quota for each community represents a fair nature and structure of the community, with priority presented to women, and physically challenged.	Low
Employment and Business	Medium - High	Keep track of non-controllable forces such as market pricing; civil unrest that could adversely impact project product and thus layoffs pre-maturely.	Low
Livelihood	High	Develop a training management plan; based role assessment and available jobs; begin training for community members.	Low - Medium
ASM	Low - Medium	Following the completion of ASM compensation; where/if applicable absorb ASM workers into other construction activities to ensure continual income sources for members.	Low
Housing Demand	High	Ensure adequate accommodation for employees, especially foreign migrant workers, so as not to put pressure on existing housing need in the project area	Very Low
B. Access to Infrastructure, Utilities, Community Services and Amenities			
Community	High	Ensure adequate domestic water sources are provided in each of the directly impacted communities through Matambo Corridor fund. Water access program should be based on the WASH Commission Guidelines of accessibility to determine number of water access point for each of the project impacted communities.	Low - Medium
C. Environmental Changes			
Community	High	Develop a blasting management plan; develop a dust mitigation measure including watering of exposed surfaces. Ensure a robust dust monitoring plan, which should include speed reduction on roads around communities. Where community concerns are raised concerning water impact - include points in regularly sampling and monitoring plan.	Low
D. Crime and Safety			
Community	High	Ensure to develop a security management plan; this plan should include emergency contact details for all site personnels. Plan should ensure security patrols and fencing or access restriction to mine areas and assets.	Medium - High
E. Cultural Heritage and Traditional Practices			
Community	High	Develop a success planning to ensure locals are hired to keep project management and leadership role as soon as possible. Plan should put on a track measurement to ensure residents as obtaining the needed scales to assume project leadership roles, and not only casual jobs. Develop a working schedule the incorporates key dates / times for traditional ceremonies. Ensure employees are free to participate.	Low - Medium
F. Health			

Community	High	Develop a 'Just - Culture' and socialize the understating with employees and communities. Encourage reporting of exploitation without reprisal from management or foreign migrant workers.	Low - Medium
G. Public Road Safety			
Community	High	Develop a robust traffic management plan. Plan should include rehabilitation to public roads following construction. Work along with county authorities to ensure funds are dedicated to support impact mitigation in program area; and where successful - inform local communities on amount and time of payment including recipients.	Low
H. Land use			
Community	High	Ensure current site layout does not need additional expansion so as to maximize the current land use / layout and reduce need for any additional clearing. Develop a land use management plan to support mining operations. Develop a rehabilitation and closure plan; ensure to begin rehabilitation as soon as possible; especially where current land is no longer needed. Initiate rehabilitation immediately.	Low - Medium

Table 19: Social Impact Risk Assessment

6.3 Potential Impacts and Mitigation Measures

The recommendations for potential mitigation measures are mainly for the negative impacts. Generally, positive impacts will not require any preventive and mitigation measures regardless of their ratings, unless stated. Given the nature of the proposed Project, it is acknowledged that some of the mitigation measures identified are not measures that the project proponent could implement but should be implemented by the relevant government agencies, as well as local government authorities. The mitigating measures identified classified into construction and operational phases. The mitigation measures that are recommended consider, among others, the following factors:

- An opportunity to address the high impact or significant issues, especially those affecting the livelihood, safety, and livability of the community.
- Acknowledgement of feedback and suggestions provided by the community and institutional stakeholders during the public engagements via key informant interviews and focus group engagements.
- Consistent with the aspirations of the community.
- Appropriate and can be implemented effectively.
- Promotes and raises skills level of the local community and utilizes human resources available.
- In line with the capacity of the project proponent and government agencies
- Proposes stipulated time frame of implementation, whether during planning, construction and project implementation or operational phase of the Project.

6.3.1 Potential Impacts During Pre – Construction

In the planning or pre-construction stage of the Project, the main activities that are carried out are surveys, engineering design and technical studies that include the following:

- Topographic surveys.
- Preliminary planning and design of the mine and associated infrastructures layout to determine the most optimal layout.
- Pre-environmental impact assessment.
- Soil investigations
- Erosion and Sedimentation Control
- Pre – Social Impact Assessment
- Road and Transportation Assessment

The impact is not very significant, and no mitigations are needed. These are specialist studies involving professional and technical input to conduct sampling and survey works at the Project area and its vicinity, desktop studies, computer

simulation and engineering design work. These activities are low-impact activities and do not involve any inflow of migrant workers, non-local from other parts of Liberia or foreign, often from neighboring countries. Therefore, no change in demographic character, livability, socio-economic wellbeing, etc. is expected.

6.3.2 Potential Impacts During Construction and Operational Phases

The significance ratings of the impacts to the local population and the community are indicated in Table 19 for the construction and operational phases of the Project. Among the positive impacts that are considered high priority and significant to the local population are:

- Employment and business opportunities from the activities. For example, new businesses under the initiative of the local population may also come on-stream to service the workers during construction and operational phases.
- An opportunity to improve their household income, livelihood, and lifestyle.
- Increased demand for housing and rental accommodation due to the inflow of non-local workers.
- Land use changes from agriculture to a use that enhances the value to the land; and
-

As for the negative impacts, the most significant and high priority impact relates to:

- The livelihood of the full-time farmers and ASM workers and the possibility that their livelihood might not be sustained.
- Risk perception of the project employees of uncertainty over their future
- Safety of motorized vehicles and pedestrians on local public road due to an increase in traffic volume and movement.
- Potential to remove community cohesion due to lack of easy access.
- To a lesser extent, some impacts have moderate significance to the community, but which, nonetheless, still require either monitoring or preventive action to minimize their impacts. The variables with moderate significance include:
    - Perceived fear and anxiety over crime, public safety, health, and social conflict – issues usually associated with the presence or proximity of foreign migrant workers.

CHAPTER SEVEN: STUDY CONCLUSION

The findings of this SIA indicate that the construction and the operation of the proposed Matambo Open Pit Gold Mine have both positive and negative impacts. Positive impacts are mainly due to creation of employment opportunities, boosting of the local economy due to increased disposal income and contribution to the overall national revenue of Liberia which ultimately may lead to improved quality of life.

On the contrary, negative impacts may be experienced due to migration of job seekers into the project area and surrounding towns and village; damage to property and infrastructure because of mining activities; decline in the quality of life due to air, noise, land and water pollution and increased traffic.

As was seen in the preceding chapters, a significant proportion of the population of the project area is resident in Bangorma Town which has a population of 4,300 residents.

The combined average monthly household income for residents within the project study area was reported as equivalent to roughly US$590.

The clinic in Bangorma Town operates in a catchment network, servicing nearly 12 communities within and around the project area. Ensuring continual access to this social service is critical to improving the health access to residents in the project area.

Given this backdrop, the mine offers an opportunity to contribute to the overall improvement of the socio-economic status of Matambo Corridor. Striking a balance between economic, social, and environmental conservation is often challenging considering the numerous stakeholders and differing motives. A healthy competitive environment needs to be established for the opposing land uses such as mining, agriculture, and human settlement because mining activities lead to large scale destruction of the environment and land disturbance.

To this BMMC is committed to a full-scale rehabilitation of the project area; a detailed rehabilitation plan is presented in the overall project closure management plan; these commitments as well as supporting the communities through direct project initiatives are strong ethical foundations to which BMMC is committed to.

In addressing the negative impacts, the social impact study outlines the following solutions:

- Upgrading and maintenance of the public road network to pre – construction status or better.
- Increasing the level of higher skilled local employees.
- Expanding the domestic water point sources.
- Establishing mining supplier parks to enhance enterprise development in the project communities.
- Resolving land claims to improve economic growth and improve living conditions.

- Providing comprehensive support corporate social contributions initiatives so that project communities can directly benefit from corridor development programs.

Ultimately, if the proposed Matambo Open Pit Mining Project is authorized, every effort must be directed to ensure that it leaves a lasting positive legacy in the Matambo Corridor. This can be done by enforcing the implementation of mitigation measures that are outlined in the Environmental and Social Management Plan [**ESMP**].

APPENDIX 10-2: RELOCATION ASSISTANCE PLAN (PETRA, 2024)

CHAPTER 11
ASSESSMENT OF CUMULATIVE IMPACTS

TABLE OF CONTENTS

11 ASSESSMENT OF CUMULATIVE IMPACTS 11-1

11.1 METHODOLOGY 11-1
11.2 EXISTING AND PLANNED DEVELOPMENTS 11-1
11.3 CUMULATIVE IMPACTS 11-2
11.3.1 Air Quality 11-2
11.3.2 Greenhouse Gas Emissions 11-2
11.3.3 Land Use 11-3
11.3.4 Surface Water Resources 11-3
11.3.5 Groundwater Resources 11-3
11.3.6 Clearing of Natural Vegetation 11-3
11.3.7 Traffic Volumes, Wear and Tear, Damage to Roads and Road Safety 11-3
11.3.8 Noise 11-3
11.3.9 Evaluation of Major Cumulative Impacts 11-3
11.3.10 Measures of Prevention and Attenuation and Compensation of Cumulative Impacts 11-4

11 ASSESSMENT OF CUMULATIVE IMPACTS

11.1 METHODOLOGY

A qualitative risk-based methodology was followed for the identification and assessment of cumulative impacts. Based broadly on the IFC Rapid Cumulative Impact Assessment (RCIA)[1] approach, the methodology comprised of the following steps:

- The spatial and temporal boundaries for the cumulative impact assessment were determined. For the Matambo Open Pit Project (the Project), the spatial boundary was qualitatively regarded as the extent of the key social and environmental resources potentially affected;
- The key social and environmental resources which may be impacted upon by the proposed development were identified. For this Project, these resources were determined through the findings of the various specialist studies and defined to be as follows:
  - Identification of the existing and planned surrounding developments / land uses which have had / may have an impact on these key social and environmental resources. These were regarded as all surrounding land uses including existing artisanal mining and agricultural activities; and
  - The pre-mining state of the key social and environmental resources was reviewed to determine if local and international limits have been exceeded or if there is evidence to suggest that natural assimilative capacity has been or may, over the life of the Project, be exceeded.
- Each Project impact was assessed to determine whether it had the potential to be cumulative in nature. This was done by considering whether any of the following circumstances apply:
  - The Project impact could be caused by multiple activities or processes and/or at multiple locations associated with the proposed development; and
  - The Project impact affects a resource which is already impacted upon by existing developments.
- An assessment of the contribution of the Project impact to the cumulative impact was undertaken and consideration was also given to the overall significance of the cumulative impact; and
- Where necessary, mitigation measures were proposed for managing and monitoring the Project contribution to the cumulative impact.

The significance of the predicted cumulative impact was expressed as follows:

SIGNIFICANCE	INTERPRETATION
HIGH	There is a significant risk for cumulative impacts **and** the Project impact represents a significant contributor to the expected cumulative impacts. Controlling the Project impact will substantially reduce the predicted cumulative impact.
MEDIUM	There is a significant risk for cumulative impacts, but the Project impacts are not a dominant contributor to the predicted cumulative impact. The predicted cumulative impact is the result of multiple activities requiring action by a range of role players rather than any one party.
LOW	There is limited to no significant risk for cumulative impacts **and** the contribution from the Project impact is negligible or nil. Applying additional control measures to the Project impact will have no influence on the predicted cumulative impact.

11.2 EXISTING AND PLANNED DEVELOPMENTS

In order to assess the potential cumulative impacts that may arise from the proposed development in the area it is necessary to develop an understanding of current and planned projects that are likely to impact on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

[1] IFC 2013. Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets

From available information the following is known about current activities as well as planned projects in the area:

- BMMC is the holder of a Class A Mining License Area that includes the Matambo area. No other Class A mining licenses are held over the same property.
- The Matambo Resource is situated in the North-West of the MDA area.
- BMMC operates the existing New Liberty Gold Mine (NLGM) and Weajue and Ndablama Mines within the MDA.
- BMMC proposes developing the Matambo Resource by means of establishing an open pit mine.
- Use of existing haul roads within the MDA to transport product to NLGM for processing.
- Artisanal mining is historically prevalent in the general Matambo area (gold). No other known mining licenses are known of in the immediate vicinity of the project. Various support services are provided for the artisanal miners from villages such as Bangorma and Gogoima.
- Limited logging is taking place within the greater project area.
- Subsistence farming is practiced within the license area.

11.3 CUMULATIVE IMPACTS

11.3.1 Air Quality

Many construction-phase activities and pollution sources at different locations within the project area will generate air emissions. Emission contributions from site activities will contribute to a cumulative impact on the ambient air quality within the region.

Due to the large distances between Matambo pit 2 and 3 and the sensitive receptor locations, the impact of mining activities at these pits on ambient air quality at sensitive receptor locations (including villages and the proposed accommodation camp) is expected to be negligible.

Operations at the Matambo pit 1 could result in exceedances of the WHO AQGs for PM_{10}, $PM_{2.5}$ and NO_2 at Bangorma village. The proposed camp is ideally suited as a sampling location for air pollutants, including PM_{10}, $PM_{2.5}$ and NO_2. Sampled concentrations at this location should be used for compliance evaluation, as well as for tracking the effectiveness of implemented mitigation measures.

Vehicle entrainment from unpaved roads is expected to be the most significant potential contributor of dustfall, PM_{10} and $PM_{2.5}$ emissions. The source of NO_2 and SO_2 emissions from Project activities are predominantly from vehicle exhausts.

No other major emitters of NO_2 and SO_2 are present in the project area, with dust primarily associated with vehicle traffic on the public roads caused during the dry season.

Peens & Associates (2024) reported mean annual rainfall of 3 372 mm at NGLM (12 km southeast of the Matambo project). These high precipitation rates are expected to result in significant natural mitigation of fugitive dust sources.

A 10 km haul road was constructed by BMMC for the ore transportation to NLGM. Through implementation of mitigation measures, slow travelling speeds and possible relocation of the Bangorma village, the impacts to air quality can be managed. The cumulative impact is therefore considered to be **Low**.

11.3.2 Greenhouse Gas Emissions

Since GHG emissions are typically reported at a country-level, it is deemed appropriate to consider this cumulative impact at a country-scale.

The Project activities which are expected to contribute the most to GHG emissions are the combustion of liquid fuels for transportation and mining purposes. No other major GHG emitters are present in the area, with the limited public and commercial traffic not considered a main contributor to GHG emissions. The Project GHG emissions are therefore minor, and the post-mitigation significance of the cumulative impact is consequently assessed to be **Low**.

11.3.3 Land Use

The open pit mining and construction of the support infrastructure will entail the removal and stockpiling of significant quantities of soil, as well as the complete removal of soil and soft overburden in places where open pit mining is planned and where the foundations for the larger structures are to be excavated.

These impacts will be most dominant during the construction phase but will continue throughout the operation and into the decommissioning phase, the open cast mining voids and Waste Rock Stockpiles being permanent features that will be left un-mitigated in the landscape. The main impacts will include the loss of land use and utilisable resource (sterilisation and erosion), compaction and possible contamination or salinisation. The effects of existing activities (artisanal and historical mining) on and around the site might result in localised cumulative impacts albeit that these will be very minor in comparison to the scale of the proposed mining activities. The construction of the mining infrastructure and its support activities will, if un-managed and without mitigation have a variance of impacts based on the duration and spatial extent/scale of the disturbance planned. The cumulative impact remains **Medium** negative throughout the LoM until suitable mitigation and rehabilitation has been completed.

11.3.4 Surface Water Resources

Although the potential of hydrocarbon spills and other pollutants is considered possible due to the various existing mines within the MDA, the proposed development will not place significant additional pressure on surface water resources in the area and the impact is therefore considered to be **Low**.

11.3.5 Groundwater Resources

Pit-lakes will develop in all mined-out pits after cessation of dewatering activities. Surface decant or pit overflow could take place at the three (3) Matambo pits, with water flowing into the Matambo River system. The impact on the Matambo River quality is likely to be acceptable in terms of international and local water quality standards. The impact significance rating is seen as **Low**.

Ongoing subsurface infiltration of leachate from the waste rock dumps could generate a long-term groundwater contaminant plume downgradient from these facilities. No community wells are likely to be impacted. The potential water quality impact on nearby streams is seen as **Low** to **Medium**, and it is likely that dilution in this high rainfall environment would be sufficient to mitigate the potential impact. The cumulative impact is therefore seen as **Medium** to **Low** with mitigatory measures implemented through the LoM.

11.3.6 Clearing of Natural Vegetation

Existing natural habitats support populations of flora and fauna. Clearing and grubbing of vegetation for infrastructure (Construction & Operation) – the removal of vegetation will directly result in the loss of suitable habitat required by various species of conservation concern (SCC), and these habitats are replaced by necessary infrastructure that persists for the life of the mine or longer.

11.3.7 Traffic Volumes, Wear and Tear, Damage to Roads and Road Safety

With the use of the private haul road, the cumulative impact on the public road is therefore considered to be negligible. The cumulative impact on the haul road, however, is **Very Low/ Negligible**.

11.3.8 Noise

The construction and operational phase noise impact is expected to be low. The project contribution to noise emissions is therefore deemed to be minor with mitigation measures implemented at the correct phases of the development. With no other major noise emitters noted in the area, the post-mitigation significance of the cumulative impact is considered **Low**.

11.3.9 Evaluation of Major Cumulative Impacts

Due to the remote nature of the project in relation to other significant developments, the cumulative impacts associated with the Matambo Open Pit Project are generally considered **Medium to Low**. Existing activities were taken into account during the impact assessment and considered as part of the ESIA.

Future developments are to be in the area would need to consider the Matambo project as part of the baseline and cumulative impact assessment process.

11.3.10 Measures of Prevention and Attenuation and Compensation of Cumulative Impacts

Besides the implementation of the mitigation measures associated with the Environmental and Social Management Plan, the following measures can be considered:

- The development of an Environmental Management Plan Framework for all mining projects planned in the region to ensure that the key environmental and social impacts are identified and addressed in an integrated and coordinated manner.
- Continuous engagement with political and traditional leaders as well as other parties that hold exploration and exploitation permits in the area and develop a strategic plan for the prevention and management of the influx of jobseekers.
- Develop a regional plan to assess and mitigate the pressure that developments will place on social infrastructure in the area.
- The implementation of the Community Development Plan and the allocation of the funds towards the development of social infrastructure to mitigate the project impacts.
- Continue the Social Monitoring Program.

CHAPTER 12
EVALUATION OF PROJECT ALTERNATIVES

TABLE OF CONTENTS

12 EVALUATION OF PROJECT ALTERNATIVES 12-1

12.1 NO DEVELOPMENT OPTION (NO GO OPTION) 12-1
12.2 MINE DESIGN ALTERNATIVES 12-2
12.2.1 Pit Locations and Dimensions 12-3
12.2.2 Alternative Mining Methods 12-3
12.2.3 Alternative Mineral Processing Methods 12-3
12.2.4 Location, Number and Design of Mine Residue Facilities and Support Infrastructure 12-4
12.3 RAW WATER SUPPLY ALTERNATIVES 12-5
12.4 SOLID WASTE DISPOSAL ALTERNATIVES 12-5
12.5 MINE HAUL ROAD ALTERNATIVES 12-5
12.6 ENERGY SUPPLY OPTIONS 12-5

LIST OF FIGURES

FIGURE 12-1: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION OPTION 1 12-1
FIGURE 12-2: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION OPTION 2 12-2
FIGURE 12-3: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION COMPARED TO MAJOR WATER COURSES OPTION 1 12-3
FIGURE 12-4: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION COMPARED TO MAJOR WATER COURSES OPTION 2 12-4

LIST OF TABLES

TABLE 12-1: SITE SELECTION CRITERIA – KEY ASPECTS AND CONSIDERATIONS 12-2

12 EVALUATION OF PROJECT ALTERNATIVES

A few alternatives have been considered as part of the Matambo Open Pit Mine Project (the Project). These are summarised in the sections below.

The approach to the consideration of alternatives in this ESIA comprised of the following:

- Identification and review of alternatives typically considered in Projects of this nature;
- Specialist assessment of the areas proposed for development of Project infrastructure in order to confirm whether there was conflict between the development footprint and sensitive ecological and social features; and
- Application of the mitigation hierarchy (avoid, minimise, restore, offset/compensate) to significant risks and impacts.

12.1 NO DEVELOPMENT OPTION (NO GO OPTION)

The no-go option considers the consequences of a decision not to proceed with the Project. For the Matambo Project, this would imply that none of the proposed infrastructure and structures be constructed and that no mining or mineral processing activities take place.

The consequences of the no development option on biophysical aspects include the following:

- The present land use activities would continue;
- With no alternative employment opportunities, it is likely that the use of natural resources through activities such as artisanal mining, or the replacement of natural vegetation with agricultural activities will intensify; and
- The possible negative impacts of the proposed mining and mine support activities on the receiving environment would not occur. There would be no associated loss of natural resources, and no permanent change to the landscape from the WRDs, open pits and haul road.

The consequences of the no development option on socio-economic aspects include the following:

- The proposed investment in community infrastructure, as described in the community development plan, would not occur;
- There would be no Project royalties, taxes and other revenues payable to the Government of Liberia;
- The skills development, training and employment opportunities, stimulation of the local economy and the wider socio-economic benefits to the area would not be realized; and
- The indirect benefits of the Matambo Project, including the establishment of local businesses and procurement of local goods and services would not accrue.

Mineral development is considered a key cornerstone of the Economic Development Plan and Mineral Policy for Liberia. The development of the Matambo Project will contribute to the following goals and outcomes associated with the Economic Development Plan and the Mineral Policy of Liberia:

- National revenue and foreign exchange earnings;
- The creation of inclusive sustainable employment;
- Provision of raw materials for down-stream industries & national reconstruction;
- Improvement in social and physical infrastructure;
- Industrial development (up-, side- & down-stream linkages) and the stimulation of new economic activity through the provision of the requisite infrastructure;
- Positive impacts on the environment and local communities;
- Development of sustainable communities;
- Improvement in skills formation and knowledge creation; and

- Technology transfer and development.

Based on the impact assessment completed and the fact that the impacts associated with the Project can be mitigated in terms of a properly implemented Environmental and Social Management Plan, the no development alternative is not considered to be a feasible alternative in this instance.

12.2 MINE DESIGN ALTERNATIVES

The mitigation hierarchy is a systematic approach to mitigation planning and can be summarised into the following steps:

- Avoidance;
- Reduce/ Minimization;
- Restoration; and
- Offsets.

In the Scoping Phase of the project, mitigation measures were predominantly focussed on avoidance and minimisation. This is done through activities such as the site layout selection process and implementation of the environmental design criteria including the environmental sensitivity plan, by the engineering team.

In the Impact Assessment Phase, the findings and recommendations of the specialist studies were used to refine the site layout selection and to develop the environmental and operational controls which are focused on impact minimisation and restoration (as part of mine rehabilitation and closure).

The project site has been selected based on the presence of a mineable resource. The project plan and site layout has been based on limiting the project area footprint, avoiding sterilization of the mineable resources, and avoiding sensitive areas where possible, from an environmental and social perspective, while still considering engineering feasibility and financial considerations.

The site layout does include the disturbance of habitat identified to be sensitive. The option is available to consider offsets as a final step in the mitigation hierarchy.

Various aspects were considered during the site selection process, including the following main considerations:

- Community Health and Safety;
- Biodiversity and Critical Habitats;
- Occupational Health and Safety;
- Economic Considerations;
- Engineering and Technical Considerations;
- Sensitive Receptors; and
- Important Ecosystem Services.

The criteria and key considerations associated with the site selection process and alternatives analysis included the following:

TABLE 12-1: SITE SELECTION CRITERIA – KEY ASPECTS AND CONSIDERATIONS

ASPECT	KEY CRITERIA AND CONSIDERATIONS
Engineering	Suitability in terms of proximity to key infrastructure, geology and sterilisation of resources.
Financial and Commercial	Gold reserve and the economics of mining this reserve.
Community Health and Safety	Potential impacts that infrastructure placement may have on local communities.
Occupational Health and Safety	Impacts that the location of key infrastructure may have on employees and ensuring that the mine can be operated while complying with the applicable health and safety requirements.

Biodiversity and Ecology	Impacts that the activities or placement of infrastructure may have on critical, natural or modified habitats. The site selection hierarchy included: • Avoid as far as possible any critical habitat areas. • Avoid the wetland and floodplain associated with the tributary of the Mafa River that passes to the east and south of the resource area. • Avoid or limit the impact on ecological support areas. • Avoid or limit the impact on natural habitats. • Where natural habitats could not be avoided, mitigation measures are required.
Ecosystem Services	Impacts that the activities or placement of infrastructure may have on Type I and Type II ecosystem services. The site selection hierarchy included: • Avoid directly impacting on priority ecosystem services.
Community infrastructure and assets	Impacts that the activities or placement of infrastructure may have on existing community infrastructure and assets. The hierarchy included: • Avoiding any social or community infrastructure. • Avoid community assets or limit the extent to which such facilities are impacted.
Legally protected and internationally recognized areas	The Matambo Project area does not fall within any legally protected/ internally recognized areas.

The site selection process took into consideration suitable sites for key infrastructure based on engineering and technical considerations, as well as known environmental and social infrastructure.

12.2.1 Pit Locations and Dimensions

The location and dimensions of the pits at Matambo were identified and delineated through exploration activities, such as drilling and metallurgical analysis of rock samples.

No other pit locations have therefore been identified.

12.2.2 Alternative Mining Methods

Gold mining has been successfully undertaken all over the world through both surface and underground mining methods. Underground mining is often perceived to be advantageous to surface mining in that the visual impact of the underground mining is typically less significant than surface mining and there are no surface pits to manage into the future.

Underground mining is generally more expensive than surface mining and is therefore generally reserved for deeper ore bodies with higher metal grades. Other factors such as the mining depth, rock wall stability, geometry of the deposit and the ratio of overburden to ore (stripping ratio) also influence the choice of mining method.

In the case of the Matambo Project, the shape, orientation, metal grade and topography, among others, require that the mineral deposits be mined through surface mining.

12.2.3 Alternative Mineral Processing Methods

The existing facilities at the New Liberty Gold Mine (NLGM) will be used for the processing of ore that will be mined at Matambo Mine. The establishment of a processing plant at the area is not considered a viable option, for the following reasons:

- Economic considerations. The life of mine for Matambo is relatively short.
- Additional land would be required for the establishment of the plant and associated TSF facility.
- Significant additional environmental and social impacts would be associated with a processing plant, TSF and related infrastructure.

12.2.4 Location, Number and Design of Mine Residue Facilities and Support Infrastructure

Mine residue facilities required for the project comprise of the WRDs, temporary Resampling Stockpiles (RSPs), CIL Stockpiles, Heap Leach Stockpile (low-grade ore stockpile) and Saprolite and Topsoil Stockpiles. Of these, only the WRDs will remain at closure.

The number and location of the facilities were determined through consideration of the following factors:

- Volume of rock material generated;
- Physical and chemical characteristics of the rock material;
- Structural stability;
- Suitable topography;
- Geotechnical suitability;
- Avoidance of areas which can potentially be mined in the future, including any surface infrastructure needed for future operations;
- Optimal distance from the pits (WRDs); and
- Consideration of sensitive receptors including aquifers, watercourses, terrestrial ecology, and settlements.
- Ecosystem services associated with water and food supply to the community.
- Activities and assets supporting livelihoods in the area.

The initial design for the WRD and Saprolite and Topsoil Stockpile associated with Pit 3 intersected with a significant watercourse and confirmed Critical Habitat.

An alternative position for these structures was thus identified to avoid as much of these sensitive features as possible.

The two alternatives considered for the WRD and Saprolite and Topsoil Stockpile at Matambo Pit 3 are shown in FIGURE 12-1 FIGURE 12-2.

The layout in FIGURE 12-2 was selected as it would avoid the major watercourse in the area as seen in FIGURE 12-3 and FIGURE 12-4. The revised layout is expected to have a better environmental and social impact as it will have less potential for surface water contamination.

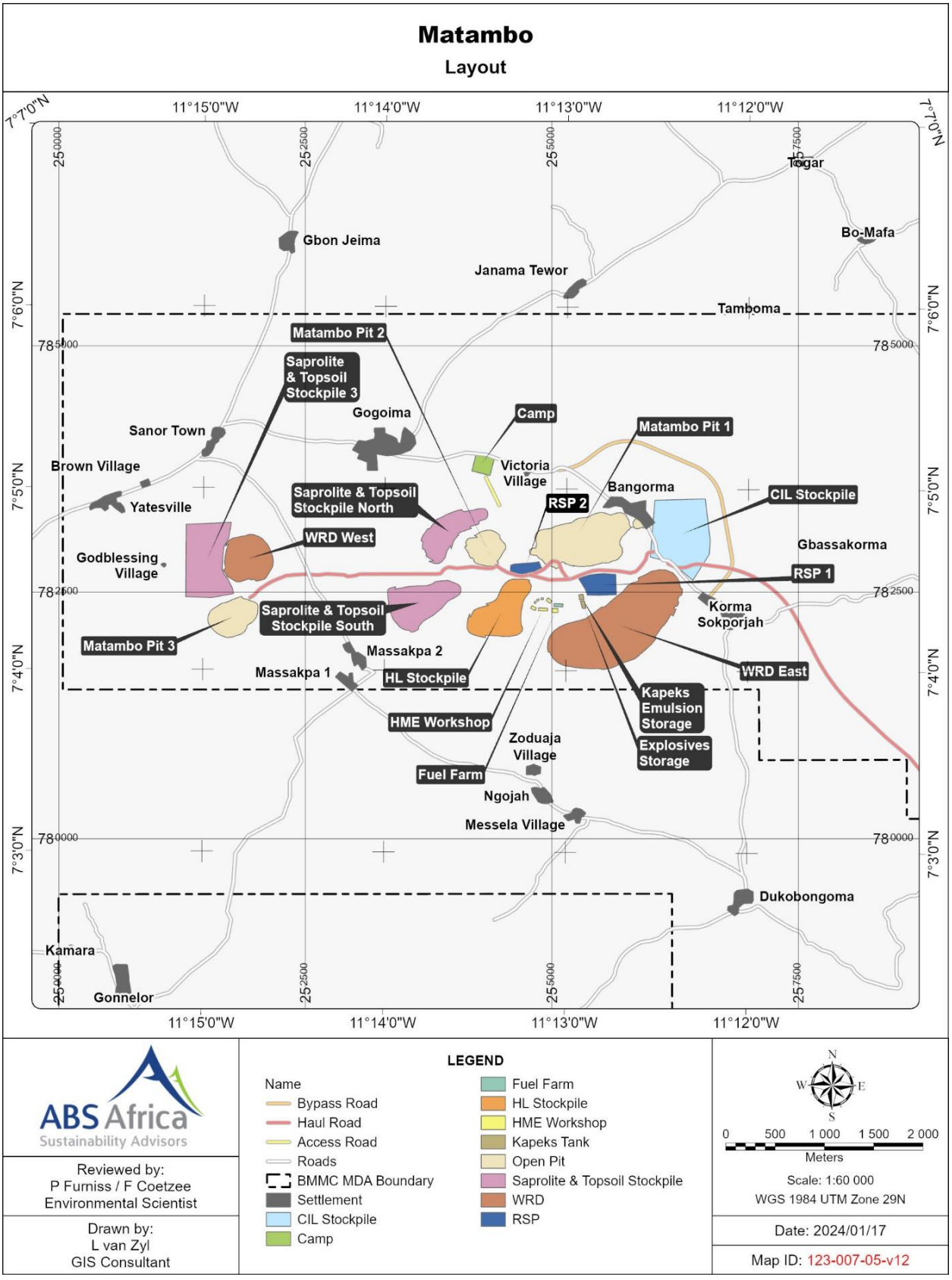


FIGURE 12-1: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION OPTION 1

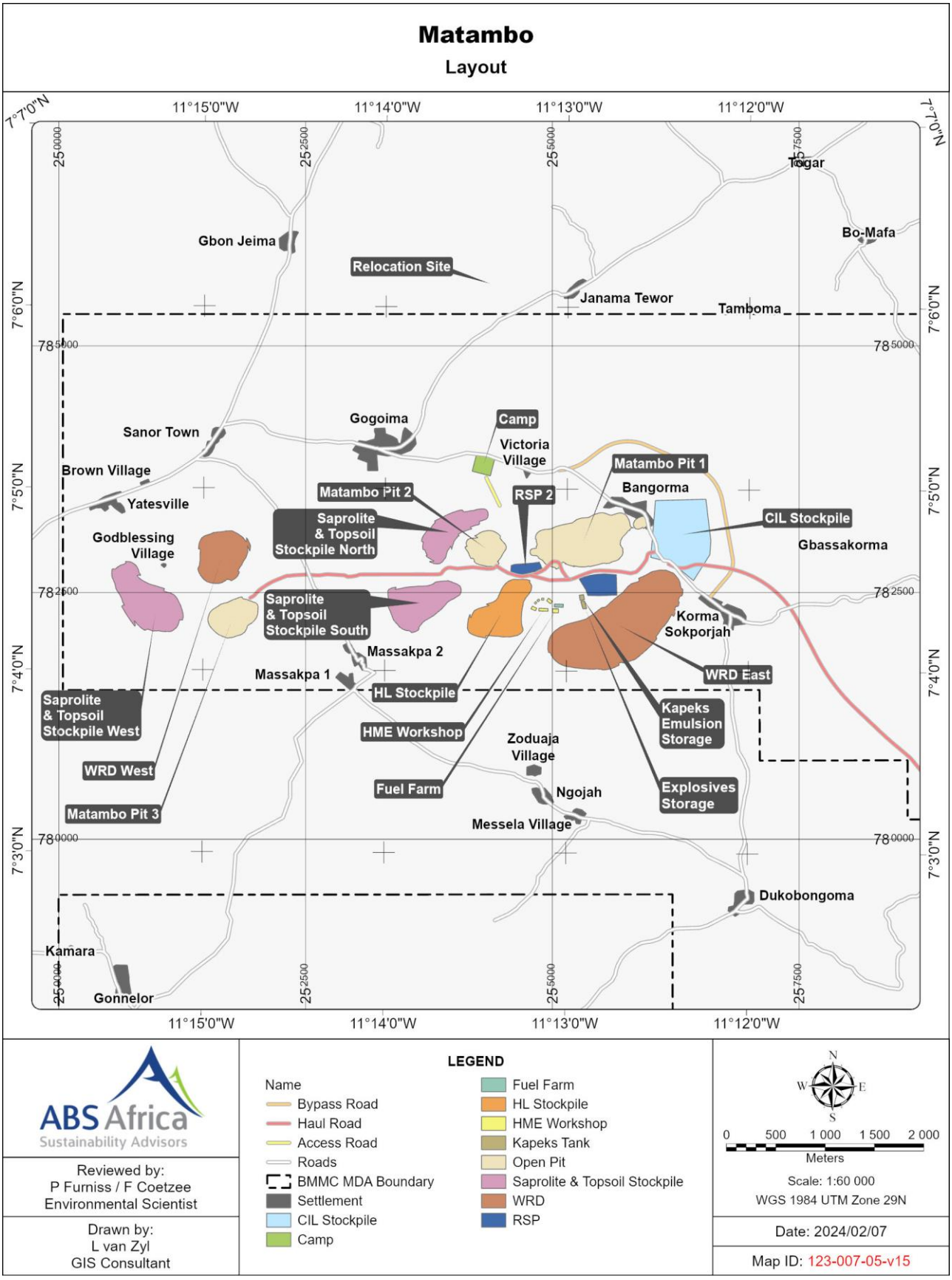


FIGURE 12-2: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION OPTION 2

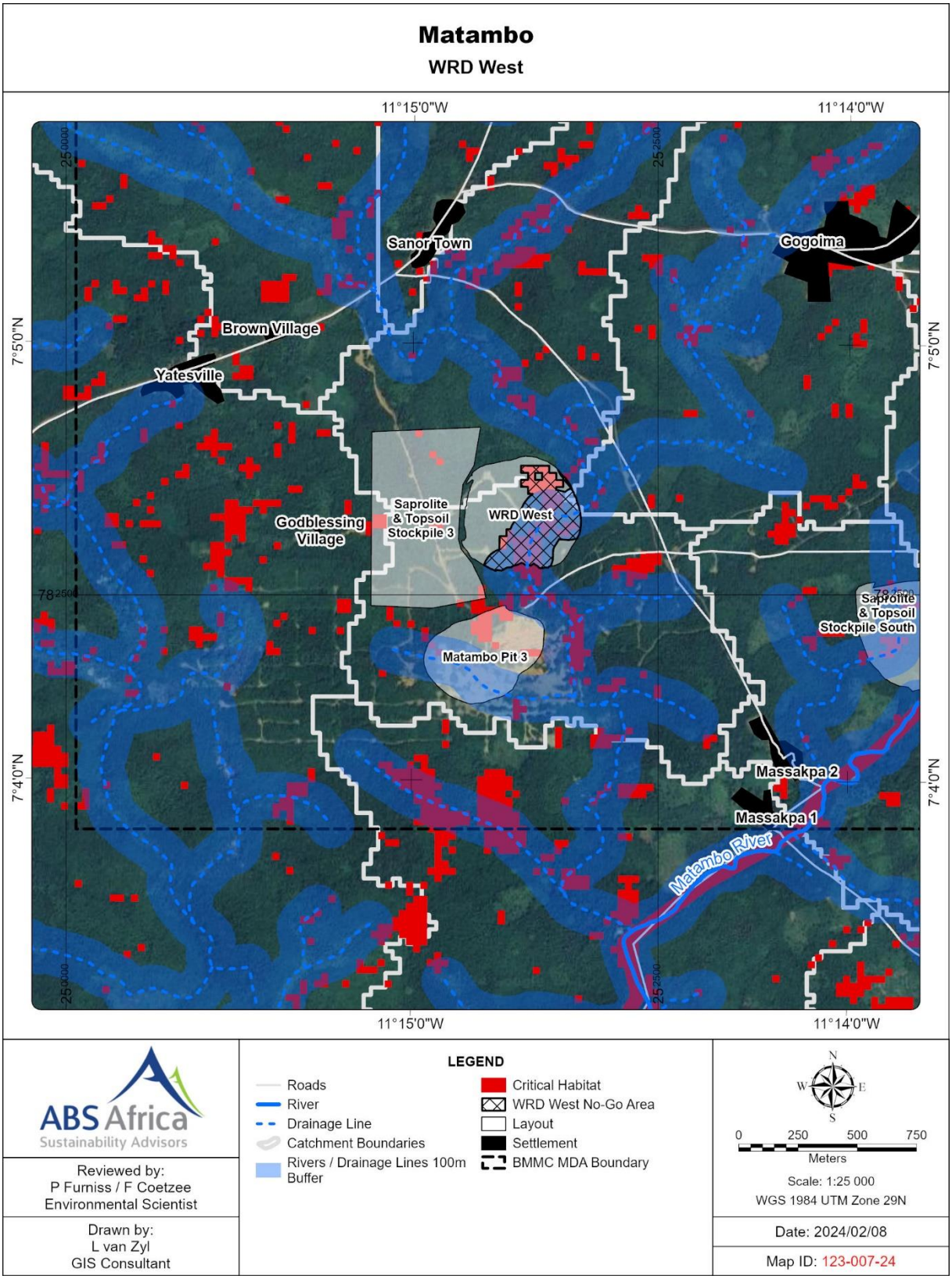


FIGURE 12-3: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION COMPARED TO MAJOR WATER COURSES OPTION 1

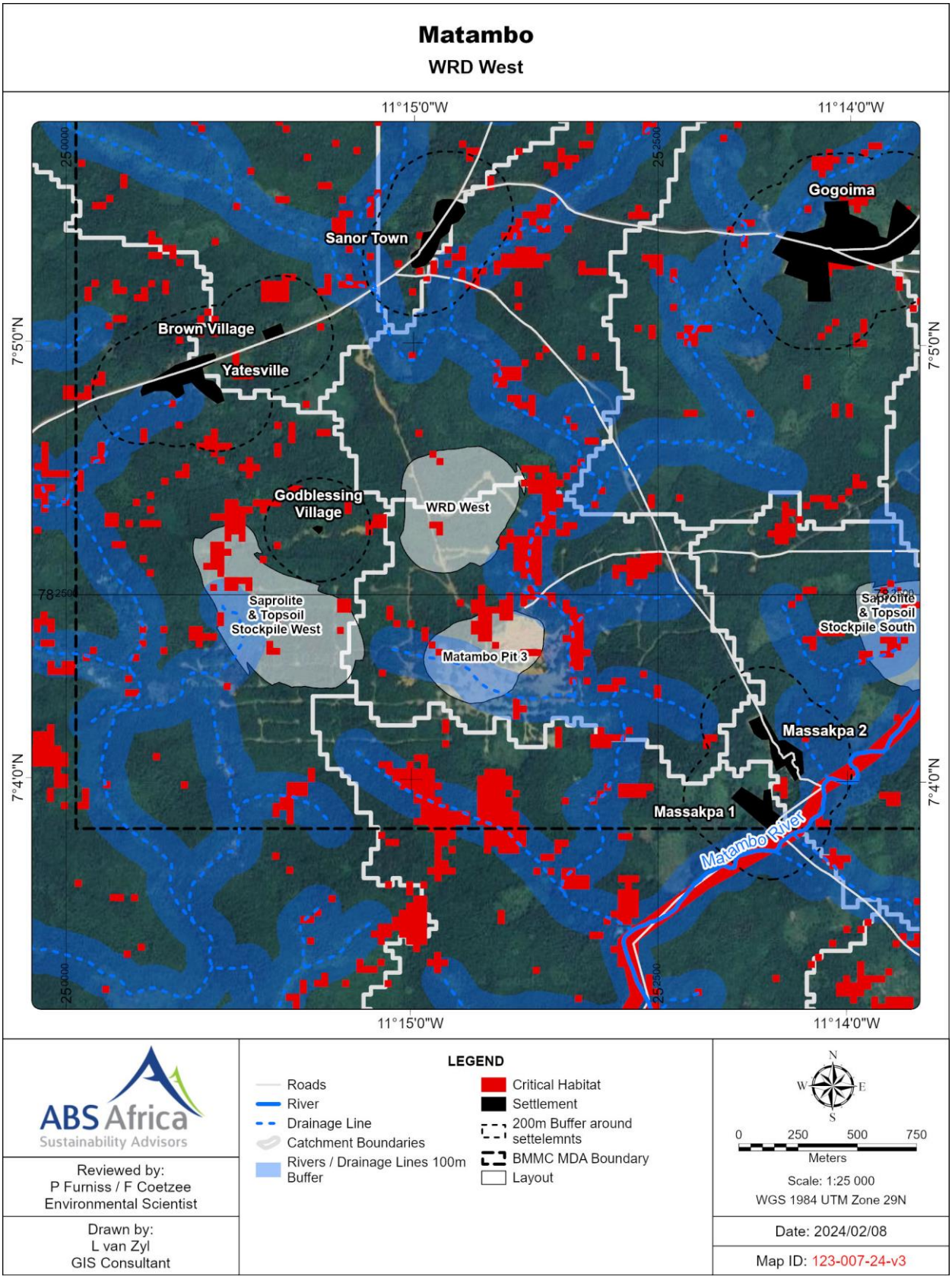


FIGURE 12-4: WRD AND SAPROLITE STOCKPILE AT PIT 3 LOCATION COMPARED TO MAJOR WATER COURSES OPTION 2

12.3 RAW WATER SUPPLY ALTERNATIVES

Potable water will be supplied to Matambo via the existing treatment and bottling facility at NLGM. No bulk water infrastructure will be established.

Non-potable water requirements for the mining, workshop and other activities will be provided through two boreholes, one at the camp area and one at the workshop area.

Storm water in general will be channelled away from the infrastructure site by means of diversion berms and drains, to avoid contamination. Run-off water from the stores and storage areas around the site, that cannot be redirected is classified as dirty water and will drain into a sump for collection in the wastewater treatment plant.

A wastewater treatment plant (package plant) will be established at the camp area for the treatment of sewage. No bulk wastewater infrastructure will be established. French drains will be established at the camp and workshop areas. These will be emptied by a wastewater truck on a regular basis and the effluent taken to the package plant at the camp area for treatment. Treated water from the package plant will be discharged.

12.4 SOLID WASTE DISPOSAL ALTERNATIVES

Various types of solid waste will be generated by the Project activities. A summary description of these types is provided in the Project Description section of the ESIA.

For all non-mineral solid waste, the following waste disposal alternatives have been considered:

- Offsite disposal at an EPA-registered local or regional waste disposal facility;
- Onsite disposal. This option implies the disposal of solid waste at a facility on the Project site. The facility may be an incinerator and/or a new waste disposal (landfill) facility.
- Transportation and disposal of waste at the existing facilities currently established and operated at NLGM.

There are no EPA-registered or approved waste disposal facilities in the region. Waste at NLGM and other mining sites within the BMMC-MDA is thus managed through landfill disposal. Using the existing waste disposal site at NLGM is not practicable as this site is more than 10 km from Matambo. A new waste disposal site will thus need to be established at Matambo.

12.5 MINE HAUL ROAD ALTERNATIVES

As part of the initial alignment of the haul road, a least cost model was developed and the route aligned taking into consideration biodiversity, social infrastructure, sensitive receptors as well as agricultural resources.

12.6 ENERGY SUPPLY OPTIONS

During the construction and operation phase energy will be needed and required demand will be supplied by surface substations that will be installed.

The following options were considered for the power requirements:

- Electricity from the national electricity network (grid power);
- Liquid fuel (diesel) generators;
- Liquid fuel (Heavy Fuel Oil (HFO) generators
- Renewable energy; and
- Combination of the above.

Grid power would be the preferred option for the supply of power to the site as it limits the amount of fuel required to be stored on site. However, the remoteness of the site prohibits a grid power connection.

Other power supply options including co-generation, renewable energy generation options, and natural gas are not considered to be feasible as they are either not technically suitable, economically viable, or available in the region.

Therefore, as with NLGM, power will be provided through generator sets and the power will be distributed via overhead powerlines to the offices and buildings.

CHAPTER 13
STAKEHOLDER ENGAGEMENT

TABLE OF CONTENTS

13 STAKEHOLDER ENGAGEMENT 13-2

13.1 PROJECT LOCATION 13-2
13.2 STAKEHOLDERS IDENTIFICATION 13-2
13.2.1 Consultation Strategy 13-2
13.3 GRIEVANCE MANAGEMENT SYSTEM 13-5
13.3.1 ESIA Process 13-5
13.3.2 Post-ESIA Process 13-5
13.3.3 Consultation Findings 13-5
13.3.4 Consultation and Participation During Project Implementation 13-7
13.3.5 Disclosure of ESIA 13-7

LIST OF TABLES

TABLE 13-1: SUMMARY OF VARIOUS LEVELS OF STAKEHOLDER ENGAGEMENT 13-4
TABLE 13-2: NON - LOCAL STAKEHOLDERS 13-4
TABLE 13-3: SUMMARY OF COMMUNITY THEMATIC ISSUES / CONCERNS 13-5
TABLE 13-4: SUMMARY OF STUDY-AREA STAKEHOLDER CONCERNS AND CORRESPONDINGS 13-6

LIST OF APPENDICES

APPENDIX 13-1: MATAMBO STAKEHOLDER ENGAGEMENT PLAN (PETRA, 2024) 13-9
APPENDIX 13-2: MATAMBO ESIA COMMUNITY CONCERNS_ROUND1 13-10

13 STAKEHOLDER ENGAGEMENT

Stakeholder engagement was conducted to support the wider environmental and social impact assessment (ESIA) in keeping with both national and international guidelines and regulations. The Social Impact Assessment (SIA) and stakeholder engagement was undertaken by Petra Resources Inc. (Petra) in 2023 and 2024 (APPENDIX 10-2 and APPENDIX 13-1).

A summary of the consultation exercise is provided in this chapter of the ESIA Report.

13.1 PROJECT LOCATION

The Matambo Resource is situated in the north-west of the MDA area. The area is surrounded by nine (9) active communities, which are:

- Bangorma;
- Gogoima;
- Kumah Sorkporjah;
- Saanor;
- Yattesville;
- Brown Village;
- God Blessing Village;
- Massakpa_01; and
- Massakpa_02

13.2 STAKEHOLDERS IDENTIFICATION

13.2.1 CONSULTATION STRATEGY

The Stakeholder's Engagement Plan (SEP) for this project is aligned with international guidelines including the International Finance Corporation Performance Standards (IFC_PS); and the national statues and guidelines including the Revised 2021 Environmental and Social Impact Assessment Guidelines issued by the EPA. The SEP will be regularly monitored, reviewed, and updated by PRI / BMMC throughout all stages of Project implementation. The SEP is guided by fundamental principles including:

- Purposeful
- Inclusive
- Timely
- Respectful
- Transparent

A Project Brief and Notice of Intent were submitted on 15 November 2023 to the EPA in keeping with the Environmental Management Laws of Liberia and the 2022 Revised Environmental and Social Impact Assessment Guidelines. A revised Project Brief was re-submitted to regulators on 12 December 2023.

The social engagement covered 13 communities – these communities had direct engagement with the project activities, including prior notifications, focus group discussions, project information document, grievance boxes; and consultations and engagement meetings. However, based on the mine design, only nine communities were considered for the social impact baseline studies and impact analysis.

The nine communities were combined into four (4) cluster groups for the consultations:

- Cluster 1:

- Bangorma; and
- Gogoima.

➲ Cluster 2:

- Kumah Sorkporjah.

➲ Cluster 3:

- Saanor;
- Yattesville; and
- Brown Village.

➲ Cluster 4:

- Massakpa_01;
- Massakpa_02; and
- God Blessing Village.

Consultations with project affected communities are intended to disclose project information, findings of environmental and social studies to notify communities of potential positive and negative impacts, note apprehensions based on disclosed impacts, present proposed mitigation measures for identified impacts and obtain alignment and agreement for the proposed project to proceed.

To maintain opportunities for continued project-related contact, at the launch of the ESIA exercise in November 2023, suggestion boxes were stationed in 5 – locations within the study area and residents informed of their purpose and use during prior notice engagements. The study team also provided a summary of the project scope and design via a Project Information Document (PID) during the first episode of ESIA engagement in November 2023. This PID also included methods to provide comments and feedback to the project through the independent consultants via telephone, email address and physical office location.

A chronological summary of formal stakeholder engagements related to this ESIA exercise is outlined below:

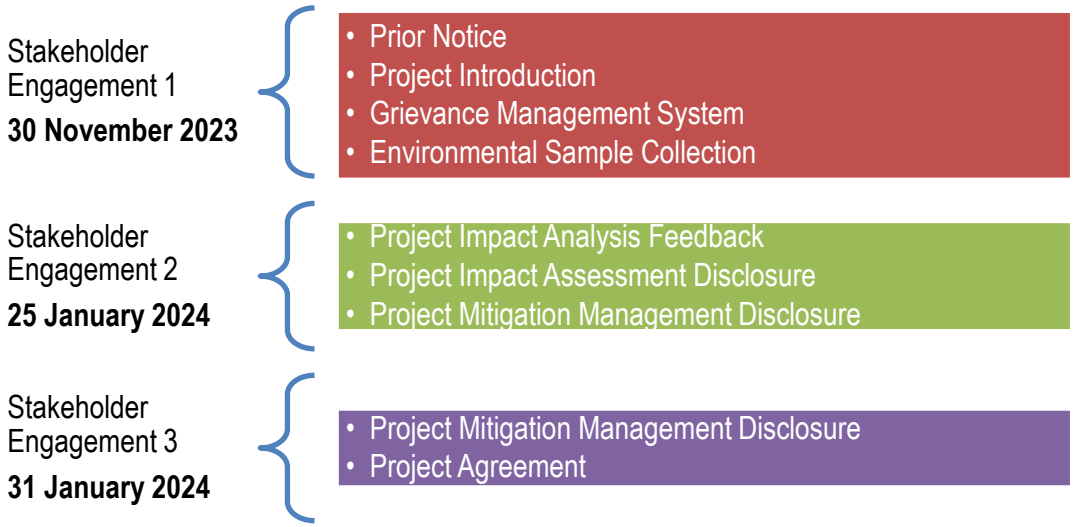


FIGURE 13-1: TIMELINE OF STAKEHOLDER ENGAGEMENT

The process was to ensure that as many as stakeholders as possible across the project landscape could be engaged at multiple levels. Engaging stakeholders involved capturing their interests, concerns as well as support for the project implementation including managing expectations at all levels.

TABLE 13-1 lists the stakeholders at the local level, including the mode of engagement and consultations undertaken and TABLE 13-2 lists the non – local stakeholders, as well as the mode of consultations and engagement.

TABLE 13-1: SUMMARY OF VARIOUS LEVELS OF STAKEHOLDER ENGAGEMENT

Community Name	Engagement Mode					
	Prior Notice	Project Information	Direct Engagement / Consultation	Focus Group Discussion	Suggestion / Grievance Box	Impact Assessment
Bangorma[1]	☒	☒	☒	☐	☒	☒
Kumah_Sorkporjah[2]	☒	☒	☒	☒	☒	☒
Gogoima	☒	☒	☒	☒	☒	☒
Victoria Village	☒	☒	☐	☐	☐	☒
Yattesville	☒	☒	☒	☐	☒	☐
Saanor Village	☒	☒	☒	☐	☐	☐
Brown Village	☒	☒	☒	☐	☐	☒
God Blessing Village	☒	☒	☐	☐	☐	☒
Massapkpa_01[3]	☒	☒	☐	☒	☐	☒
Massakpa_02[4]	☒	☒	☐	☒	☒	☒

TABLE 13-2: NON - LOCAL STAKEHOLDERS

STAKEHOLDER CATEGORY	DESCRIPTION	INCORPORATED MODE / ENGAGEMENT
Political Leadership	Senators – Grand Cape Mount County Superintendent – Grand Cape Mount County Representative District #03 (Tewor District)	Submission of information package containing: ➲ Project Brief ➲ Project Information Document ➲ Notice of Intent
Regulatory Authorities	Environmental Protection Agency of Liberia Forestry Development Authority Ministry of Mines and Energy Ministry of Internal Affairs National Bureau of Concessions Ministry of Agriculture Liberia Land Authority National Investment Commission National Disaster Management Agency	Submission of information package containing: ➲ Project Brief ➲ Project Information Document ➲ Notice of Intent
NGOs	Conservation International Flora and Fauna International Green Advocates Society for The Conservation of Nature in Liberia	Submission of information package containing: ➲ Project Brief ➲ Project Information Document ➲ Notice of Intent
Public	ELBC – National Broadcasting Station (Monrovia, Liberia) ECOWAS Radio Station (Monrovia, West Africa) Puma FM[5] Radio Station (Tubmanburg, Bomi County) Radio Piso (Robertsport, Cape Mount County) Radio Cape Mount (Senje, Bomi County)	➲ Radio public Service Announcements for 10 business days. ➲ Newspaper ads for 10 business days

[1] FGD conducted on health and education.
[2] FGD conducted on traditional and customary practices at this community host a sacred site.
[3] FGD conducted on health and education.
[4] FGD conducted on health and education.
[5]Radio Puma FA has the widest coverage in the area.

	Daily Observer Newspaper (Monrovia) Frontpage Africa Newspaper (Monrovia)	

13.3 GRIEVANCE MANAGEMENT SYSTEM

13.3.1 ESIA PROCESS

Suggestion boxes were placed at Bangorma, Gogoima, Kumah Sorkporjah, Massakpa_02, and Saanor.

The PRI considered all comments and complaints associated with the Project during the ESIA process. The grievance mechanism was outlined to communities during the first public consultation session within the Project Area. Grievances were expressed verbally through direct interactions with the PRI team (during and after the survey), by leaving notes in designated Suggestion Boxes installed in several communities, or through delivery to the BMMC project camp.

Any person or organization could send comments and/or complaints in person, by phone or email using the contact information provided at the end of the document. All comments and complaints are responded to either verbally or in writing, in accordance with the preferred method of communication specified by the complainant, if contact details of the complainant are provided.

A grievance log of all grievances and responses to these (including those received and addressed by contractor(s)), is included in the ESIA report.

13.3.2 POST-ESIA PROCESS

The grievance management system remains in place after the ESIA process has been concluded.

All grievances will be registered by BMMC and acknowledged within 5 working days and responded to within 20 working days of receiving the grievance. Individuals who submit their comments or grievances have the right to request that their name be kept confidential.

A grievance log of all grievances (including those received and addressed by contractor(s), based on which grievance management reports will be produced, and submitted to interested stakeholders including BMMC and regulatory authorities. In cases when the complainant is not satisfied with the way his / her grievance has been addressed, they may re-submit their grievance. In responding to the unresolved grievance PRI will then invite representatives of the relevant local community to participate in the process so that a mutually agreed solution is identified and implemented.

13.3.3 CONSULTATION FINDINGS

Two rounds of impact disclosure and feedback consultations were conducted in the project area between 25 January – 1 February 2024. A total of 9 communities totalling 297 individuals participated in the engagements and discussions. During the engagements the project design, impacts from specialists' studies were presented to the participants.

TABLE 13-3: SUMMARY OF COMMUNITY THEMATIC ISSUES / CONCERNS

WATER POLLUTION	EMPLOYMENT	COMPENSA-TION	ASM BENEFITS	ROAD REHABILITATIO N	HEALTHCARE ACCESS	SOCIAL COHESIO N	AIR QUALITY	NOISE AND VIBRATION	SCHOO L	SANITATION
6	3	3	4	3	2	2	1	1	3	2

13.3.3.1 Consultation Rounds summary

Key concerns documented during the engagement centred around the following topics. As all consultations were attended by community team representatives from BMMC, clarification and feedback to stakeholders was offered by both Petra and BMMC teams where necessary. Responses to various specific points of concern were captured (APPENDIX 13-2).

- **Livelihood and economic change:** Some stakeholders raised concerns regarding:

- Threats to aquatic species for fishing communities;
- Longer travelling distance and incurrence of high transportation costs for social services;
- Safety of pedestrians [mine vehicles / human] interactions within increase traffic in project area;
- Alternative income-generation and livelihood for residents and reduction in the traditional way of livelihood (ASM activities/subsistence farming);
- Jobs and business opportunities for the locals;
- Positive spillover effects, e.g. demand for food, housing, etc. from project actives; and
- Improvement to household income and disposable income.

➲ **Environmental Change:** Stakeholders are concerned that the project would lead to:

- Loss of wildlife and hunting;
- Decline in marine resources;
- Changes in watercourse of major rivers – Matambo and Mafa rivers;
- Reduced water quality (discharges from mining operations);
- Impact to air quality from dust; and
- Loss of tranquility due to increase in noise levels.

➲ **Health and Safety:** Stakeholders raised concerns about the potential of Noise and air pollution as well as crime and personal safety**.**

➲ **Demographic change:** Stakeholders raised concerns regarding the impact of the inflow of foreign workers and the inflow of non – local workers.

➲ **Culture and Heritage:** Stakeholders raised concerns regarding the potential of the project leading to trespassing in cultural heritage and sacred customary land areas and the chance finds management and practices.

➲ **Land use:** Some stakeholders are concerned about competing land use management and the further clearing of forested lands for development.

All expressed queries and concerns were documented and presented to BMMC who in some cases provided clarity on the scale and extent of the mitigation measures or took the concerns back to their management for improvement or modification where necessary.

During the engagements a total of 97 concerns were raised and responded to directly by BMMC representative. Thematic concerns raised and addressed can be seen in TABLE 13-4.

TABLE 13-4: SUMMARY OF STUDY-AREA STAKEHOLDER CONCERNS AND CORRESPONDINGS

THEMATIC AREA / CONCERN	BMMC'S RESPONSE
When mining activities are completed, will communities have access to the mine area to be able to use the land for farming purposes?	The rehabilitation plan for the project area is based on returning most of the mine development area to productive agriculture use [grazing and/or cultivation]. Certain areas, namely the pits and WRD, will however be permanent and farming at these locations may not be possible.
How many pits will there be in the project area?	Based on the current project design, it is expected that the project will have 3 pits.
After decommissioning, will communities be able to work in the pit area? Will the operations of the pit impact communities?	The pits are expected to be flooded post – mining. Several studies including air quality, water, noise, and blasting have been completed to determine the impact of mining on surrounding communities. These studies have indicated that

	with the mitigation measures implemented, the pit activities are unlikely to affect the communities.
Bangorma is the center point for most of our social activities and services including the clinic; now relocating Bangorma will impact other residents?	For health care, BMMC has informed and is engaging directly with the MoH for the relocation of the clinic to the New Bangorma community; to help fill the gap; BMMC is equally engaging with MoH to have a health post in Kumah Sorkporjah to provide emergency services so that communities in the south will still have access to health care.
Will blasting, noise and vibration especially in Pit_01 impact residents of Kumah Sorkporjah?	Blasting can affect water quality, noise, vibration and has risks from fly rock. These impacts were investigated by a specialist and the study concluded that with the blasting mitigation measures implemented, there is expected to be a very low impact from blasting at Pit_01.
Will the company minimize dust pollution?	The frequency of dust suppression on roads near communities will be increased to reduce dust levels especially in the dry season.
Augustine and Kuteh Villages were included in the Household Survey; and since then, no further engagement with these communities.	Following the mine design, it was indicated that Augustine and Kuteh Villages were outside of the direct impact zone; however, these communities are still in the project zone of influence; and as such engagements will always be ongoing.
The youths are not satisfied with the hiring process.	BMMC has encouraged the communities to ensure equal and fair distribution of jobs, especially amongst the youths and women demographics within the project area.
It is understood that ASM in Bangorma have been compensated what is the plan for miners in Kumah Sorkporjah?	BMMC has compensated license holders and not individual members working in the ASM sector; if you're in Kumah Sorkporjah and owns a license area that was impacted by the construction activities; you also would be compensated.
BMMC has stopped rehabilitation the road since the construction of the haul road.	BMMC is currently in pre – construction activities and thus utilizing all its equipment and resources towards this purpose. After mining stats some equipment will be available to help support maintenance works.
Community members are asking BMMC to give support to people that are involved in agriculture / farming	BMMC has brought in agri – technicians to begin working with those in farming to improve crop production as well as marketing and finance.
How will communities get safe drinking water?	BMMC shall pay into the Matambo Corridor Development Fund and the Community Development Fund in the MDA to help address some of these social issues.
Why should residents of Tewor District go to Gola Konneh for training?	BMMC has set up a training resource center in Kinjor; BMMC encourages communities across its MDA area that are interested in TVET programs to attend the institution; as BMMC does not have the resources to set up an institution in each and every district across the MDA area.

13.3.4 CONSULTATION AND PARTICIPATION DURING PROJECT IMPLEMENTATION

The project will continue to implement a robust consultation strategy throughout the project lifecycle. A thorough consultation strategy promotes environmental and social sustainability and enhances its acceptance and aids in the design and smooth implementation of the project.

13.3.5 DISCLOSURE OF ESIA

Relevant information about environmental and social risks and impacts of the project was made available in the Project area in a timely and accessible manner. It was in a form and language(s) that is understandable to the people affected by the project, other stakeholders, and the public. This allow all the ability to provide meaningful inputs into the design and implementation of the project.

The ESIA study team agreed to the following:

- Make available the Draft ESIA, ESMPs, mine designs / plans, or other approved forms of documentation; and
- Other documents described above as soon as they become available. The ESIA study team also agreed to disclose any material changes to the disclosed environmental and social information for the project as soon as they become available.
- To further enhance access to the environmental and social information related to the Projects, in addition to the disclosure of such information by the Project team, the contact information related to the study team, as well as the project owners are presented in this document.
- The mitigation measures to offset the adverse social impacts will also be disclosed to the affected persons.
- To ensure inclusivity meaningful consultations during and after the studies, lined ministries / agencies will be invited to public consultations with project communities for enabling their participation in preparing, implementing, and monitoring of the project.

APPENDIX 13-1: MATAMBO STAKEHOLDER ENGAGEMENT PLAN (PETRA, 2024)



Proposed Matambo Open Pit Gold Mine

PETRA RESOURCES
INCORPORATED –

STAKEHOLDERS ENGAGEMENT AND CONSULTATIONS PLAN

TEWOR DISTRICT, GRAND CAPE MOUNT COUNTY, LIBERIA

NOVEMBER 2023 – FEBRUARY 2024

Contents

1.0 INTRODUCTION 3

2.0 STAKEHOLDERS ENGAGEMENT ACTIVITIES 3

2.1 Stakeholders Identification and Analysis ..... **Error! Bookmark not defined.**

2.2 Disclosure of Information and Stakeholders Engagement 4

2.3 Grievance Redress Management 4

3.0 CONTACT DETAILS FOR PUBLIC CONSULTATIONS AND DISCLOSURE 7

3.1 Engagement Schedule 7

Appendix A 8

Grievance Sample Form 8

1.0 INTRODUCTION

To support the planned and ongoing development of the Matambo Open Pit Project, effective stakeholder engagement is needed to avoid and minimize the social risks of the proposed project and to ensure that the Project has a long-term social license to operate.

This document is a Stakeholder Engagement Plan (**SEP**) describing the planned stakeholder consultation and engagement process for the Project. It outlines a detailed and systematic approach to stakeholder engagement that will help BMMC develop and maintain over time, a constructive relationship with their stakeholders throughout the duration of the Project.

The document also includes a grievance mechanism for stakeholders to raise their concerns about the Project. The SEP has been produced in accordance with the international best practice and was guided by the International Finance Corporation (**IFC**), and national practices of the Environmental Protection Agency (EPA) revised ESIA Procedural Guidelines (2021). The SEP will be regularly monitored, reviewed, and updated by PRI / BMMC throughout all stages of Project implementation.

2.0 STAKEHOLDER ENGAGEMENT

2.1 Stakeholders Identification and Analysis

PRI identified stakeholder groups that may be affected by and/or interested in the implementation of the Project, and cascaded communication methods and media for each group. This approach included face-to-face engagement, verbal explanations with support from translators, receiving documented project notice information, and detailed proposed plans.

The below points reflect the criteria used to guide stakeholder identification.

- Communities within 500m^2 of the proposed project boundary [ESIA study area].
- Communities to a maximum extent of 2500m^2 of the proposed project area; [considered the maximum extent of local area];
- Statutory local authorities and leadership (both appointed and elected), including customary and traditional leadership, women, elders, and youth community leaders.
- Statutory and regulatory authorities.
- Private sector and other interested parties including non-governmental organizations.

These stakeholders and their varying levels of interests in and authority over the proposed project required that they need to be presented with varying amounts of information over a series of engagements.

2.2 Disclosure of Information and Stakeholders Engagement

The Environmental Impact Statement (**EIS**) and SEP is being submitted as part of the ESIA report. A high-level summary of findings of the ESIA are expected to be published in picture / billboard format in the project communities through BMMC routine, ongoing project-wide community and stakeholder engagement. These summaries will also be communicated to the local communities through town hall meetings in English, and where necessary a local translator would be used, so that project information is totally understood.

PRI, with the assistance of local authorities and local community representatives, will ensure that the local population, particularly residents and businesses living or operating in the vicinity of the Project or using resources which may be affected, are informed about the project. This particularly pertains to the commencement of construction activities and expected impacts.

The ESIA report will be developed and an Environmental and Social Impact Statement submitted based on findings of field data analysis. A robust public consultation process as defined by national and international statues shall guide the information disclosure processes. All meetings, presentations, reports, and findings shall be summarized and communicated to stakeholders throughout the project.

The topics to cover during the public consultations will include evaluation of crop and other damages, mechanism for making claims and receiving payment, any land use restrictions as well as expected difficulties in accessing land plots during the Project construction and operations. BMMC will develop annual environmental and social reports which will describe Project impacts, mitigation and enhancement activities undertaken, and a summary of processed external grievances. These reports will be submitted to regulators and will be provided to all interested stakeholders.

2.3 Grievance Redress Management

PRI will receive and consider all comments and complaints associated with the Project during the ESIA process. The grievance mechanism will be outlined to communities during the first public consultation session within the Project Area. Grievances can be expressed verbally through direct interactions with the PRI team (during and after the survey), leaving notes in designated Suggestion Boxes to be installed in several communities, or through delivery to the BMMC project camp.

A sample of the Project Public Grievance Form is provided at the end of this document (Appendix A). Any person or organization may send comments and/or complaints in person, by phone or email using the contact information provided at the end of the document. All comments and complaints will be responded to either verbally or in writing, in accordance with the preferred method of communication specified by the complainant, if contact details of the complainant are provided.

All grievances will be registered and acknowledged within 5 working days and responded to within 20 working days of receiving the grievance. Individuals who submit their comments or grievances have the right to request that their name be kept confidential. PRI will monitor the way in which grievances are being handled by the BMMC and ensure they are properly addressed within deadlines specified above.

PRI will keep a grievance log of all grievances (including those received and addressed by contractor(s), based on which grievance management reports will be produced and included in the ESIA report, and submitted to interested stakeholders including BMMC and regulatory authorities. In cases when the complainant is not satisfied with the way his / her grievance has been addressed, they may re-submit their grievance. In responding to the unresolved grievance PRI will then invite representatives of the relevant local community to participate in the process so that a mutually agreed solution is identified and implemented.

At all times, complainants are also able to seek legal remedies in accordance with the laws and regulations of the Republic of Liberia. A separate, internal grievance mechanism shall be available for BMMC employees and will also be made available for contracted workers once they begin working.

2.4 Stakeholder Engagement Activities as Implemented

Prior to the launch of the Matambo Open Pit ESIA exercise in mid-November 2023 several early stakeholder engagements relating to the project had already occurred between BMMC and several national regulators. In November 2023, the regulatory authorities including the Ministry of Mines and Energy (MME), and the Environmental Project Agency of Liberia (EPA) were notified about the project. With EPA documented guidance from August 2023 outlining the need for an ESIA, a Project Brief and Notice of Intent were submitted on 15 November 2023 to formally announce the launch of the studies and broader ESIA undertaking. A revised Project Brief was re-submitted to regulators on 12 December 2023.

Following these regulatory and community notifications about the Project, a socio – economic baseline mapping was conducted in the project area. The goal of this exercise was to document socio – economic points of interests, including shared community infrastructures, as well as getting an understanding of the type and kind of social services available and delivered within the project study area. The survey also sought to understand and document the general cultural, traditional, and customary practices of the residents in the area. The baseline mapping exercise was another opportunity to engage residents directly during the data collection to update them about ongoing proposed project plans and continue to obtain input and concerns regarding the project.

This survey allowed the study team to organize and plan a more detailed engagement exercise throughout the project area. With this background, communities with similar interests, cultural alignment and socio-economic structure were

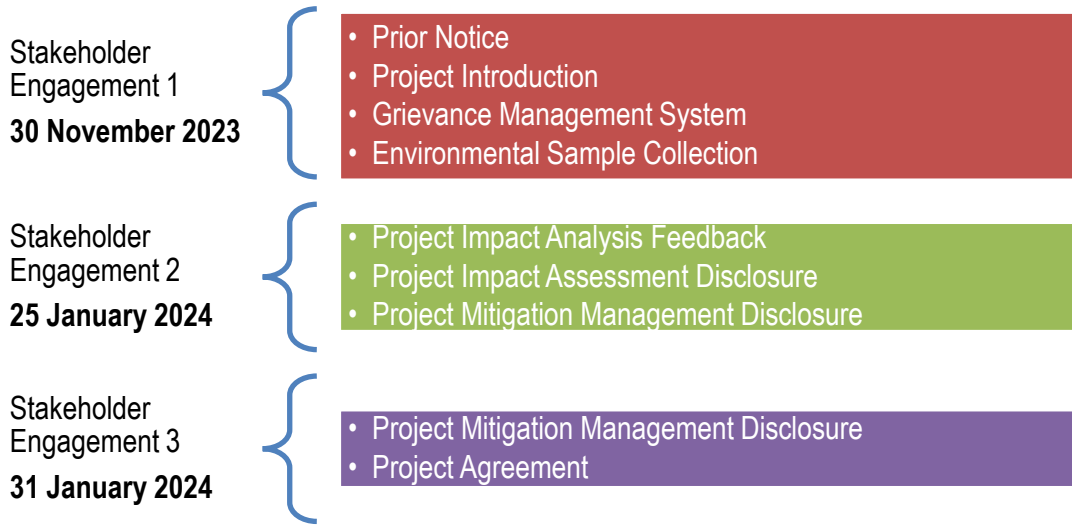
clustered into a single group for direct engagement and consultations. Four [4] cluster groups were identified for the consultations.

- **Cluster 1:**
  - Bangorma
  - Gogoima
- **Cluster 2:**
  - Kumah Sorkporjah
- **Cluster 3:**
  - Saanor
  - Yattesville
  - Brown Village, and
  - God Blessing Village
- **Cluster 4:**
  - Massakpa_01
  - Massakpa_02

Three rounds of community feedback consultations were scheduled for this ESIA exercise, however due to expedited timelines, two rounds of engagement and consultations were held. Consultations with project affected communities are intended to disclose findings of environmental and social studies to notify communities of potential positive and negative impacts, note apprehensions based on disclosed impacts, present proposed mitigation measures for identified impacts and obtain alignment and agreement for the proposed project to proceed.

To maintain opportunities for continued project-related contact, at the launch of the ESIA exercise in November 2023, suggestion boxes were stationed in 5 – locations within the study area and residents informed of their purpose and use during prior notice engagements. The study team also provided a summary of the project scope and design via documentation [Project Information Document] during this first episode of ESIA engagement in November 2023. This PID also included modes and methods to provide comments and feedback to the project through the independent consultants via telephone, email address and physical office location.

A chronological summary of formal stakeholder engagements related to this ESIA exercise is outlined below:



3.0 CONTACT DETAILS FOR PUBLIC CONSULTATIONS AND DISCLOSURE

Telephone / Text	**+231.778.616.555 OR +231.881.616.555**
Email	Info@petraliberia.com
Direct	During consultation sessions in the field
Suggestion Boxes	▪ Bangorma ▪ Gogoima ▪ Kumah Sorkporjah ▪ Massakpa_02 ▪ Saanor

3.1 Impact Disclosure and Feedback Engagement Schedule

Cluster	Dates
Cluster_01	▪ January 25th, 2024 ▪ January 31st, 2024
Cluster_02	▪ January 25th, 2024 ▪ January 31st, 2024
Cluster_03	▪ January 27th, 2024 ▪ February 1st, 2024
Cluster_04	▪ January 27th, 2024 ▪ February 1st, 2024

Appendix A

Grievance Sample Form

Town / Village Name:	Full Name:
Contact information and preferred method of communication. **Please mark how you wish to be contacted (mail, telephone, e-mail, verbal).**	☐ By mail (please provide postal address _____ _____ ☐ By Telephone ☐ By Email ☐ Verbally
Description of Grievance **What happened? Where did it happen? Who did it happen to? What is the result of the problem? Source and duration of the problem?**	
Date of Incidence / Grievance	☐ One time incident / grievance (date / time): ☐ Happened more than once (dates / times): ☐ On-going (current experiencing problem):
Incidence Thematic Area	☐ Environmental_____ ☐ Social _____ ☐ Cultural _____ ☐ Health / Safety _____
What would you like to see the problem resolved?	

Signature: _____

Date: _____

Please return this form to:

Phone Number	**+231 881.616.555 / +231.778.616.555**
Address	Ocean Ambassador Compound Adjacent Old Budget Bureau, Redemption Road, Capitol Hill, Monrovia, Liberia
e-mail	info@petraliberia.com

APPENDIX 13-2: MATAMBO ESIA COMMUNITY CONCERNS_ROUND1



Presented to:
Bea Mountain Mining Corporation

Prepared by:
Petra Resources, Inc.
Ocean View, Ambassador Compound
Redemption Road, Capitol Hill
Monrovia, Liberia
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29 January 2024

Contents

1.0 EXECUTIVE SUMMARY 3

1.1 Location and Purpose 4

1.2 The Engagement and Consultation Plan 6

1.3 Early Findings 8

2.0 Matrix of Community Questions & Concerns 10

3.0 NEXT STEPS 13

4.0 CONSULTATIONS PHOTOS 13

1.0 EXECUTIVE SUMMARY

The proposed Matambo Open Pit Gold Mine ("***Project***") is owned by Bea Mountain Mining Corporation (***BMMC***) which also currently owns and operates the New Liberty Gold Mine (***NLGM***) both situated in Grand Cape Mount. As part of the statutory requirements both international and national, stakeholders in the project area must be engaged and consulted about the potential risks and proposed mitigations, to obtain synergy across the project area landscape.

BMMC engaged the services of 3rd party independent environmental consultants to conduct an Environmental and Social Impact Assessment ("***ESIA***") of the project, so as to determine, document and propose mitigation measures for potential impacts to the environment or community as a result of the project's activities.

ABS Africa, Inc. is leading the focus on the environmental aspects related to the project, while Petra Resources, Inc. is leading the social engagement aspects of this project. Both companies are duly accredited by the Environmental Protection Agency of Liberia.

A total of 159 persons with 44 accounting for females across 8 communities were consulted from 25th – 27th January 2024. Communities were brought together in clusters for open, town-hall style consultations based on their relative proximity and relationships between their residents. The table below reflects the consultations as clustered by the respective communities.

Date	Cluster	Communities	Engagement / Type Form
26-Jan-24	One	Bangorma / Gogoima	Prior Notice / Grievance Box / Focus Group Discussion /Consultation
27-Jan-24	Two	Kumah Sopkorjah	Prior Notice / Focus Group Discussion / Grievance Box / Consultation
25-Jan-24	Three	Saanor / Yattesville / God Blessings	Prior Notice / Key Informant Interview / Consultation
25-Jan-24	Four	Massakpa_01 / Massakpa_02	Prior Notice / Grievance Box / Consultation

Table 1: Stakeholder's consultation listing

1.1 Location and Purpose

The Project is located within the Grand Cape Mount County of Liberia, situated within the greater Bea Mountain Mining Corporation Mineral Development Agreement (BMMC-MDA) property/concession area. A small portion of the greater Bea Mountain Mineral Development Agreement intersects the Gbarpolu County, but no infrastructure is planned in the Gbarpolu County for this Project. The Matambo site is host to various artisanal small-scale mining [ASM] activities located West of the Mafa River. The area is rural and remote with several villages and communities including some of the oldest villages of Bangoma, believed to be nearly 200 years old.

The area is rural and remote, with several communities and hamlets around the proposed project area. Key communities around the proposed project area include:

- Massakpa_01 and Massakpa_02
- Kumah Sorkporjah, and
- Gogoima

The town of Bangorma serves as a catchment community for most of the surrounding towns and hamlets. Bangorma provides access to the community clinic[1], the community also hosts other public services including voting registration, certification, and registration of marriage, etc. Due to the proximity to the proposed Matambo Open Pit #01; the project is in negotiation with the leadership and residents of Bangorma so that the community is relocated prior to mining. Tahn the District Capital is approximately 12.0km west of the project area. Although, it is not within the project area – its influence is significant within the project area, due to its political and cultural importance.

[1] Communities indicated during consultations that clinic was collectively constructed with contributions from 12 surround towns / hamlets/ village and they need the clinic in a more centralized location so that all would have equal access to the services as it was not designed to only serve Bangoma.

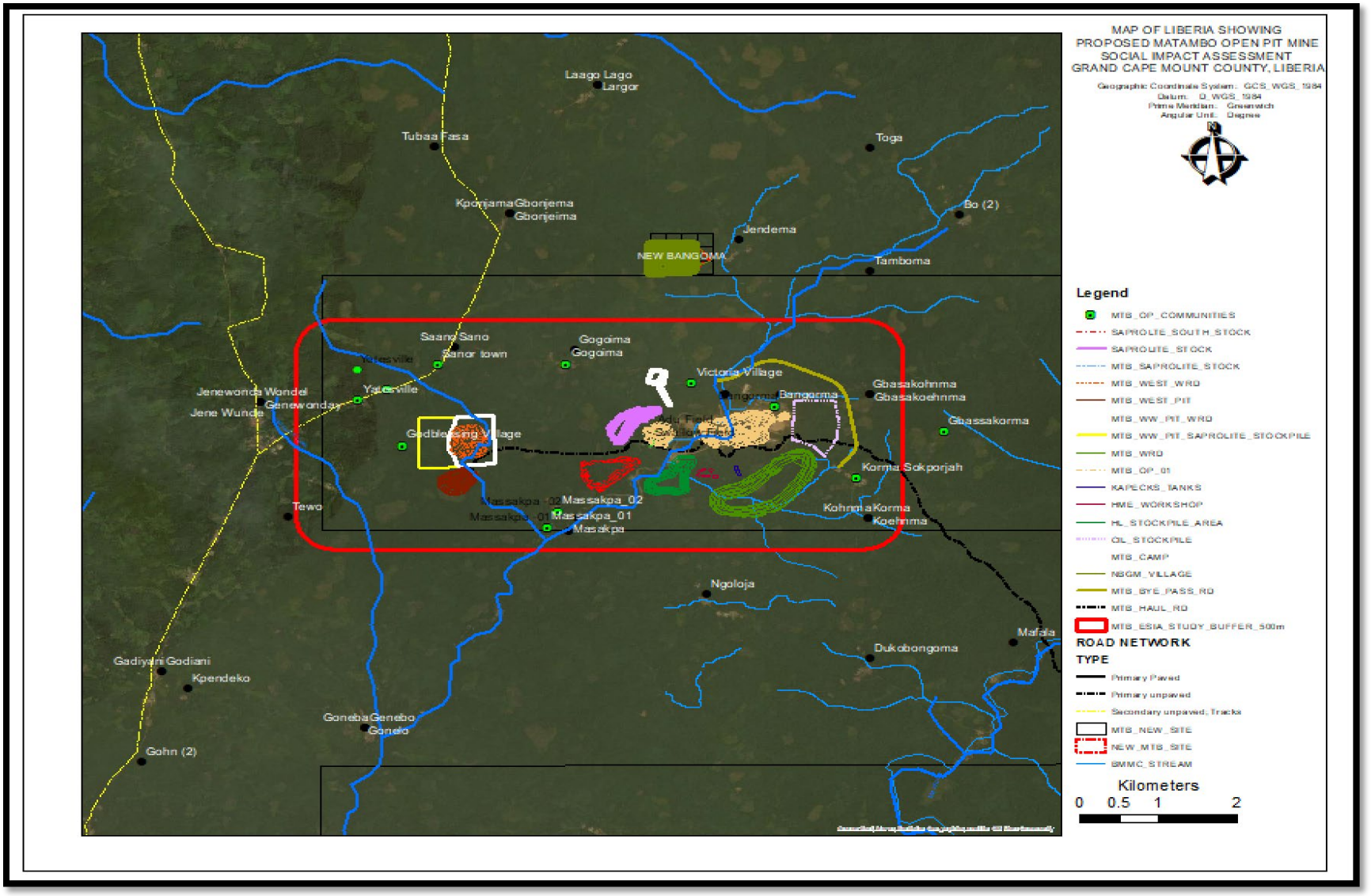


Figure 1: Map of the proposed Matambo Open Pit Mine with infrastructures and communities

1.2 The Engagement and Consultation Plan

The Stakeholder's Engagement Plan (**SEP**) for this project is aligned with international guidelines including the International Finance Corporation Performance Standards (**IFC_PS**); and the national statues and guidelines including the Revised 2021 Environmental and Social Impact Assessment Procedural Guidelines issued by the EPA. The SEP is guided by fundamental principles including:

- Purposeful
- Inclusive
- Timely
- Respectful
- Transparent

A Project Brief was submitted November 2023 to the EPA in keeping with the Environmental Management Laws of Liberia and the 2021 Revised Environmental and Social Impact Assessment Guidelines. The SEP anticipated at a minimum 3 rounds of engagements at the local level to present the potential impacts and proposed mitigation measures associated with the project.

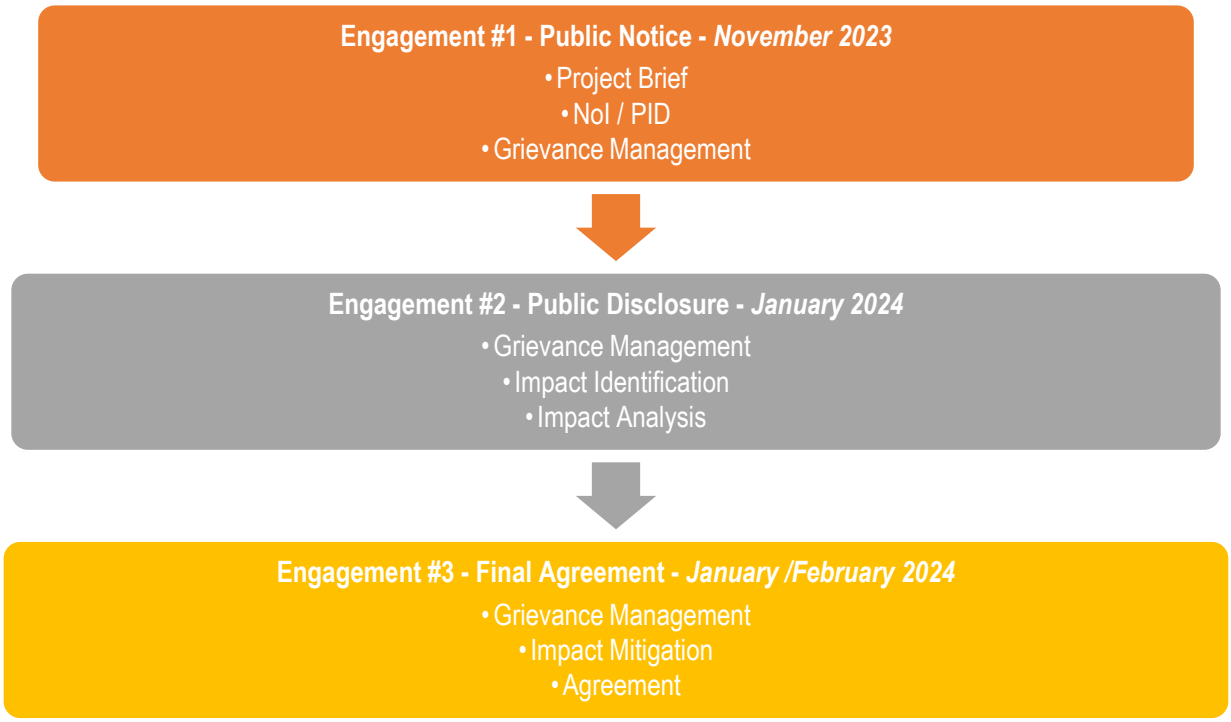


Figure 2: Consultations and engagement process

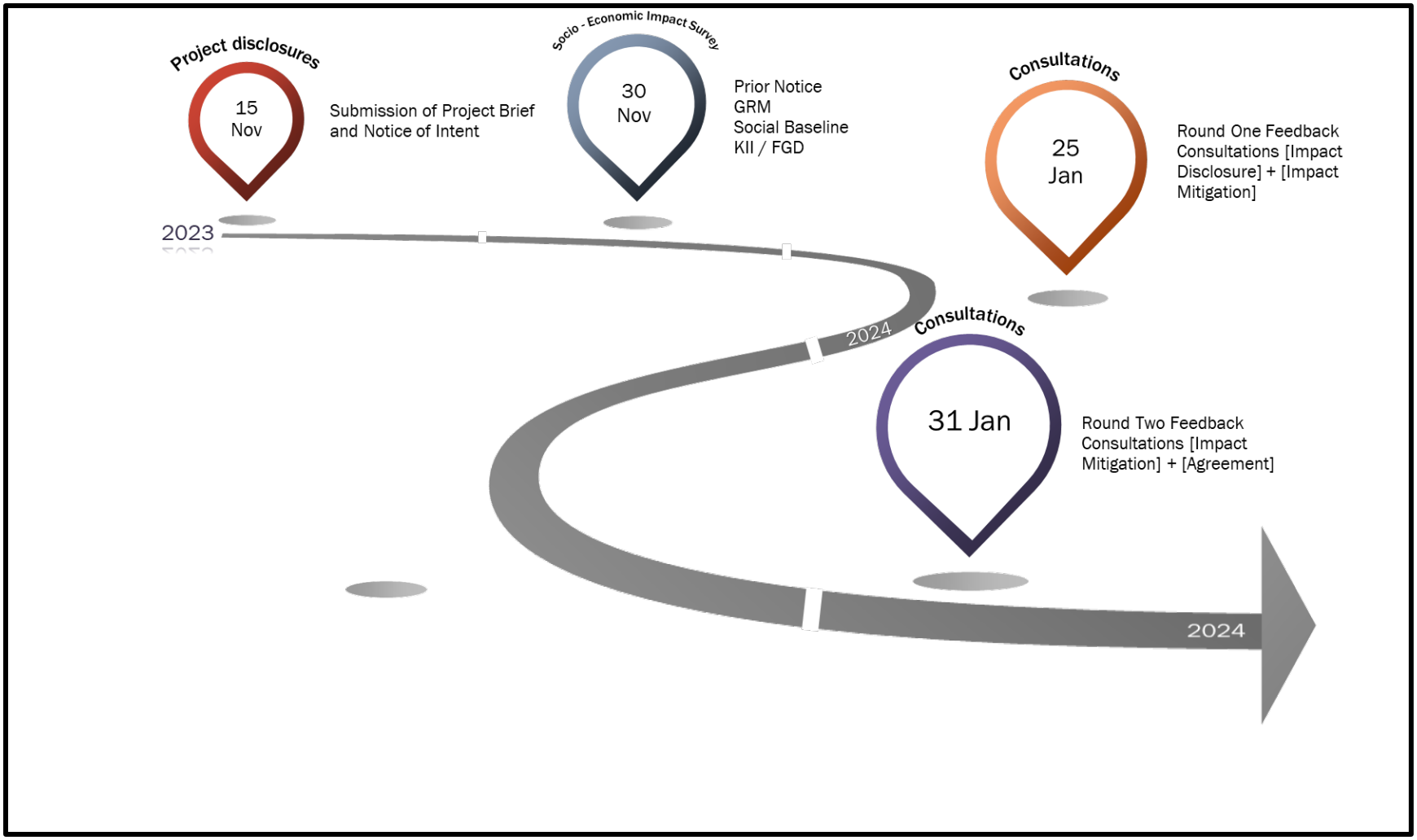


Figure 3: Engagement timeline

1.3 Early Findings

A total of 8 communities have been targeted as part of the stakeholder engagement plan. The *Prior Notice* exercise was undertaken in early December 2023 alongside kickoff of the socio-economic baseline data collection. During the Prior Notice engagements, Petra laid the foundation for the stakeholder engagement activities with communities, including communicating and initiating key components of the grievance redress mechanisms, such as installing suggestion boxes in five communities. *Key Informant Interviews (KIIs)* were also held in select communities and with key representatives of those communities; and *Focus Group Discussions (FGDs)* were also conducted in 3 of the 8 communities.

The first round of community consultations undertaken on 27 January was to disclose to these 8 communities the initial findings of the specialist studies that have been underway. These disclosure consultations also included informing the respective communities about potential impacts of the various aspects of the proposed project based on their respective unique individual and shared resources and communities as identified through the specialist impact studies. The company's proposed mitigation plans being developed in response to the identified potential environmental and social impacts were also conveyed to communities during the consultation sessions.

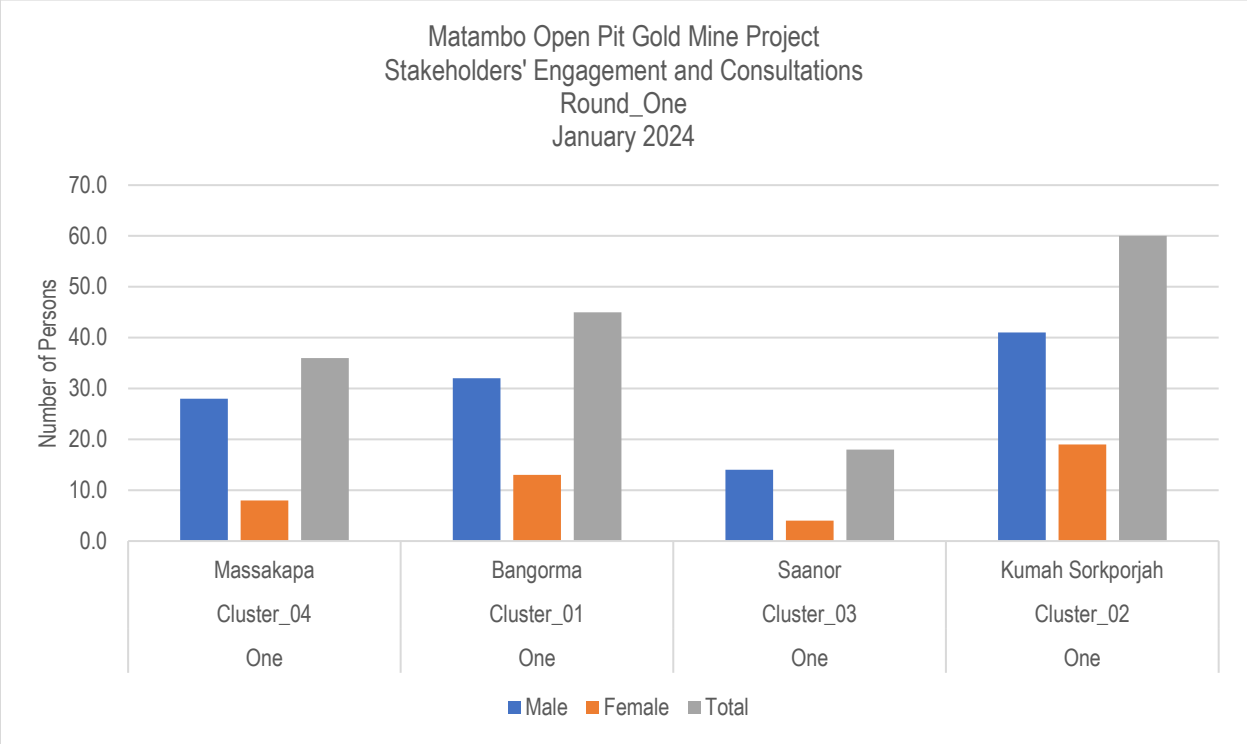


Figure 4: Statistics of stakeholders' participation in Round_01

Grievance Boxes were installed in the following five communities:

- Gogoima
- Bangorma
- Kumah Sorkporjah
- Saanoh Village, and
- Massakpa_02

During the Prior Notice engagements, all communities were informed about the workings and functions of the grievance boxes that the engagement exercises is ongoing, contact details were provided for consultants so that stakeholders having concerns, questions, or suggestions can have the opportunity to provide their input to the project.

The first round of feedback consultations in January included BMMC responses to community concerns documented through the Prior Notice engagements, suggestion box submissions, focus group discussions and data documented through the ongoing environmental and social specialist studies. Communities were also reminded that the suggestion boxes remain stationed in all 5 locations and can still receive inputs before the final alignment consultation.

Further questions and concerns raised by the 8 communities during this first round of feedback consultation have been documented and detailed below.

- ***Employment***: Residents are concerned that employment is done by quota from communities, and that some communities, especially Kumah Sorkpojah believes that quota allotted them is very low.
- ***Land use and rehabilitation*****:** Some stakeholders raised concerns about landuse and rehabilitation following the cessation of the mining operations. Stakeholders are seeking you know if the land can be reused from agricultural purposes, and if there'll be access to all parts.
- ***Water pollution / contamination*****:** Some stakeholders are concerned about the quality of domestic water in the project area – they are saying that the mining activities of the project proponent has resulted in the deterioration of the water quality.
- ***Dust, noise and vibration*****:** Stakeholders are concern that the construction activities has resulted into significant noise and dust generation that its impeding their abilities to get out and doing daily chores.
- ***ASM fields*****:** Stakeholders raised concerns that the project is removing them from their ASM fields, and no compensation; their worries is that their livelihood is been taken away with no mitigation measure.

2.0 Matrix of Community Questions & Concerns

Cluster_Name	Cluster_Number	Date	Community Concern / Issues
Kumah-Sokporjah	Two	26-Jan-24	When the company does decommissioning will we be able to use the land for farming?
Kumah-Sokporjah	Two	26-Jan-24	Where will Pit 1,2 & 3 be located? Will there be only 3 pits?
Kumah-Sokporjah	Two	26-Jan-24	After decommissioning, will we be able to go to work in the pit area?
Kumah-Sokporjah	Two	26-Jan-24	Will the operation of the pit not affect us?
Kumah-Sokporjah	Two	26-Jan-24	All of our social-economic activities are in Bangorma and now Bangorma will be located. Will it not affect us? How will we access health facility?
Kumah-Sokporjah	Two	26-Jan-24	Will the blasting at Chinese Camp (pit 1) not affect us?
Kumah-Sokporjah	Two	26-Jan-24	What will our benefits be from the company's operation?
Kumah-Sokporjah	Two	26-Jan-24	After closure, will we the pit area not affect us?
Kumah-Sokporjah	Two	26-Jan-24	Will the company minimize dust pollution?
Kumah-Sokporjah	Two	26-Jan-24	Will the waste rock dump not slide from erosion during the rainy season?
Kumah-Sokporjah	Two	26-Jan-24	The waste rock dump will be occupying our land. How will we do our farming activities?
Kumah-Sokporjah	Two	26-Jan-24	Will water from the waste rock dump not affect our water?
Kumah-Sokporjah	Two	26-Jan-24	The dust is really disturbing us. My garden near the haul road was damaged due to dust. The company spray chemical on my garden.
Kumah-Sokporjah	Two	26-Jan-24	The haul road passed through my farm. Some were paid for and some were not paid for.
Kumah-Sokporjah	Two	26-Jan-24	When will the training begin? Kumah is receiving less slot for employment. Appealing to the company to address the issue of slot distribution.

Kumah-Sokporjah	Two	26-Jan-24	Will chemicals be used during blasting? Will the chemicals affect us?
Kumah-Sokporjah	Two	26-Jan-24	The study team visited Kuteh village, but we have not heard from them since the household survey
Kumah-Sokporjah	Two	26-Jan-24	BMMC told us that we are one of the affected communities, but we are included in the Matambo corridor meeting.
Kumah-Sokporjah	Two	26-Jan-24	Augustine and Kuteh village were included in the survey, but we have not heard nothing up till now.
Kumah-Sokporjah	Two	26-Jan-24	During the operation of the 3 pits, will nothing happen to the people of Kumah?
Kumah-Sokporjah	Two	26-Jan-24	The dust is disturbing our children. We are experiencing increase in cough
Kumah-Sokporjah	Two	26-Jan-24	Prior to BMMC activities, we were using our waters for fishing, but currently there's no way to fish due to the overflow of the water. How will we manage?
Kumah-Sokporjah	Two	26-Jan-24	Youth are not satisfied about the way of hiring. If the issue is not addressed, we will protest
Kumah-Sokporjah	Two	26-Jan-24	We have common boundary with Bangorma, and we do our farming along the boundary. What if we are on our farms and blasting go on, will we not be affected?
Kumah-Sokporjah	Two	26-Jan-24	We are in Tewor district, why will the training be done in Gola Konneh district?
Kumah-Sokporjah	Two	26-Jan-24	We learned that the artisanal miners in Bangorma have been settled. What about the miners in Kumah?
Kumah-Sokporjah	Two	26-Jan-24	Plead with BMMC to give priority to the people of Kumah that are involved into agriculture for training and business.
Saanor	Three	25-Jan-24	Residents were mining on Kwakwe field for survival. Now BMMC has removed us and open a pit. How will our people hustle? We have asked BMMC to water the road passing through our town, but they have refused.
Saanor	Three	25-Jan-24	When will the skills training begin?
Saanor	Three	25-Jan-24	BMMC has stopped rehabilitating our road since the construction of the haul road
Saanor	Three	25-Jan-24	How will we survive when our children have been removed from Kwakwe field?
Saanor	Three	25-Jan-24	How will we get safe drinking water?
Saanor	Three	25-Jan-24	How will our old people suffering from pressure deal with the blasting?

Saanor	Three	25-Jan-24	The distance between Saanor and kwakwe field is less than 500m. How posssible the blasting will not affect us?
Saanor	Three	25-Jan-24	Our communities(Saanor, Yatesville, & Brown Village) are marginalized during recruitment. Why?
Saanor	Three	25-Jan-24	How soon will employment start?
Bangorma	One	26-Jan-24	When is the exact time relocation will take place?
Bangorma	One	26-Jan-24	Will all residents be relocated at once?
Bangorma	One	26-Jan-24	Is it true that the houses in new Bangorma are joined? Why? Will it not create future problem?
Bangorma	One	26-Jan-24	Bangorma has 2 big Sande zoe houses. We don't want the Zoe house in new Bangorma to be smaller than the ones we have. There are traditional items in the Zoe houses, we want a sacrifice to be performed to transfer them to new Bangorma.
Bangorma	One	26-Jan-24	What will become of unskilled people after the construction phase?
Bangorma	One	26-Jan-24	What will become of farmers in new Bangorma who survive by farming in old Bangorma?
Bangorma	One	26-Jan-24	Will there be road from new Bangorma to Mafa river?
Bangorma	One	26-Jan-24	Old people don't fit within the project benefits presented. What will become of them?
Bangorma	One	26-Jan-24	We survive by artisanal mining, and we have been removed. How will we manage?
Massakpa	Four	25-Jan-24	How do we know the risk to surface water and groundwater is low-medium
Massakpa	Four	25-Jan-24	How far will the town be protected from dust? Will the road be rehabilitated daily or monthly?
Massakpa	Four	25-Jan-24	Will blasting not affect not affect houses?
Massakpa	Four	25-Jan-24	What mechanism has been put in place for safe drinking water?
Massakpa	Four	25-Jan-24	What will be Massakpa social-economic benefit?
Massakpa	Four	25-Jan-24	Whose land is the open pit on? Whose land is the newly constructed access road to the open pit on?
Massakpa	Four	25-Jan-24	Why is Massakpa getting less slot for employment? Recruitment Committee informed the town that BMMC give mandate on how slot is allocated
Massakpa	Four	25-Jan-24	Will there be regular employment or only contract?
Massakpa	Four	25-Jan-24	No woman from Massakpa has been employed with the company
Massakpa	Four	25-Jan-24	Will the education benefit take into consideration all levels (primary - tertiary & vocational)

Table 2: Round_01 Stakeholders' engagement concerns

3.0 NEXT STEPS

The final round of engagements and consultations is expected from 31st Jan - 1st Feb 2024 for the agreement and discussions based on proposed mitigations to concerns around potential impacts for environmental and social assessments. The final consultation will also include any new submissions into the five suggestion boxes located across the communities within the landscape.

4.0 CONSULTATIONS PHOTOS



Figure 5: Consultation in Kumah Sorkpojah Village



Figure 6: Consultation in Bangorma Town



Figure 7: Engagement in Saanor Village



Figure 8: Consultation in Massakpa Village



Presented to:
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January 2024

Contents

1.0 EXECUTIVE SUMMARY 3
1.1 Location and Purpose 4
1.2 The Engagement and Consultation Plan 5
1.3 Early Findings 7
2.0 LIST OF STAKEHOLDERS 9
3.0 NEXT STEPS 11
4.0 CONSULTATIONS PHOTOS 12

1.0 EXECUTIVE SUMMARY

The proposed Matambo Open Pit Gold Mine ("***Project***") is owned by Bea Mountain Mining Corporation (***BMMC***) which also currently owns and operates the New Liberty Gold Mine (***NLGM***) both situated in Grand Cape Mount. As part of the statutory requirements both international and national, stakeholders in the project area must be engaged and consulted about the potential risks and proposed mitigations, so as to obtain synergy across the project area landscape.

BMMC engaged the services of 3rd party independent environmental consultants to conduct an Environmental and Social Impact Assessment ("***ESIA***") of the project, so as to determine, document and propose mitigation measures for potential impacts to the environment or community as a result of the project's activities.

ABS Africa, Inc. out of South Africa is leading the focus on the environmental aspects related to the project, while Petra Resources, Inc. an EPA certified and licensed environmental evaluator is leading the social engagement aspects of this project.

A total of 138 persons with 41 accounting for females across 10 communities were consulted from 31th January 2024 – 1st February 2024.

Date	Cluster	Communities	Engagement / Type Form
31-Jan-24	One	Bangorma / Gogoima	Prior Notice / Grievance Box / Focus Group Discussion /Consultation
31-Jan-24	Two	Kumah Sopkorjah	Prior Notice / Focus Group Discussion / Grievance Box / Consultation
1-Feb-24	Three	Saanor / Yattesville / God Blessings	Prior Notice / Key Informant Interview / Consultation
1-Feb-24	Four	Massakap_01 / Massakpa_02	Prior Notice / Grievance Box / Consultation

Table 1: Stakeholder's consultation listing

1.1 Location and Purpose

The Matambo Project is situated approximately 90km west of the Capital Monrovia towards the Liberia – Sierra Leone border; and then via a 60km laterite road via New Kinjor through the famous mining settlement of Bangorma. The area is rural and remote, with several communities and hamlets around the proposed project area. Key communities around the proposed project area include:

- Massakpa_01 and Massakpa_02
- Kumah Sorkporjah, and
- Gogoima

The town of Bangorma serves as a catchment community for most of the surrounding towns and hamlets. Bangorma provides access to the community clinic[1], the community also hosts other public services including voting registration, certification, and registration of marriage, etc. Due to the proximity to the proposed Matambo Open Pit #01; the project is in negotiation with the leadership and residents of Bangorma so that the community is relocated prior to mining. Tahn the District Capitol is approximately 12.0km west of the project area. Although, it is not within the project area – its influence is significant within the project area, due to its political and cultural importance.

[1] Community clinic was constructed with contribution from 12 surround towns / hamlets/ village, needed the clinic in a more centralized location so that all would have equal access to the services.

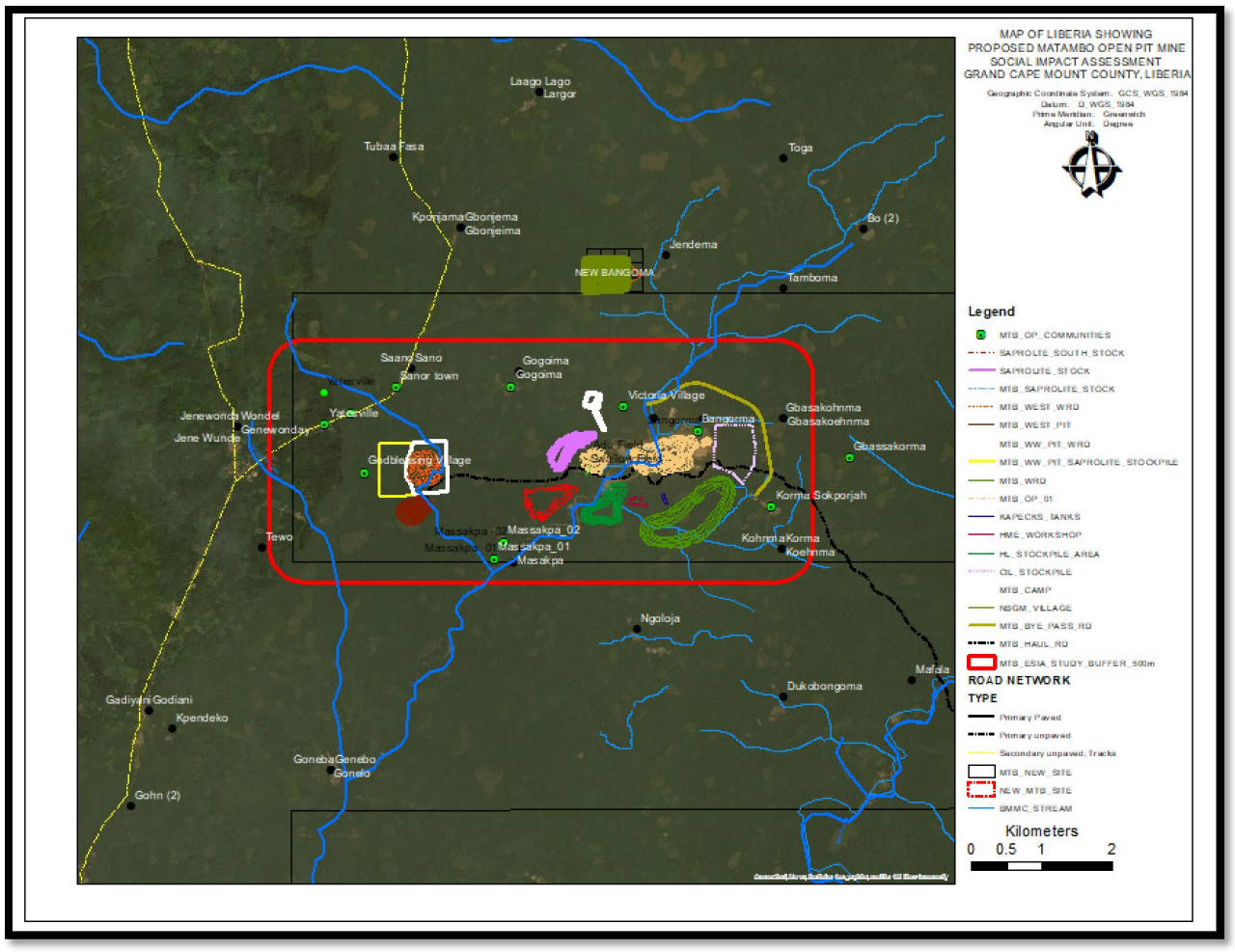


Figure 1: Map of the proposed Matambo Open Pit Mine with infrastructures and communities

1.2 The Engagement and Consultation Plan

The Stakeholder's Engagement Plan (**SEP**) for this project is aligned with international guidelines including the International Finance Corporation Performance Standards (**IFC_PS**); and the national statues and guidelines including the Revised 2020 Environmental and Social Impact Assessment Guidelines issued by the EPA. The SEP is guided by fundamental principles including:

- Purposeful
- Inclusive
- Timely
- Respectful
- Transparent

A Project Brief was submitted November 2023 to the EPA in keeping with the Environmental Management Laws of Liberia and the 2020 Revised Environmental and Social Impact Assessment Guidelines. The SEP anticipates at a minimum 3 rounds of engagements at the local level to present the potential impacts and proposed mitigation measures associated with the project.



Figure 2: Consultations and engagement process

This summary report presents the activities and findings of Engagement #2.

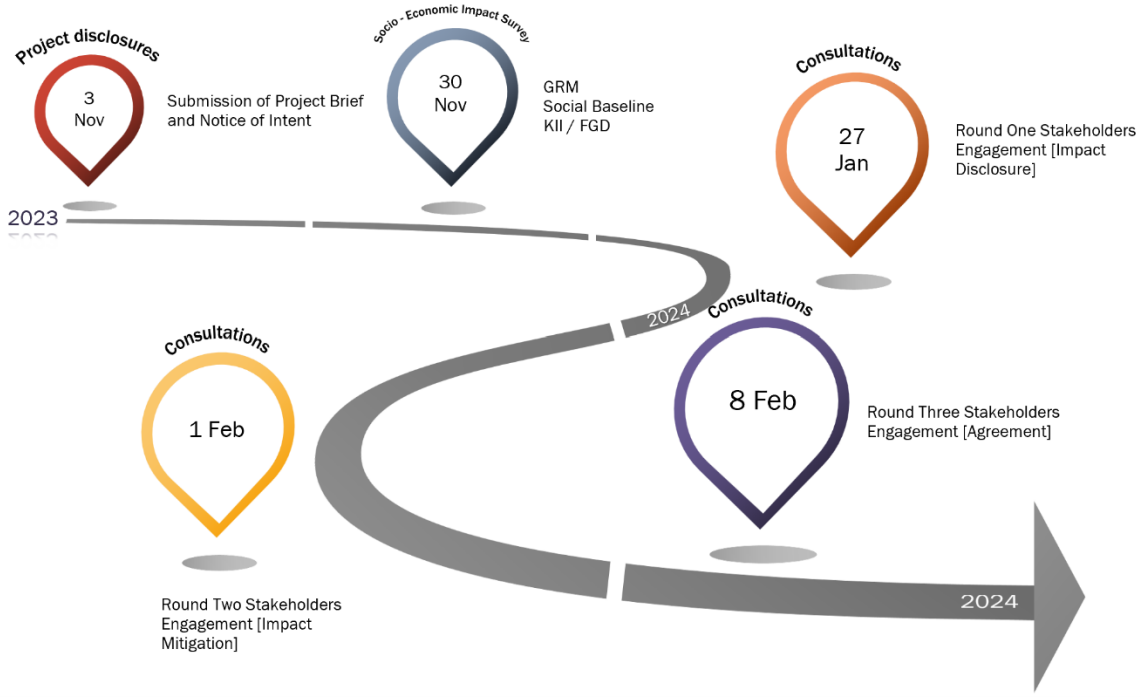


Figure 3: Engagement timeline

1.3 Early Findings

A total of 8 communities were engaged over a 2 day period. The *Prior Notice* exercise was used as entry points to the stakeholder's engagement activities; *Key Informant Interviews (KIIs)* were also held in select communities and with key representatives of those communities; and *Focus Group Discussions (FGDs)* were also conducted in 3 of the 8 communities.

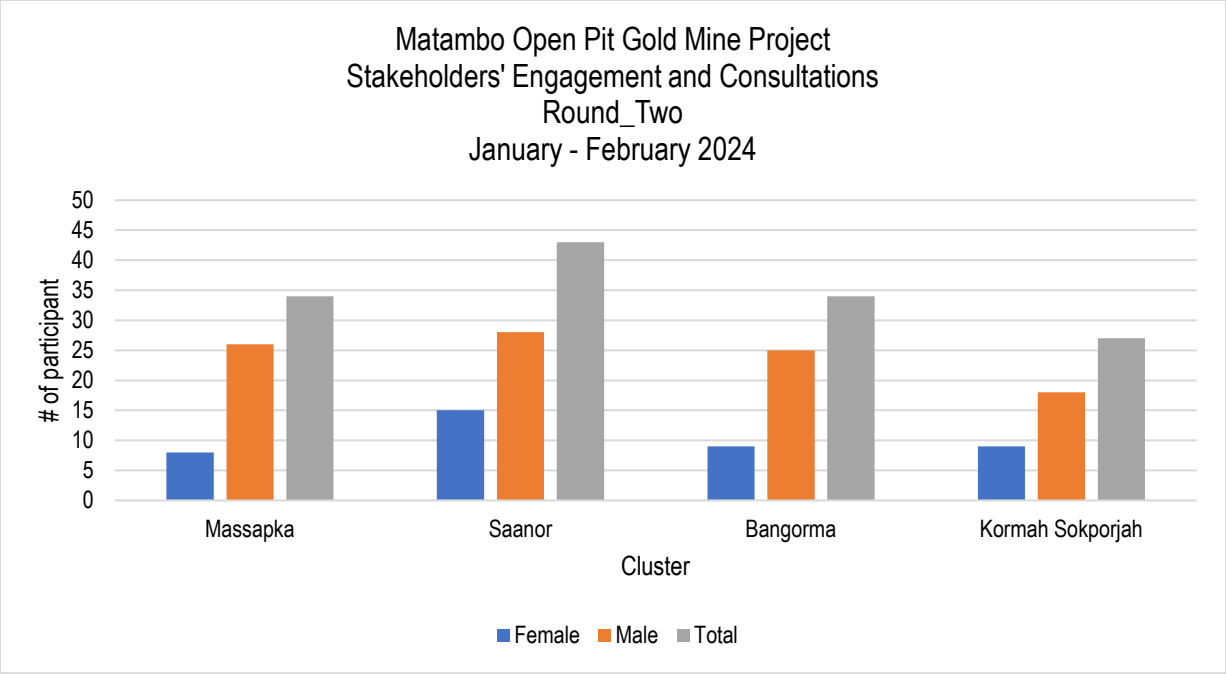


Figure 4: Statistics of stakeholders' participation in Round_02

Grievance Boxes were installed in 5 – communities:

- Gogoima
- Bangorma
- Kumah Sorkporjah
- Saanoh Village, and
- Massakpa_02

During the engagements, all communities were informed about the workings and functions of the grievance boxes that the engagement exercises is ongoing, contact details were provided for consultants so that stakeholders having concerns, questions, or suggestions can have the opportunity to provide their input to the project.

Key concerns documented during this round of engagement surrounds the following:

- *Employment*: Residents are concern that ongoing employment is done by quota from communities, and that some communities believes that quota allotted them is very low. There has also been concerns that slots are sold to job-seeking non-locals. There is also concern about short – term employment.

- *Land use and rehabilitation*: Some stakeholders are still concerned about the usage of their land without discussions and agreement – there was a huge concern over the removal of a natural boundary marker (tree) belonging to the people of Massakpa.
- *Water pollution / contamination*: Stakeholders has shifted their concerns from possible contamination due to mining activities to basic need for water. In a place like Saanor, residents strongly emphasized on the need for a hand pump to be dug.
- *Dust, noise and vibration*: Stakeholders are concern that the construction activities has resulted into significant noise and dust generation that its impeding their abilities to get out and doing daily chores.
- *ASM fields*: Stakeholders raised concerns that livelihood of local (gold boys) has been affected by the project.

2.0 LIST OF STAKEHOLDERS

Community	Cluster	Date	Issue Raised
Bangorma	One	31-Jan-24	What happened to our shops?
Bangorma	One	31-Jan-24	We raised issues with the GM - have you received the letter? If yes, where are we?
Bangorma	One	31-Jan-24	The new houses - I want everyone to go and see it. Those houses when you sit in the chair on the porch, there will be one space left again. The RC is the liaison between the people and the community. If the company do not address this, we will not agree. They should pay for our crop. There is also no air condition in the houses. The land demarcation is very close.
Bangorma	One	31-Jan-24	All the rooms are big. The major problem is the joining of the houses. This is not the original plan.
Bangorma	One	31-Jan-24	Will BMMC blast?
Bangorma	One	31-Jan-24	Can you blast in pit 2 while we are here? When will it happen?
Bangorma	One	31-Jan-24	Our old people are here, so it will be okay to take them from here first.
Bangorma	One	31-Jan-24	This people told us that before we blast, they would remove us from here.
Bangorma	One	31-Jan-24	What will happen to the gold boys in this town? I was told to make a list and give it to the company.
Bangorma	One	31-Jan-24	We had a protest and put some people together to represent us. We made some demands and give the list to people to give it to the company. I have asked the people and they've said you have not said anything yet.
Bangorma	One	31-Jan-24	What will happen to the plum trees? They are not only for eating mango - they also serve as wind breaker. I'm recommending that we have wind breakers around . It will help save the lives of our people.

Bangorma	One	31-Jan-24	The first meeting you told us - you will feed us.
Bangorma	One	31-Jan-24	How does the company know who has the land pit 2 falls in?
Kumah Sorkpojah	Two	31-Jan-24	We spoke about the dust management and you people said that you were going to work on it. Are you guys working on it?
Kumah Sorkpojah	Two	31-Jan-24	Yes. I know somebody asked the question and the answer was provided. What if I'm farming and the siren blows, but I do not hear it - what will happen to me?
Kumah Sorkpojah	Two	31-Jan-24	How are you going to build the bypass for Korma?
Kumah Sorkpojah	Two	31-Jan-24	You should build the road good or else you will not use Korma road.
Kumah Sorkpojah	Two	31-Jan-24	TO PETRA - You told us that after the assessment you were going to come and tell us our problem, what happened?
Kumah Sorkpojah	Two	31-Jan-24	During the exploration, they said that they were going to cater to the volunteer teachers. Since the exploration ended nothing has been done. Why?
Kumah Sorkpojah	Two	31-Jan-24	I heard the lady saying that you will take people from here to another district for schooling - are we not equip to host a school?
Kumah Sorkpojah	Two	31-Jan-24	Will you pay for the land you are using for the road?
Saanor	Three	1-Feb-24	How BMMC does daily wages? What is the plan BMMC has for older people? Especially for those doing farming.
Saanor	Three	1-Feb-24	Pumps in the town are partly damaged. The town is urgently in need of a hand pump.
Saanor	Three	1-Feb-24	Yatesville has not received slot for employment.
Saanor	Three	1-Feb-24	Suggest the hand pump be constructed by BMMC. Road rehabilitation must be cardinal to BMMC.
Saanor	Three	1-Feb-24	What will BMMC do for our road?
Saanor	Three	1-Feb-24	There are lot of BMMC employees living in Saanor & Yatesville, but there is no school. Appealing with BMMC to construct junior high school.
Saanor	Three	1-Feb-24	The town is not given slot.
Saanor	Three	1-Feb-24	Appealing to BMMC to construct hand pump in Brown Village.
Saanor	Three	1-Feb-24	Dissatisfied about slot allocation. Drinking water is unsafe.
Saanor	Three	1-Feb-24	Drinking water is unsafe. Appealing to BMMC to construct hand pump.
Massakpa	Four	1-Feb-24	If names on the list are not from Massakpa, will BMMC put them down>
Massakpa	Four	1-Feb-24	Will the watering of the road be done only in the company's operation area or all over Massakpa?

Massakpa	Four	1-Feb-24	Who is responsible if someone drinks contaminated water and die?
Massakpa	Four	1-Feb-24	Massakpa has not received the deed, but BMMC is already working. How will we manage?
Massakpa	Four	1-Feb-24	What is our benefit?
Massakpa	Four	1-Feb-24	BMMC Should provide more clarity on blasting. Will chemical affect the town?
Massakpa	Four	1-Feb-24	Massakpa should be treated like Bangorma. BMMC should inform Massakpa about any operation that will be done on Massakpa land.
Massakpa	Four	1-Feb-24	Does BMMC have the right to clear the bush in Massakpa without informing the town?
Massakpa	Four	1-Feb-24	Is it right to remove the town cornerstone without informing the town?
Massakpa	Four	1-Feb-24	BMMC is already operating on Massakpa land. BMMC has removed our cornerstone. Massakpa is not satisfied about the removing of their cornerstone (Felling of tree). Massakpa has not received deed, but BMMC is already operation on the land.
Massakpa	Four	1-Feb-24	BMMC should have informed the town before removing the cornerstone (Fell the tree). Massakpa will not sit and discuss with BMMC until the cornerstone is replanted.

Table 2: Round_01 Stakeholders' engagement concerns

3.0 NEXT STEPS

Recommend that BMMC continue to engage stakeholders through its community relation team.

4.0 CONSULTATIONS PHOTOS



Figure 5: Consultation in Kumah Sorkpojah Village



Figure 6: Consultation in Bangorma Town



Figure 7: Engagement in Saanor Village



Figure 8: Consultation in Kumah Sokporjah Village

Merry Christmas

Date: Dec. 13, 2023

Page No.

Date: / /

We did received the suggestion Box by the Town Chief in person OF Chief Boakai C. Kemokai OF Bangorma at the hour OF 9:15Am.

SUGGESTION TO BMMC

1. The employment status should be in the increase For the Citizens OF Bangorma and its Surrounding Corridor.

2. The newly Constructed houses that was build by the people OF Bangorma should be highly on the Agenda.

3. Noccational Training Center should be Prioritize For the Citizens OF Meimassa Clan.

4. University Scholarship should be given to the Citizens OF Tewor District.

5. Our Farm to market roads should be re-Constructed.

Please Turn Over

Page No.

Date : / /

6. Health Care, Sanitation and Agricuture Program should be your Concern as Company.

7. Empowerment For Matambo Corridor women through Micro Loan.

8. Some level OF Benefit should be given to our Olfer Parents OF Matambo Corridor.

* Above all, Bangorma is over 117 years Old.

Thanks but we hope to achieve Good Goal as we look Foreward to Move to our new Bangorma with happeness.

Prepared by: William B. Kawah on
0881-323773
0778-33 1950
Address Currently: Bangorma Town

- We also survived by our petit traps in the bush to Consume meat, the sound of the Machine will cause them or the animals to go away.

- The small Creeks are where we placed our baskets to get fish to eat but the chemical will destroy or kill them.

DEC. 14 - 2024

FROM. TENNEL FAHNBULLEH

NEED: MONEY TO MAKE BUSSINESS - 0580350264

TENNEL FAHNBULLEH
0880350264

DEC. 14 - 2024

FROM ASATU FREEMAN - 0555556558

NEED. BUSSINESS

Signed
ASATU FREEMAN
0555556558

* The Community is lack of good net-work System both Orange and Lone Star

* The Company Should put our Voluntary teathers on Salary

* The Bea-Mountain Minning Company should rehabilitate our School

- The health Center in Bangorma was Constructed by Korma, N'gorjah, Jendema, Augustine, and etc. this health Center is going to be remove, how are we going to be in the areas.

Let BMMC open a ~~trauma~~ Center for us

The road that was build close to the town, ~~the we are~~ is effacating us in korma, dueal the dusk

We will only have ~~safe~~ drinking water

We The Youths of Koma Town, We want For the company to Impermanent.

- let the Company put our Older people, disable people, town chief, youth chairman, ~~and~~ chair lady and Imam on salary.

- Let the Company put our traditional heads of the town on salary.

* Rehabilitation of our road to Jendema / Jendewende Market

* Safe Drinking water

* Teachers Empowerment

* Houses are cracking due to the Sound of the heavy equipment.

+ latrine for the Community
+ Mosque
+ Drinking water
+ Health Center
+ Our school should be renovated

- The breeze will Caused serious problem for us when the Mine starts

- The youths want to attend vocational school to get skills so they can live by

- The Majority of the youths are not employ by the Com Pan...

BEA - Mountain Co. DEC. 14 - 2023

From: Ismeal Tanwelly : 088611572

NEED: I am a driver: AND I need a space to Driver

Contact: 0886137

Ismeal Tanw

BEA Mountain Mining C. - DEC. 14 - 2023

From: Vanney Fahnbulleh - 0886797080/0776405592

NEED: WANT MONEY TO make BUSINESS

Signed
Vanney Fahnbulle
0886797080
0776405592

(*) We the people of Forma are affected all over:

1. We are very closer to the Mine
2. There will be no Safe Drinking Water while Minning in Bangorma
3. There will be no good roads
4. There will be no good farming in the areas Cu2, the Company will occupy the entire areas.

PEACE Page
Date / /

Korma, Town, Sortporja
We are also asking the
Company to take the
youth both men and woman
to trained them and
provide the jobs in the
Company.

- Our school is lack of teachers
and our children want to learn
let the Company help us.
- Drinking water is not safe
for us.

Suggestion

- Youth Empowerment
- Women Empowerment

PEACE | Page
Date / /

Korma Town Sorkpor Ja
We need hand pump's
for save drinking water

Korma Town, the Town Chief
Because of the banking
of the river I can
not have access to
my field easly because
of the over flow of the
water, So, we need
a boat, So we can have
access to our field and
farms accross ma far
river. The Town, Chief
Korma Town
we are also asking the
Company to assist's us
with qualified Teachers
and Should take the responsibility
to pay them.

- The blasting will Cause
Serious health problem:
1. Our pregnant women
2. High blood ~~patient~~ pressure
patient, including: older people.

- The school is very closer to the
Mine and our children are

NB: How our living Condition is going to be like when Bangorma is Move and the health-Center is there, how our health-condition is going to be like. Korma Sarkpojah, Al'gojah, Jendema, Augustine village and etc. are all depending on that same Clinic located in Bangorma. Where are we going to be Carding our ~~preg~~ pregnant women and ~~other~~ Sick patients.

We are kindly appealing to the Company to help our Voluntary teachers to help teach our children.

Massa Talawalay
Clan Speaker

We are totaly affected, the Mafa River is where we used to get fish from but right now there is no way, because the Mafa River is running freely for fish to Move up and down. Some are even dying due to the water pollution.

Massa Talawalay
Clain Speaker

We are also asking the Company to please help our disable people in the town. We are talking about people that are tired and Cannot Move about.

Our town is affected and our youth in the town are not employ by the Company, there is no other areas for them to get their livings to sustain their families.

Let the Company ~~estab~~ establish a Vocational training Center for our children.

* Our Crops are destroyed by the dust Caused by the heavy equipment Movement.

* Our drinking water is not Safe and whenever we take bath with the water, we experienced skin rash and body Scratch.

* Currently we are experiencing heavy air pollution. ie, the breeze is Consist of dust and we are experiencing headache, even the children are Coughing.

Massa Talawalay
Clan speaker

Korma, Town Sorkpoja

PEACE Page
Date / /

December 15/2025

Suggestions for Korma Sorkpoja, Town.

There should be a training program adulted by the company by training the youth within the Town for the jobs ahead of them.

Signed

Victor S. Kollie

Korma, Town Sorkporja

December 15/2023

Suggestion.

Korma, Town

I want the Company to build a hospital for the Community

Korma, Town

we need a high School for Kormaba

the Company should open an access road to go Gogorma Town. ending to Teinii Korma Town

And Korma is affected from the dust, and the heavy sound ~~of the~~ from the heavy equipments

Korma, Town,

CHAPTER 14
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

TABLE OF CONTENTS

14 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 14-1

14.1 INTRODUCTION 14-1
14.2 IMPLEMENTATION OF THE ESMP 14-1
14.3 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM 14-2
14.3.1 Leadership 14-3
14.3.2 Environmental Policy 14-3
14.3.3 Roles and Responsibilities 14-3
14.3.4 Actions to Address Risks and Opportunities 14-3
14.4 ENVIRONMENTAL AND SOCIAL ACTION PLAN AND STUDIES 14-4
14.4.1 Environmental Objectives 14-5
14.4.2 Environmental Targets 14-5
14.4.3 Planning Actions to Achieve Environmental Objectives 14-5
14.4.4 Communication 14-6
14.4.5 Documentation and Information 14-6
14.4.6 Control of Documents 14-7
14.4.7 Operation 14-7
14.4.8 Performance Evaluation 14-7
14.4.9 Management Review 14-8
14.4.10 Improvement 14-9
14.5 MITIGATION MEASURES 14-9
14.5.1 Project Development Area 14-9
14.5.2 Open Pit Mining, and Waste Rock Dump 14-11
14.5.3 Power Supply 14-14
14.5.4 Roads and Transport 14-14
14.6 ENVIRONMENTAL MANAGEMENT PLAN 14-16
14.7 SOCIAL MANAGEMENT PLAN 14-33
14.7.2 Environmental Management 14-34
14.7.3 Grievance Management 14-34
14.8 ENVIRONMENTAL MONITORING PLAN 14-34
14.8.1 Inspections 14-34
14.8.2 Aftercare And Maintenance 14-34
14.8.3 Post Closure Environmental Monitoring 14-34
14.9 RECORD-KEEPING 14-34
14.9.1 Monitoring Plan 14-35
14.10 EMERGENCY PREPAREDNESS AND RESPONSE PLAN 14-39
14.10.1 Objectives 14-39
14.10.2 Scope 14-40
14.10.3 Responsibility 14-40
14.10.4 Management 14-40
14.10.5 Aspects To Be Incorporated into the EPRP 14-40

LIST OF TABLES

TABLE 14-1: ENVIRONMENTAL MANAGEMENT PLAN FOR THE MATAMBO OPEN PIT PROJECT 14-17
TABLE 14-2: MONITORING PLAN FOR KEY ENVIRONMENTAL PARAMETERS 14-36
TABLE 14-3: MATAMBO MONITORING POINTS 14-37

LIST OF MAPS

MAP 14-1: MONITORING POINTS AT MATAMBO 14-42

14 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

14.1 INTRODUCTION

In response to issues and potential impacts identified in the impact assessment phase, Bea Mountain Mining Corporation (BMMC) has designed and will implement a variety of mitigation measures to reduce, minimize, or eliminate adverse effects that could result from development of the proposed Matambo Mine (the Project). Mitigation measures that will be implemented during construction, operation and closure of the Project are described herein.

In general, the mitigation measures proposed are designed to:

- Reduce or eliminate the adverse effect through life of mine (LOM) planning and engineering design wherever possible.
- Minimize adverse effects by limiting the degree or magnitude of the action and its resulting effects.
- Remedy the adverse effect by rehabilitating the affected environment.
- Develop and implement environmental and social management plans to manage, monitor and review adverse effects.
- Develop and implement social management plans to enhance positive social impacts (e.g., employment).
- Compensate for the adverse effect by replacing or providing substitute resources or environments.

Monitoring measures will be used to ensure that actions taken are effective in ameliorating both foreseen and unforeseen effects. In addition to describing specific actions to mitigate potential effects, the overall philosophy of BMMC is described herein with respect to its obligations to minimize and mitigate adverse effects on the environment within the Project area.

Mitigation actions presented in this section represent BMMC obligations to be a good steward of the environment and a good neighbour in the communities in which it operates. Methods of measuring the degree of success that BMMC achieves in meeting these responsibilities are described in section 14.8.

The Environmental and Social Management Plan ('ESMP') for the Project has been compiled in line with the requirements of the relevant legislation of Liberia while also taking into consideration best practice guidelines such as the International Finance Corporation (IFC) Performance Standards and associated Environmental, Health and Safety (EHS) guidelines.

In characterizing the area and the general environmental management requirements associated with the planned mining activities, the ESMP has been categorized into the following environmental aspects:

- Visual Impacts Management,
- Noise Management,
- Air Quality Management,
- Blasting and Vibration Management,
- Soils and Land Management,
- Surface and Groundwater Management,
- Biodiversity Management,
- Health and Safety Management, and
- Closure and Rehabilitation.

14.2 IMPLEMENTATION OF THE ESMP

BMMC will be responsible for ensuring implementation of the Environmental and Social Management Plan for the proposed development. BMMC will also ensure that a procedure is developed such that all senior positions on site have their environmental and social responsibilities and accountabilities clearly outlined. These descriptions

will form part of the contractual obligations upon which individual employees are engaged. Specific accountabilities and responsibilities outlined in the procedures will be communicated through the Mine Manager.

BMMC will construct and operate the Project in accordance with their Environmental, Occupational Health and Safety, and Community Relations and Development policies. Periodic auditing and reviews will be conducted by internal and external auditors to verify conformance and confirm management behaviour is in accordance with these policies.

The Company is committed to ensuring that the Occupation Health & Safety (OHS), Community Relations (CR) and Environment Departments' staffs are appropriately qualified for implementing their assigned responsibilities effectively. In order to fulfil this requirement, the Company shall recruit competent individuals and put in place a continuous training and skills upgrading program. Typical duties and responsibilities for the OHS, CR and Environment staff will include, inter alia to:

- Ensure that environmental monitoring programs are carried out on schedule and correctly;
- Review environmental data and recommend appropriate actions;
- Monitor environmental compliance of mine operations;
- Train others in the team and general personnel on mine environmental issues;
- Design and implement restoration of disturbed areas and re-vegetation studies;
- Establish, train and ensure readiness of the emergency response teams;
- Report on environmental data and incidents of significance as per regulations;
- Liaise with the appropriate regulatory authorities on incidences with environmental risks;
- Provide technical and environmental support to mining operations;
- Ensure that grieving mechanism is carried out for stakeholders,
- Review grievance data, recommend and monitor appropriate actions for related grievances,
- Ensure commitments listed in the ESIA are met, and
- Review (periodically) the existing monitoring system and design.

14.3 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

BMMC will develop an Environmental and Social Management System (ESMS) upon approval of the ESIA once a decision is made to proceed with the project.

BMMC shall develop, maintain, implement, document and continually improve the ESMS which shall be done in accordance with the ISO 14001:2015. This will be done through the following:

- Annual review of checklist, management plans, documenting and controlling of reviewed documents;
- Regular inspections, audits and annual management review will be undertaken to assess the progress and performance of BMMC; and
- Motivations, training and support will be provided by Top management.

BMMC is committed to maintaining environmental and social management through implementing best practice and ensuring the ESMS is continuously improved. Continuous improvement of the ESMS will be achieved through the following:

- Constant reviewing of BMMC's environmental and social goals;
- Analysis of environmental impacts and legal requirements;
- Establishing environmental objectives and targets;
- Developing programs and procedures to achieve objectives and targets;
- Monitor progress in achieving objectives and targets;
- Ensuring employees are both environmental aware and competent through training; and

- Constant review of the ESMS and making improvements were applicable.

14.3.1 Leadership

To ensure that the ESMS is implemented and adhered to by BMMC, it is imperative that BMMC's senior management show commitment to the ESMS. Senior management will ensure the following in respect to the ESMS:

- Take accountability for the ESMS;
- Ensure that the Environmental Policy and the environmental objectives are developed and are aligned with the strategic direction of BMMC;
- Will ensure that the ESMS is integrated within the business function of the company;
- Will provide the required resources to ensure that ESMS is implemented and maintained;
- Will communicate the importance of environmental & social management and the importance of conforming to the ESMS requirements to achieve the intended outcomes of the ESMS;
- Promoting continual improvement of the ESMS; and
- Providing direction and support to individuals to contribute the effectiveness of the ESMS.

14.3.2 Environmental Policy

BMMC will be guided by its Environmental Policy and the objectives and targets set in the policy.

14.3.3 Roles and Responsibilities

BMMC is committed to providing resources that are key to the implementation and control of the ESMS. The ESMS roles and responsibilities will be clearly defined throughout all the relevant functions and levels of BMMC, to facilitate effective environmental and social management. BMMC will also ensure that resources vital to the implementation and control of the ESMS, will be made available.

BMMC's senior management will need to appoint management representatives with clearly defined roles, responsibilities and authority, to ensure the following:

- Ensure that ESMS requirements are developed, implemented and maintained in accordance with the ISO 14001:2015; and
- Report on the performance of the ESMS to senior management for review and basis for improvement of the ESMS.

14.3.4 Actions to Address Risks and Opportunities

BMMC shall develop, implement, and maintain procedures required to meet the requirements relating to Environmental and Social Aspects, Legal Compliance and Action Plans associated with the proposed development.

BMMC will need to consider the following:

- The issues identified in understanding the context of the organizations;
- The needs and considerations of stakeholders; and
- The scope of the ESMS.

BMMC will determine the risks and opportunities related to the environmental aspects identified and their compliance obligations, as per the ESIA and ESMP.

- BMMC shall ensure that all documented information is maintained;
- Risks and opportunities are addressed; and
- Procedures are developed to ensure the effective functioning of the ESMS.

14.3.4.1 Environmental and Social aspects

The planning process begins with the identification and updating of the environmental and social aspects. The ESIA has been undertaken and provides environmental and social aspects which have been identified during the process.

In addition, to the identified aspect identified as part of the ESIA, BMMC shall establish, implement and maintain a register of their environmental and social aspects by developing an procedure in order to identify environmental and social aspects, associated with the following:

- BMMC's activities; and
- Products and services that can be controlled and those that BMMC influence.

BMMC shall ensure that all identified environmental and social impacts that pose a significant risk to the environment, are managed by this ESMP.

14.3.4.2 Compliance obligations

BMMC, as part of the ESMS requirements, will develop and implement a legal register to identify all legal requirements that are relevant to the company.

As part of the legal requirements procedure, BMMC will need to identify the following:

- Relevant regulations;
- Codes of practice; and
- Guidelines and policies.

It is the responsibility of BMMC to ensure that the Legal Register is maintained and kept up to date.

14.4 ENVIRONMENTAL AND SOCIAL ACTION PLAN AND STUDIES

During site preparation and Project construction, several specific activities will occur that may result in impacts to physical, biological, and socio-economic resources. Impacts to these resources are discussed in greater detail in the Assessment of Impacts, proposed mitigations, and monitoring sections of the ESIA.

BMMC will develop, update, and amend the Environmental and Social Action Plans to manage the anticipated impacts, as per the requirements of the IFC's Sustainability Framework:

- Emergency Preparedness and Response;
- Traffic and Transport Management;
- Community Relations Management including a Stakeholder Engagement and a Grievance Mechanism;
- Hazardous Materials Management;
- Environmental Monitoring;
- Social Monitoring & Evaluation;
- Community Development including a Local Employment and a Local Procurement;
- Environmental & Social Management System Manual;
- Employment Management and Training;
- Air Quality Management;
- Noise and Vibration Management;
- Soil and Land Management;
- Surface and Groundwater Management;
- Integrated Waste and Water Management;

- Health and Safety Management; and
- Cultural Heritage Management.

14.4.1 Environmental Objectives

BMMC is tasked with the responsibility for developing a set of environmental objectives that will be implemented and maintained at various functions and levels within the company. BMMC must ensure that the objectives that have been developed must be aligned to the environmental policy that has been established.

The objectives and targets must be established at the relevant functions and levels of the company and must be measurable.

Senior management will be required to approve the programs, objectives and targets that form part of the ESMS prior to implementation.

14.4.2 Environmental Targets

Environmental targets must be established and set for the environmental objectives established by BMMC to be achieved. Environmental targets must be reviewed on an annual basis, or when required due to new developments.

BMMC will develop a series of management and action plans to use to achieve their objectives and targets. The objectives and targets are to be specific and measurable.

14.4.3 Planning Actions to Achieve Environmental Objectives

BMMC will ensure procedures are developed, implemented, and maintain to address the following aspects:

- Identification of the resources that will be required to achieve the objectives;
- Appoint parties responsible for undertaking the actions required;
- Develop a time frame in which the activities will be completed; and
- Establish indicators for monitoring progress.

In doing this, BMMC will ensure that actions required to achieve its environmental objectives will be integrated into the organizations business systems and processes.

BMMC is committed to providing resources that are key to the implementation and control of the ESMS. The ESMS roles, responsibilities and authorities will be clearly defined throughout all the relevant functions and levels of BMMC to facilitate effective environmental management. BMMC will ensure that resources vital to the implementation and control of the ESMS will be made available to the relevant function.

BMMC's senior management will appoint management representatives, in addition to their respective of their other responsibilities will have clearly defined roles, responsibilities and authority to ensure the following:

- Ensure the EMS requirements are developed, implemented and maintained in accordance with the ISO 14001:2015; and
- Reporting on the performance of the EMS to senior management for review and basis for improvement of the EMS.

As part of the EMS, BMMC will ensure that individuals who are performing tasks for BMMC or on behalf of BMMC whose work has potential to impact on the environment, are competent and provided with the appropriate education and training. All associated records must be retained of education and training provided. In addition, BMMC will ensure that individuals undertaking activities on behalf of BMMC including contractors and sub-contractors have undergone an assessment of the potential environmental and social impacts that may be caused as well as the competence required to before the activities.

In addition, BMMC will develop and maintain a procedure in order to identify the required training needs that are associated to either environmental aspects or to the ESMS. BMMC is committed to creating awareness and ensuring competence is achieved throughout the relevant business functions by addressing the following:

- Roles and responsibilities required to achieve conformity with the ESMS;
- Ensuring conformity with the environmental policy, procedures, and requirements of the ESMS; and
- Potential consequences for not adhering to specified operating procedures.

BMMC will develop a training matrix which must be used for identification, evaluation, recording and fulfilment of training needs. BMMC must ensure that ESMS training is undertaken at all relevant business functions and that these records are retained in the training matrix developed by BMMC. Where appropriate the training documents may be retained on site or at the Human Resources department.

BMMC must ensure that they identify the required training needs that are associated with environmental aspects and the EMS.

14.4.4 Communication

BMMC will ensure that all information regarding the ESMS, environmental policy, procedures, environmental targets and objectives and the environmental performance are made available to all employees either via notice boards, newsletters or through the company's intranet.

Employees who wish to enquire or have complaints regarding the ESMS can do so through the grievance mechanism. It will be the responsibility of the grievance committee to maintain a register of all complaints and enquires regarding the EMS. Depending on the scope and nature of the enquiry or complaint the grievance committee shall determine the action required and maintain records of action undertaken.

BMMC will ensure that the environmental policy is made available at BMMC's offices as well as on the company's web page. As with internal queries or complaints external complaints lodged with regards to the ESMS will be reviewed by the grievance committee and the actions undertaken to resolve the query or complaint recorded.

BMMC shall establish an implement a method(s) for external communication in which decisions will be communicated when required.

14.4.5 Documentation and Information

BMMC will develop the ESMS manual and as per the requirement of the relevant guidelines and standards. The EMS manual covers the following:

- Environmental policy;
- Environmental objectives and targets;
- Scope of the ESMS;
- ESMS roles, responsibilities and authorities;
- Operational procedures to ensure objectives are achieved;
- Monitoring Procedures to measure key activities; and
- Top management review of the ESMS.

BMMC will develop the Environmental and Social Procedures which the ISO 14001:2015 specify. These must be supported by a set of operational procedures and instructions with defined responsibilities to control identified environmental and social aspects that have been identified by BMMC.

The fourth level is characterized by the establishment of environmental records which arises due to the implementation of the EMS its procedures and instructions. Environmental records must contain the following as defined in each of the environmental procedures and instructions:

- Checklists;
- Reports; and
- Meeting records.

14.4.6 Control of Documents

BMMC will maintain all environmental documents in a central location and all records must be accessible to all employees. Electronic copies of the documents will be available through the BMMC server. BMMC must ensure that all documents are reviewed periodically and where applicable and deemed necessary these documents must be revised and approved by authorized personnel for each revision.

The document controls are as follows:

- Environmental documents must be reviewed and where applicable be revised and approved by authorized personnel;
- Current version of all documents must be made available at locations where operational activities are undertaken;
- Outdated documents must be removed from all access points to ensure that they not used; and
- Outdated documents that must be retained legal or knowledge preservation purpose must be identified for this use.

BMMC must ensure that all relevant documentation must be legible, dated with the correct revision dates, identifiable, maintained and retained for a specific period. BMMC must develop, implement, and maintain procedures outlining the control of documents related to the ESMS. The procedure must outline where documents can be located, how they are reviewed and when are these documents reviewed.

BMMC must develop, implement, and maintain a procedure to identify, store, protect, retrieval, retention and disposition of their environmental records.

14.4.7 Operation

14.4.7.1 Operational controls

BMMC shall develop, implement, and maintain identified operational procedures to manage identified significant environmental aspects.

BMMC will ensure that all operations and activities undertaken by employees, contractors and sub-contractors that are associated with the identified significant environmental aspects are properly controlled and that the relevant operational procedures in terms of the environmental procedures and instructions are communicate to those individuals whose task may result in significant environmental aspects.

These documents outline the mechanism for the development, implementation, and maintenance of the ESMS and thus ensure that the ESMS is maintained in accordance with the environmental policy and the objectives and targets that have been defined and communicated to the employees, contractors and sub-contractors.

14.4.7.2 Emergency preparedness and response plan

BMMC will develop, implement, and maintain an Emergency Preparedness and Response Plan in order to respond to environmental accidents, accident and emergency situations. The Emergency Preparedness Plan directs BMMC on how to respond, prevent or mitigate environmental impacts during potential emergency situations and potential accidents. The requirements of the International Cyanide Management Code must be incorporated into this plan.

14.4.8 Performance Evaluation

14.4.8.1 Monitoring and measurement

BMMC shall ensure that procedures will be designed, implemented, and maintained on a regular basis to monitor key operation activities that may have a significant environmental impact.

The procedures must include the following:

- Documenting of information to monitor performance;
- Applicable operational controls; and
- Conformity with the organization's environmental objectives and targets.

Monitoring of the ESMS program is done through audits and the day-to-day items are monitored through designed programs and Checklists.

BMMC will develop, implement, and maintain an audit program and procedure in which periodic environmental audits on the EMS to ensure the following:

- To determine whether the EMS:
  - Conforms to planned environmental management including the ISO 14001:2015 requirements; and
  - The EMS has been properly implemented and maintained.
- Audit results and information will be used as management reviews to ensure environmental improvement.

BMMC shall ensure that the audit program and the audit schedule will be based on the environmental importance of the activities and on the results of previous audits undertaken. The audit procedure must ensure the following is covered:

- Audit criteria;
- Scope;
- Frequency and method;
- Responsibility and requirements for undertaking an audit; and
- Reporting of results and retaining records.

BMMC must ensure that the audits carried on the ESMS are undertaken on a regular basis. The site environmental audits must be undertaken in a timely manner to ensure preventive actions are being undertaken as planned and that corrective actions are being carried out.

14.4.9 Management Review

BMMC will implement the "plan-do-check-act" cycle to review the ESMS periodically. The plan-do-check-act method will require top management of BMMC to act and review the ESMS periodically to ensure its relevance and effectiveness.

Before the review by BMMC's top management, the ESMS committee shall ensure that management review and inform all participants, gather all relevant records, and prepare a summary report for if required for discussion.

The top management and the ESMS committee will take part in the annual management review. The objective of this review will be to assess the environmental management work done in the past year and evaluate the EMS regarding any changes in legislation, concerns and lessons learnt from previous experience.

The following topics must be discussed in the management review but not limited to:

- Review of the environmental policy, the objectives, targets and programs;
- Review of the legal compliance to ensure compliance and any changing circumstances related to its environmental aspects;
- Environmental aspects of activities and their disclosure to the public;
- Findings of internal audits;
- Review of any nonconformities and their preventative and corrective plans;
- Identify areas of improvement; for environmental performance;
- Review the adequacy of the emergency preparedness and response plan;
- Identify modifications to the existing EMS based on the above bullet points; and
- Follow up action from previous management reviews.

The review will form the basis of the new "plan-do-check-act" cycle to initiate improvements in BMMC's environmental and social performance and enhance the EMS.

It is important that all findings in the management review are recorded in the minutes from the meeting and EMS committee must retain a record of the minutes.

14.4.10 Improvement

14.4.10.1 General

BMMC must ensure that key characteristics of its operations and activities are on a regular basis monitored and measured. The results of the ESMS will be recorded together with the following:

- Nonconformity;
- Corrective action; and
- Preventive action.

BMMC will conduct periodic audits of the EMS which will provide the basis for the management review.

14.4.10.2 Nonconformity, corrective action, and preventive action

The continual improvement of the ESMS can be achieved through identifying nonconformities, correcting the non-conformities, and preventing the correct non-conformities from re-occurring.

To ensure improvement BMMC must develop, implement, and maintain procedures for outlining the handling of nonconformities, potential nonconformities, and the measure for taking corrective and preventative action. BMMC will define the responsibilities and authorities to:

- Handle and investigate the nonconformity;
- Action required to mitigate the impact caused;
- Initiate corrective and preventative actions required;
- Ensure corrective and preventive action plans are appropriate to extent of the problem and corresponding with the environmental impacts encountered;
- Results of corrective and preventative actions taken are recorded;
- A review of the effectiveness of the actions is undertaken; and
- Record changes to procedures which have resulted due to corrective or preventative measures and that necessary changes will also be made in EMS.

14.4.10.3 Continual improvement

BMMC shall continuously seek to improve the suitability, adequacy, and effectiveness of the ESMS to ensure constant improvement in their environmental performance.

A project implementation Readiness Assessment should be undertaken once a decision is made to proceed with the project.

14.5 MITIGATION MEASURES

14.5.1 Project Development Area

14.5.1.1 Management and mitigation measures

The Project layout has been designed to avoid, and where avoidance is not possible, minimize permanent impacts on settlement areas and existing agricultural land. The Project Development Area (PDA) is done in such a way to provide for the safety of local residents and workforce.

In addition, BMMC has committed to implementing the following mitigation and management measures to minimize the impact of the PDA land users:

- The Company will undertake a comprehensive land and asset survey after finalizing infrastructure sites, and identify the ownership of any productive land that will be temporarily or permanently lost to the Project PDA at the household level;
- Land for inclusion in the PDA will be clearly defined and marked to avoid unnecessary exclusion;
- The Company will compensate for any productive land and community land assets that will be temporarily or permanently lost to the PDA;
- The Company will provide appropriate compensation for any loss of access to productive land and will ensure continued access to productive areas located outside the PDA. Where practical and warranted, alternative access routes will be provided; and
- The Company will undertake regular public consultation to ensure the effectiveness of management and mitigation strategies.

Fly Rock Exclusion from Blasting

The layout will be developed to ensure the health and safety of local residents and the Project workforce from blasting during construction by ensuring a 500 m exclusion zone (minimum) is enforced from blasting activities.

The Company will consider the following (at a minimum):

- Methods for denying access to the 500 m radius exclusion zone (e.g. manning road access points, conducting surveys to ensure people are outside of the exclusion zone, etc.);
- Blasting conducted at specified times during the day, with adequate notice given to local communities;
- Blast times and locations will be posted on boards in local villages;
- Fly rock to be visually monitored to confirm that the exclusion zone is sufficient to protect sensitive receptors (biological and social);
- Engaging a blast contractor with relevant expertise and experience; and
- Training Project staff on fly rock safety and conduct a public education programme regarding community safety issues associated with blasting.

Compensation for inaccessible lands

The Company will develop a Community Development Plan and a Compensation Matrix that includes restoration measures for land / activities lost or disrupted via development of the PDA.

Community Infrastructure Development

Development of community infrastructure will be limited by applying a safety buffer zone to reduce the likelihood for damage to village structures in proximity to site activities.

Access

The Company will not prevent access to resources outside of the PDA, unless safety concerns require an intervention.

The Project Grievance Mechanism will provide for continued stakeholder consultation, allowing local residents to voice concerns regarding losses of access via PDA development during construction and appropriate compensation, if necessary.

The PDA will be more clearly defined during Project operations as blasting will be limited to the pit. Mitigation measures employed for the PDA will be the same as for construction, including:

- Enforcement of the fly rock exclusion zone for blasting in the portal (and all associated measures described in the Blast Management Plan);
- Existing access roads / paths to resources outside of the PDA will be ensured; and

- Stakeholder consultation will continue throughout operations, with the Grievance Mechanism provided to ensure adequate response to community complaints / issues.

14.5.2 Open Pit Mining, and Waste Rock Dump

14.5.2.1 Management and mitigation measures

Key management objectives associated with the open pit, mining and waste rock disposal facilities include:

- Design, construction and operation of the Pit, and WRD facilities to ensure adequate operational safety and compliance with relevant legislative requirements and environmental / social commitments;
- Provision of appropriate measures to manage or mitigate potential environmental and social impacts from mining, ore stockpiling and waste rock disposal activities over the Project life; and
- Development and implementation of an appropriate mine closure and rehabilitation plan that successfully meets environmental and social permitting requirements, regulatory requirements, and is in-line with community expectations.

BMMC has minimized the footprints for the pit, WRD, and Ore Stockpile to the extent practicable to limit the area of impact to productive land.

BMMC will develop a series of Standard Operating Procedures for implementation to avoid, minimize, or mitigate anticipated impacts associated with land clearance / topsoil removal from the Pit and WRD footprints. The SOPs will key management measures for adoption during all phases of the Project to address primary issues and risks, including:

- Impacts from vegetation clearance
- Erosion and sedimentation associated with disturbed construction surfaces
- Surface water quality and hydrology management
- Potential hydrocarbon spillage and handling/storage of hazardous materials and dangerous goods
- Air quality, noise and vibration emissions
- Biodiversity Management

Land and Soil Management

This section was summarised from the Soil and Land Capability study conducted by ESS (2024).

General

As part of developing a workable and sustainable management Plan the following requirements (all be they generic) should be adhered to wherever possible:

- Over areas of open cast mining workings, strip all usable soil as defined. Alluvial soils should be stockpiled separately from the colluvial (shallower) and in-situ overburden.
- At rehabilitation replace soil to appropriate soil depths, and cover areas to achieve an appropriate topographic aspect that is free draining, and the landscape is as close as possible to the pre-mining land capability rating.
- In the project area the depth of the utilisable soil material is between 400 mm and 800 mm. It is recommended that a minimum of 500 mm, and where available 750 mm is stripped from the mining and associated infrastructure areas, and 350mm from all roads (Access Ways and Haulage Ways) and founding pads. (Soil stockpiles and all dump footprints).
- The positioning of any/all storage facilities will need to be assessed on the basis of the cost of double handling and the distances to the point of rehabilitation need. Where possible the soils should be stockpiled as berm structures in positions upslope of the infrastructure from which they are removed as clean water diversion berms, and/or as stockpiles close to, but outside of the final voids and/or waste rock.

- Of importance to the success and long-term sustainability of rehabilitating these environments will be the replacement of the materials in their correct topographic position and order and in as close as possible their original state.
- Long term forward planning for the utilisation of the materials to their best advantage and the understanding of the final "End Land Use" will need to be well understood if the optimum utilisation of the materials is to be achieved. Please refer to the recommendations of materials replacement under the decommissioning and closure plan section.
- The consequences of not achieving these goals will need to be assessed and quantified in terms of the long-term ecological impacts, and will require the input of the specialist ecologists, hydrogeologists and engineers in formulating the overall management plan.

Additional:

BMMCs management and mitigation measures are to avoid or minimize potential operations phase impacts.

BMMC will progressively rehabilitate the WRD from the bottom up during the Operations Phase where possible. Lifts will be progressively contoured on the outer WRD face and will be planted with species common to the area.

If the geochemical risk is found to increase during operations, a geochemistry management plan will be developed to ensure that potential impacts associated with mine material geochemistry post-closure are minimized.

Water quality and Acid Mine Drainage management

- Stormwater management infrastructure has been designed to accommodate peak flows from a 100-year rainfall event; and
- Regular inspection of surface water management features to ensure their efficacy.

Mine safety

BMMC will conduct regular inspections of the Pits, WRDs, and Stockpiles for structural integrity to ensure the potential for landslips and other geotechnical and geochemical instability issues are adequately managed. Additional measures include:

- Provision of 24-hour security guards and restricted access safeguards,
- The explosives magazine at the site will be appropriately designed and located to ensure the safety of employees on site,
- The magazine will be located a minimum of 800 m buffer distance from human settlements and a minimum 250 m buffer distances from mine built structures. (Distance subject to review during detailed design when the quantities of explosive have been confirmed);
- A 500 m blast exclusion zone (minimum) will be enforced for all blasting activities for the Project. To ensure people are outside the blast exclusion zone, the Company will deploy methods including sirens, amplified verbal warnings, the posting of sentries, the closure of access roads and pre-blast surveys.
- Appropriate handling and storage of explosives will be developed by BMMC.
- The Company will develop a Blast Management Procedures that will further specify blasting, training, auditing, PPE and other requirements.

Air Quality Management

Based on the evaluation of the Matambo Project on ambient air quality, mitigation measures and monitoring and management objectives are outlined in this section.

Given the high rainfall rate in the study area and the large distance between the Matambo 2 and 3 pits and nearby sensitive receptor locations, it is not foreseen that mitigation measures will be required for mining activities at these pits during the wet season from March to November. It is, however, recommended that best practise mitigation measures be applied during the dry season, particularly on the access roads, to minimise impact on the receiving environment. Regular watering of all roads is recommended. It is further recommended that the vehicle

fleet, particularly the haul trucks be well maintained and regularly serviced to minimise the impact of exhaust emissions on nearby sensitive receptor locations.

It is recommended that no mining, stockpiling or hauling be conducted within 250 m of sensitive receptor locations. Based on the above, it is recommended that the residents of Bangorma be relocated prior to the commencement of mining activities at the Matambo 1 pit.

Further recommendations include:

- Air quality monitoring to be conducted annually at the accommodation camp. Recommended pollutants to be sampled, include PM_{10}, NO_2, SO_2 and dust fallout. Sampling campaigns are scheduled during the dry season between November and February.
- Annual monitoring of PM_{10}, dust fallout, NO_2 and SO_2 is conducted at the nearest sensitive receptors along the haul road.
- A complaints register is kept at the mine offices, the accommodation camp, and the nearby villages. Communities should be encouraged to report any air quality related concerns such as dust, smoke, odours, or health impacts in detail, as well as all other environmental related concerns. Quarterly engagement meetings should be held with communities to identify any air quality related problems. The community should be educated on the effects of the pollutants emitted on human health and to report any such symptoms.

Noise management

Good engineering and operational practices will reduce levels of annoyance specifically at off-site NRs near mining activities. For general activities, the following good engineering practice will be applied to all project phases:

- All diesel-powered equipment and plant vehicles should be kept at a high level of maintenance. This should particularly include the regular inspection. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.
- Equipment with lower sound power levels must be selected. Vendors should be required to guarantee optimised equipment design noise levels.
- In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:
  - Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program.
  - Maintain road surface regularly to avoid corrugations, potholes etc.
  - Avoid unnecessary idling times.
  - Minimising the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur.
  - Limiting traffic to hours to between sunrise and sunset if possible. This should include other non-routine noisy activities such as construction, decommissioning, start-up and maintenance.
- A noise complaints register must be kept.
- Additional points that should be considered:
  - Good public relations are essential at all stages of the project. Surrounding receptors should be informed about the sound generated by proposed project operations.
  - Community involvement needs to continue throughout the project.
- Equipment and methods to be employed will be reviewed to ensure the quietest available technology is used. Equipment with lower sound power levels must be selected in such instances and vendors/contractors should be required to guarantee optimised equipment design noise levels.

- Machinery and equipment should be sited as far away from NSRs as possible. A 250 m buffer zone should be established between the mining activities and any NSRs (particularly schools, medical facilities and places of worship). Also:
  - Machines used intermittently will be shut down between work periods or throttled down to a minimum and not left running unnecessarily. This will reduce noise and conserve energy.
  - Plants or equipment from which noise generated is known to be particularly directional, will be orientated so that the noise is directed away from NSRs.
  - Acoustic covers of engines and compressors will be kept closed when in use or idling.
  - Doors to pump houses, and generators will be kept closed at all times.
- Regular and effective maintenance of equipment are essential to noise control. Increases in equipment noise are often indicative of eminent mechanical failure. Also, sound reducing equipment/materials can lose effectiveness before failure and can be identified by visual inspection; and
- It is recommended that the residents of Bangoma be relocated prior to commencement of mining activities at the Matambo 1 pit.

14.5.3 Power Supply

14.5.3.1 Management and mitigation measures

Key management objectives related to power supply for the Project will include:

- Provision of sufficient power supply for the Project without compromising environmental and social values.
- Implementation of a power supply that minimizes energy consumption / maximizes efficiency.
- Design of a Project power supply to minimize potential pollutant emissions.

The Company will follow international industry practices for minimizing Project related greenhouse gas emissions. Measures will include:

- Integrate energy efficiency principles in building or facility design.
- Ensure contractors comply with relevant energy conservation measures to be developed.
- Conduct awareness training on energy conservation and greenhouse gas reduction for Project employees and workforce.
- Establish energy conservation targets for the Project for measuring improvement in greenhouse -intensity of mining operations in accordance with good international industry practices.

The Company will also apply relevant SOPs to manage construction impacts of the Power Supply Facilities, including:

- Hazardous materials transport, handling, and disposal.
- General waste management.
- Dust, noise and vibration.
- Cultural heritage.

14.5.4 Roads and Transport

14.5.4.1 Management and mitigation measures

Key objectives related to managing roads and transport aspects include:

- Ensuring compliance with international guidelines for transport of hazardous materials.
- Minimizing the impact of Project mine traffic and road infrastructure on the local communities and the environment.

- Managing transport safety for the Project.
- Maximizing community benefits of Project's Road infrastructure.

BMMC will implement management and mitigation measures to address potential impacts from road upgrades and road usage. Principal contractors will also be required to develop specific Environmental and Management Plans (EMPs) which incorporate measures detailed in the following subsections and as relevant to their work activities. The Company will continue to monitor and adapt relevant measures throughout the life of the Project to ensure they remain effective.

BMMC will regularly engage with affected communities throughout the pre-construction and construction phase to ensure associated impacts are appropriately managed. In addition, the Company will implement the following measures for managing community health and safety in relation to transport:

- Vehicular speed limits as follows:
  - Maximum of 40 km/h for Main Access Road and other Project roads, Haul Roads, and other Project roads;
  - National speed limit on the national roads; and
  - 20 km/h through villages, residences or sensitive areas (e.g. school, known wildlife and livestock road crossings, and environmentally sensitive areas, etc.).
- Monitor and enforce transport safety protocols for all employees and contractors to minimize road accidents, including:
  - A 'driver code of conduct' for Project drivers and contractors.
  - The use of private vehicles restricted once past the Project entrance boundary.
  - Project vehicles to follow designated Project transport routes within permitted driving hours, subject to approval by the Company's H&S Manager.
  - Off-site vehicle movements (e.g. delivery of supplies) to daytime, where practical.
  - Regular Project driver and contractor checks for adherence to local traffic laws.
  - Training to be provided to vehicle drivers on safe driving techniques.
  - Project vehicles equipped with first aid equipment and appropriate personal protection equipment (PPE).
  - Vehicles transporting oversized loads to be preceded by an escort 'warning' vehicle.
  - Transportation of dangerous goods and hazardous materials to comply with BMMC Hazardous Materials Management Plan.
  - Zero tolerance on driving under the influence of drugs and alcohol.
  - Proper fatigue management for Project drivers.
  - Project vehicles to meet road weight limits on the designated routes, including for bridge crossings.
  - Safety inspections of Project vehicles will be conducted on a regular basis, and
  - Road safety precautionary controls, such as restricting material deliveries (particularly for hazardous materials and dangerous goods transport) and workforce movements during periods when more vulnerable road users are present on the route (e.g. during school opening and closing times).

Detailed procedures and training as part of the Project-specific Emergency Preparedness and Response Plans to be developed for managing road accidents and transporting hazardous materials.

A road incident log and reporting system that enables road users and Project drivers to report road accidents as well as unsafe driving / speeding involving Project vehicles. The database will capture relevant information, e.g. date, time, location, persons involved, and any response required, or action taken by the Company.

- Schedule for road works to be coordinated with relevant agencies and stakeholders to minimize traffic disruption for public and private road users.
- Prior notification of planned road construction activities likely to cause nuisance noise and dust (e.g. blasts) to potentially affected villagers.
- All Project roads within the PDA signposted to provide directions to traffic movements.
- Optimized transport logistics for workers and materials delivery to minimize the number of Project vehicles on the road. The Company will provide daily transportation for staff to and from the camp and work sites.
- Establishment of a vehicle and machinery maintenance programme for the Project to comply with relevant standards and guidelines for transport safety and vehicle manufacturers' instructions.
- Project Grievance Management Procedure for road users and villagers to register issues and complaints in relation to road degradation caused by Project vehicles.

Transportation of Hazardous Materials and Dangerous Goods

BMMC developed a preliminary emergency response procedure for managing risks associated with transportation of dangerous goods and hazardous materials. The procedures will be further refined in the Emergency Preparedness and Response Plans to be developed for the Project.

Hazardous substances and dangerous goods will be transported in accordance with relevant legislative requirements and applicable international and national standards and guidelines, including:

- IFC General Environmental, Health and Safety (EHS) Guidelines.
- United Nations, Transport of Dangerous Goods - Model Regulations.

Explosives and other hazardous materials will be transported by a suitably licensed and reputable carrier. Management of risks and emergency response to spills or accidents during the transport of hazardous materials and dangerous goods will be the responsibility of the carrier.

14.6 ENVIRONMENTAL MANAGEMENT PLAN

Detailed and additional management measures are presented in TABLE 14-1.

TABLE 14-1: ENVIRONMENTAL MANAGEMENT PLAN FOR THE MATAMBO OPEN PIT PROJECT

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
1	**IMPLEMENTATION**		
1.01	**SYSTEMS, POLICIES, PLANS AND PROCEDURES**	➲ A management system/s for the continuous monitoring and improvement of safety, health and environmental performance on the site will be developed and implemented. ➲ Policies, plans, and procedures detailing BMMC's commitments, company SHE targets, and management requirements will be developed and implemented throughout the LOM.	Construction / Operation / Decommissioning / Closure
1.02	**PERSONNEL**	➲ An appropriate number of qualified and experienced personnel will be appointed to monitor the implementation of this ESMP.	Construction / Operation / Decommissioning / Closure
1.03	**BUDGET**	➲ Sufficient budgetary allocation will be provided on an annual basis for the implementation of the environmental function on site.	Construction / Operation / Decommissioning / Closure
1.04	**PERFORMANCE REVIEW AND REVISION**	➲ A performance review will be undertaken at least every year to review the effectiveness of the mitigation measures in this ESMP. ➲ The ESMP will be revised as may be needed to ensure that the objectives of the ESMP are met.	Construction / Operation / Decommissioning / Closure
2	**GENERAL ENGINEERING DESIGN CONTROLS**		
2.01	**GENERAL**	➲ All water will be recycled where possible ➲ Flow meters will be installed in key water transfer areas to determine flows and detect leaks. ➲ A maintenance will be conducted to ensure piping and pumping equipment is in a good working order and does not result in unnecessary losses. ➲ Closure considerations will be reviewed and incorporated into the detailed engineering phase. ➲ A detailed decommissioning and closure plan will be developed as part of the operational activities and the plan will be reviewed every 12 months. ➲ Site engineering designs will ensure a free-draining environment in areas not affected by subsidence.	Construction and Operation
2.02	**BUILDINGS AND STRUCTURES**	➲ Structures will be painted in natural tones corresponding to the surrounding environment. At the base of the structures, earth colours should be used, fading into lighter colours merging with the skyline. Pure whites, blacks and bright colours should be avoided. ➲ To reduce the potential of glare, external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade. Shiny or bare metal should be avoided where possible.	Construction and Operation
2.03	**ACCESS AND HAUL ROADS**	➲ Access roads will require an effective dust suppression program, such as regular wetting that will retain moisture in the road surface.	Construction and Operation

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ Ensure water is safely removed off the surface of the road and released into the environment without resulting in erosion or siltation.	
2.04	**BUNDING**	➲ Bunding of areas for the storage and use of hydrocarbons (oil, fuel, etc.) will be constructed. The bunded volume is to be calculated at 110% of the total volume of the storage facility.	Construction
2.05	**BORROW PITS, SAND PITS AND QUARRIES**	➲ Aggregate materials will only be obtained from sources with the appropriate permits in place.	Construction and Operation
2.06	**WASTE ROCK DUMP**	➲ The Waste Rock Dump (WRD) Facilities to be constructed to the specified parameters of 33-degree face angle, benches at vertical intervals of 20 meters, and berm width of 20 meters. Ensure that the WRD is graded in order to minimize the potential for slope failures or rill erosion, facilitate rehabilitation activities (seeding, mulching), and provide a surface that will enhance water retention and support vegetation. ➲ Rehabilitation of the side slopes will be carried out concurrently once each lift is completed where possible. At closure the final slopes and crest will be rehabilitated. ➲ The top of the WRD and remaining safety benches will be graded to promote runoff of water (free draining), prevent ponding or impounding of water and limit erosion. Angular features, including tops and edges of the WRD, will be rounded. Topsoil and growth media will be redistributed over the waste rock.	Construction Manager / Mine Manager
BIOLOGICAL			
3	**FAUNA AND FLORA**		
3.01	**LOSS OF EXISTING HABITAT**	➲ Clearings associated with construction to occur in as small a footprint as possible. Surrounding vegetation outside the development footprint may not be disturbed; ➲ Construction camps & lay down areas should be erected on already disturbed surfaces where no vegetation clearing or soil disturbance is required; ➲ Upgrading of existing roads/servitudes should be preferable and take priority over the construction of new roads/servitudes. In addition, in the event that construction of new roads/servitudes are unavoidable, disturbed areas (e.g. fallow land or secondary forest lands) should be prioritized over ecologically intact areas (primary forests); ➲ Consider layout and site alternatives for the proposed development infrastructure to avoid or limit interaction with sensitive habitat types, which needs to be assessed and compared in order to select the option with the lowest impact; ➲ Buffer zones must be allocated to sensitive or important habitat features to alleviate the effect of habitat loss, habitat fragmentation, disturbances, increased isolation and edge effects. No vehicles or personnel are allowed to enter these areas;	Construction and Operation

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ Re–vegetation where required after clearance should commence immediately after the construction phase; ➲ Re–vegetation as part of the rehabilitation phase post–mining is critical to attempt re–establish the baseline environment pre–mining conditions; ➲ An environmental induction for all staff members must be mandatory in which specific issues related to the potential of fire are addressed e.g. only smoking in designated areas, no open cooking fires etc. Rules of mine regarding safety should be adhered to at all times. ➲ All environmentally sensitive areas should be demarcated and relayed to personnel as no-go areas; ➲ An appropriate Biodiversity Action Plan (BAP) and community–based Ecosystem Services and Corporate Social Responsibility (CSR) project implementation is recommended before commencement of project activities in order to both avoid, minimise and mitigate the aforementioned impacts, preferably leading to a net improvement of the ecosystem integrity of the project area of influence; and ➲ Biodiversity Offset Plans (BOP) represent the last resort within the mitigation hierarchy and should be implemented under the auspices of the "net gain" and "like–for–like" principle where it is unavoidable that identified IFC PS6 Critical Habitat will be lost through project activities.	
3.02	**DIRECT MORTALITY**	➲ All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) while within the project area during the construction and operation phases. Speeding fines/penalties must be awarded to offending drivers, or speed restriction bumps should be erected along the access roads to reduce the speed of all vehicles; ➲ Road mortalities should be monitored by both vehicle operators (for personal incidents only) and the ECO (all road kill on a periodic monitoring basis as well as specific incidents) with trends being monitored and subject to review as part of the monthly reporting. Monitoring should occur via a logbook system where staff takes note of the date, time and location of the sighting/incident. This will allow determination of the locations where the greatest likelihood exists of causing a road mortality and allow mitigation against it (e.g. fauna underpasses, and seasonal speed reductions mentioned above). Finally, mitigation should be adaptable to the onsite situation which may vary over time; ➲ Reduce direct mortalities by allowing for fauna to cross the roads, particularly where the roads cross a sensitive natural habitat (e.g. streams). This can be achieved by constructing fauna underpasses under the roads (large culverts or large open–ended concrete pipes laid into the raised roads). These underpasses should be used in conjunction with "fauna barriers" which prevent the most susceptible small fauna from crossing the roads on the surface by directing them towards the underpasses where they can cross under the roads safely. It is important to note that utilization of underpasses is strongly dependent on animal body size (larger culverts are more successful) and the surrounding habitat;	Construction, Operation and Decommissioning

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ All staff operating motor vehicles must undergo an environmental induction training course that includes instruction on the need to comply with speed limits, to respect all forms of wildlife (especially reptiles and amphibians), not to transport any wildlife products or civilians carrying wildlife products and, wherever possible, prevent accidental road kills of fauna. Snakes should only be handled after inductions have taken place due to the risks of envenomation. Drivers not complying with speed limits should be subject to appropriate penalties; ➲ An environmental induction for all staff members must be mandatory in which the value and importance of biodiversity is communicated and embedded within the working culture; and ➲ BAP and CSR projects must be associated with project activities in order to prevent an imbedded culture if illegal biodiversity exploitation activities and rather promote sustainable ecosystem services.	
3.03	**DISRUPTION/ALTERATION OF ECOLOGICAL LIFE CYCLES DUE TO RESTRICTION OF SPECIES MOVEMENT**	➲ Excavated trenches must be left open for as short a time as possible to avoid acting as dispersal barriers or traps; ➲ All open excavated trenches must have at least one of the slopes with an angle of less than 45° to allow for trapped fauna to crawl out; ➲ Barriers that restrict fauna from falling into excavated pits or accessing contaminated water should be erected; ➲ Natural pathways such as watercourses should be left unobstructed such as to serve as a corridor to ensure safe movement of species across the landscape; and ➲ All unnecessary fences and barriers must be removed when the mine is decommissioned.	Construction, Operation and Decommissioning
3.04	**DISRUPTION/ALTERATION OF ECOLOGICAL LIFE CYCLES DUE TO NOISE, DUST AND LIGHTING**	➲ Equipment with reduced noise emissions or mufflers are preferred; ➲ A dust monitoring system should be implemented during the construction phase to monitor effectiveness and necessity for suppression efforts (see below); ➲ Water or dust control agents should be used in working areas and roads will be sprayed for dust suppression on a regular basis in designated susceptible areas during periods of heavy dust generation; ➲ Water abstraction for dust suppression should be made from sustainable sources such as artificial impoundments or designated aquifers. No pollution of these water sources can be tolerated and quarterly testing of abstraction sites must take place as part of the EMP. All necessary permits and legislative requirements required for the abstraction of water should be adhered to. ➲ Reduce exterior lighting to levels that are necessary for safe operation, and implement operational strategies to reduce spill light. Use non–UV lights where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators; ➲ Keep noise levels suppressed as per best practice or national standards. Do not unnecessarily disturb faunal species, especially during the breeding season and those with juveniles;	Construction, Operation and Decommissioning

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ All lighting should be orientated away from intact forest and watercourse habitat in order to minimise displacement effects of strong lighting; ➲ Existing barriers should be in place that keep fauna species away from the existing facilities. These fences should be maintained in order to ensure fauna species do not gain access to the construction site unnecessarily where they can be hurt or killed; and ➲ All staff should be subjected to an induction training program where appropriate conservation principles, safety procedures, snake bite avoidance and first aid treatment are taught. Several staff members should complete a snake handling course in order to safely remove snakes from construction areas, and these staff must be onsite and available to respond to calls and safely remove and relocate snakes if necessary.	
3.05	**CONTAMINATION AS A RESULT OF EROSION AND WATERCOURSE SILTATION/SEDIMENTATION**	➲ Implementation of a stormwater management plan with best practice erosion and sedimentation control mechanisms (traps or dams) to prevent unnecessary sedimentation in natural watercourses; ➲ Appropriate design and maintenance of roads to limit eroded rainwater runoff and / or trap such runoff before it enters natural watercourses; ➲ Implementation of earthworks and waste rock/soil storage plan where eroded runoff is captured and managed according to best practice standards; and ➲ Creation of operations management plan for stochastic erosion events as well as ongoing monitoring programs.	Construction, Operation and Decommissioning
3.06	**WATERCOURSE HYDROCARBON CONTAMINATION**	➲ Zero tolerance for hydrocarbon spillage next to the watercourses – all mining activities within 50 m of any aquatic habitat to be prohibited; ➲ No vehicles or machinery are allowed within the buffer areas (50 m) of the watercourse. Predetermined areas should be indicated where vehicles and machinery are to be stored, repaired and refuelled within a bunded area; ➲ Use of drip trays positioned under stationary vehicles to collect hydrocarbons is mandatory at all times; ➲ Implementation of rapid response emergency spill procedures to deal with spills immediately, including training of staff to deal with such instances; and ➲ Ongoing monitoring of presence of hydrocarbons in the watercourses should be done by an aquatic specialist as well as monitoring of the avifauna and herpetofauna assemblages within potentially affected watercourses.	Construction, Operation and Decommissioning
3.07	**INTRODUCTION OF ALIEN FAUNA AFFECTING NATIVE FAUNAL ASSEMBLAGES DUE TO HABITAT TRANSFORMATION**	➲ Alien fauna on site should be subjected to an aggressive and environmentally friendly eradication program prior to construction; ➲ Any remaining alien fauna post–construction should be monitored and eradicated as part of the management plan;	Construction, Operation and Decommissioning

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ Waste management (especially food and sewerage waste) must be subject to a comprehensive analysis and management plan review. Incineration of food waste is ideal but is subject to appropriate permitting procedures; ➲ Continuous monitoring of the growth and spread of alien fauna coupled with an adaptive management approach to identify suitable control mechanisms, preferably non detrimental to native fauna (other rodents, owls). Eco–friendly control mechanisms such as the lethal and reusable Goodnature A24 rodent traps should be applied as solutions. ➲ Chemical control (e.g. fumigation of shipping containers) should take place on products such as wood before they are brought to the project location, to prevent inadvertently introducing alien/invasive invertebrates to the area; ➲ An alien invasive post–mining operations closure plan should be developed and implemented one year prior to mine closure. The site needs to be restored to its previous condition/land–use, which excludes alien and invasive fauna species..	
3.08	**INTRODUCTION OF ALIEN FLORA AFFECTING NATIVE FLORAL ASSEMBLAGES DUE TO HABITAT TRANSFORMATION**	➲ Alien flora on site should be eradicated prior to construction. Any remaining alien flora post–construction should be monitored as part of the alien and invasive species monitoring and eradication action plan and controlled accordingly; ➲ Disturbance of natural areas should be avoided and the spread of alien flora into natural areas should be monitored and controlled (as per the alien invasive management plan); ➲ Continuous monitoring of the growth and spread of alien flora coupled with an adaptive management approach to identify suitable control mechanisms, preferably mechanical for such a small area. No chemical control should take place within 50 metres of any aquatic habitat; ➲ No planting of alien invasive species as part of landscaping and / or bio control. Only trees indigenous to the vegetation unit and endemic to the area may be planted, even if for visual purposes only. This should be indicated prior to development and approved by the competent authority; and ➲ Rehabilitation post–mining operations should include an alien and invasive species monitoring and eradication action plan, in order to ensure that the spread and establishment of alien and invasive species are controlled and monitored (starting from the operational phase of the mine) and that disturbances post–mining are minimal and mitigated where necessary. The site needs to be restored to its previous condition/land–use, which excludes alien and invasive species.	
PHYSICAL			
4	**GEOHYDROLOGY**		
4.01	**GENERAL**	➲ Implementation of good housekeeping practices to prevent spillage of substances which may contaminate groundwater, for example at the workshop areas, camp and explosives magazine.	Construction, Operation and Decommissioning

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		These practices to include the storage of hazardous substances on paved or lined surfaces and the containment of hydrocarbons in oil traps. ➲ Hydrocarbon or chemical spills should be contained and remediated as soon as possible to prevent any seepage into groundwater.	
4.02	**OPEN PITS**	➲ Monitoring of groundwater levels and quality around the open pit areas. ➲ Measurement/calculation and record keeping of mine dewatering volumes should take place. ➲ Settlement of suspended solids should take place before discharge into the environment. The mine should consider downstream settlement dams. ➲ Mine water quality should be monitored and should be compared to Liberian Third Schedule - Part B (2018) an IFC Mining Effluent Guidelines (2007).	Operation
		➲ Update the post-closure scenario with the latest hydrogeological and geochemical data. Re-evaluate open pit flooding, pit-lake development and water quality.	Decommissioning
4.03	**WASTE ROCK DUMPS AND HEAP/LEACH – ORE STOCKPILES**	➲ Undertake geochemical tests to assess waste rock leachate characteristics. ➲ Undertake contaminant transport modelling to assess the potential groundwater risk.	Pre-implementation
		➲ Ponding of runoff and seepage in unlined areas should be avoided. ➲ The footprints of waste/or laydown areas should be compacted and where possible sealed with more clay-rich material. ➲ Active deposition areas should be minimised and shaping, contouring and compaction of waste should be prioritised (where possible concurrent rehabilitation). ➲ Monitor groundwater quality and water levels. All downstream surface water sources should also be monitored.	Operation
		➲ Rehabilitate potential contaminant soil below ore stockpile areas. ➲ Rehabilitation of the waste dumps, including final sloping, and consider the feasibility of capping and vegetation to reduce rainfall ponding and recharge into the material. ➲ It is recommended to cap the waste rock with upper saprolitic waste rock, and topsoil.	Decommissioning
5	**STORMWATER MANAGEMENT**		
5.01	**FLOODING OF THE EXISTING PIT AND SCOURING OF THE WRD EDGE**	➲ Ensure the diversion channels are designed based on the 1:50 year flood peaks ➲ Stormwater (contact water portion such as runoff) and waste rock seepage should be managed to minimise subsurface seepage.	
6	**SOILS AND LAND CAPACITY**		
6.01	**DELINEATION OF AREAS TO BE STRIPPED**	➲ Stripping will only occur where soils are to be disturbed by activities that are described in the design report, and where a clearly defined end rehabilitation use for the stripped soil has been identified.	Construction

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
6.02	**STRIPPING AND HANDLING OF SOILS**	➲ Soils will be handled in dry weather conditions so as to cause as little compaction as possible, and under low wind speed conditions wherever possible to reduce erosion. ➲ The "Utilizable" soil will be stripped until hard rock is encountered. These soils will be stockpiled together with any vegetation cover present (only large bushes to be removed prior to stripping). The total stripped depth should be 500mm, wherever possible.	
6.03	**DELINEATION OF STOCKPILING AREAS**	➲ Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas. ➲ Soils stockpile areas have been demarcated, and clearly marked to identify both the soil type and the intended area of rehabilitation.	
6.04	**STOCKPILE MANAGEMENT**	➲ Waste rock emplacement and benching of all stockpiles will be promoted. The purpose of this exercise will be to protect the soils and combat erosion by water and wind. ➲ Stockpiles will be established with storm water diversion berms to prevent run off erosion. ➲ Soil berm heights will be restricted where possible to <1,5m and stockpiles to <5m so as to avoid compaction and damage to the soil seed pool. Where stockpiles higher than 5m cannot be avoided, these will be benched to a maximum height of 15m. Each bench should ideally be 1.5m high and 2m wide. For storage periods greater than 3 years, waste rock cover is essential. It is recommended to keep the stockpile side slopes at a slope of 1 in 6. This will reduce run-off related erosion. ➲ No contaminated waste material will be placed on the soil stockpiles. ➲ Equipment movement on to of the soil stockpiles will be limited to avoid topsoil ➲ compaction and subsequent damage to the soils and seedbank.	Operation
6.05	**REHABILITATION OF DISTURBED LAND & RESTORATION OF SOIL UTILIZATION**	➲ Stockpiled soil will be used to rehabilitate disturbed sites either ongoing as disturbed areas become available for rehabilitation and/or at closure. The utilizable soil (300mm) removed during the construction phase of the development, shall be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the approved postmining land use (Rough grazing), and will attain a free draining surface profile. ➲ A representative sampling of the stripped soils will be analysed to determine the nutrient status of the utilizable materials. As a minimum the following elements will be tested for: EC, CEC, pH, Ca, Mg, K, Na, P, Zn, Clay% and Organic Carbon. These elements provide the basis for determining the fertility of soil. based on the analysis, fertilisers will be applied if necessary. ➲ Erosion control measures will be implemented to ensure that the soil is not washed away and that erosion gulleys do not develop prior to vegetation establishment. ➲ The rehabilitated area must be fenced, and all animals and people kept off the area. ➲ Newly rehabilitated areas must be protected against compaction and erosion. ➲ Traffic should be limited were possible	Decommissioning / Closure

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
6.06	**POLLUTION OF SOILS**	➲ If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bioremediation. The acceptability of this option must be verified by an appropriate soils expert on a case by case basis, before it is implemented. ➲ If in situ treatment is not possible or acceptable then the polluted soil must be classified and disposed of at an appropriate, permitted, off-site waste facility.	
7	**AIR QUALITY**		
7.01	**ELEVATED PM10 (INHALABLE PARTICLES) CONCENTRATIONS AS A RESULT OF MINING, TRANSPORT AND POWER GENERATION ACTIVITIES**	➲ It is recommended that air quality monitoring be conducted annually at the accommodation camp and at the nearest sensitive receptors along the haul road. Recommended pollutants to be sampled at these locations include $PM_{10/2.5}$, NO_2, SO_2 and dust fallout. ➲ Parameters and exposure times for subsequent monitoring campaigns should be adjusted based on the findings of previous monitoring campaigns (for example, if NO_2 and SO_2 concentrations are below the detection limit during the first campaign it would not be necessary to sample these pollutants during subsequent campaigns). ➲ It is recommended that a complaints register should be kept Communities should be encouraged to report environmental related concerns. It is recommended that quarterly engagement meetings be held with communities to identify any air quality related problems.	Operation
7.02	**ELEVATED PM2.5 (RESPIRABLE PARTICLES) CONCENTRATIONS AS A RESULT OF MINING, TRANSPORT AND POWER GENERATION ACTIVITIES**		Operation
7.03	**ELEVATED DUSTFALL RATES/ INCREASED DUST FALLOUT AS A RESULT OF MINING, MATERIAL HANDLING, TRANSPORT AND POWER GENERATION ACTIVITIES**		Operation
7.04	**INCREASED SO_2 CONCENTRATIONS AS A RESULT OF TAILPIPE EMISSIONS FROM VEHICLES AND OPERATIONS EQUIPMENT SUCH AS EXCAVATORS, BULLDOZERS, TRUCKS, FRONT END LOADERS, GRADERS, WATER TRUCK, FUEL TANKERS**		Operation
7.05	**INCREASED NO_2 CONCENTRATIONS AS A RESULT OF TAILPIPE EMISSIONS FROM VEHICLES AND OPERATIONS EQUIPMENT SUCH AS EXCAVATORS, BULLDOZERS, TRUCKS, FRONT END LOADERS, GRADERS, WATER TRUCK, FUEL TANKERS**		Operation

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
7.06	INCREASED CO CONCENTRATIONS AS A RESULT OF TAILPIPE EMISSIONS FROM VEHICLES AND OPERATIONS EQUIPMENT SUCH AS EXCAVATORS, BULLDOZERS, TRUCKS, FRONT END LOADERS, GRADERS, WATER TRUCK, FUEL TANKERS		Operation
7.07	INCREASED DPM CONCENTRATIONS AS A RESULT OF TAILPIPE EMISSIONS FROM VEHICLES AND OPERATIONS EQUIPMENT SUCH AS EXCAVATORS, BULLDOZERS, TRUCKS, FRONT END LOADERS, GRADERS, WATER TRUCK, FUEL TANKERS		Operation
7.08	INCREASED VOC CONCENTRATIONS AS A RESULT OF TAILPIPE EMISSIONS FROM VEHICLES AND OPERATIONS EQUIPMENT SUCH AS EXCAVATORS, BULLDOZERS, TRUCKS, FRONT END LOADERS, GRADERS, WATER TRUCK, FUEL TANKERS		Operation
7.09	POOR AIR QUALITY AS A RESULT OF TAILPIPE EMISSIONS FROM VEHICLES AND OPERATIONS EQUIPMENT SUCH AS EXCAVATORS, BULLDOZERS, TRUCKS, FRONT END LOADERS, GRADERS, WATER TRUCK, FUEL TANKERS		Operation
8	NOISE		
8.01	NOISE IMPACTS GENERATED MAY IMPACT ON THE SOCIAL ENVIRONMENT, ESPECIALLY VILLAGES ADJACENT TO THE MINING AREA AND HAUL ROUTE DUE	➲ Continuous monitoring required to ensure the efficacy of the implemented measures in keeping noise levels below 75db. ➲ All diesel-powered equipment and plant vehicles should be kept at a high level of maintenance; ➲ In managing noise specifically related to truck and vehicle traffic, efforts should be directed at:	Construction / Operation / Decommissioning

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
	TO MINING AND HAULING OPERATIONS, CONSTRUCTION OF SURFACE INFRASTRUCTURE, AND DECOMMISSIONING	➢ Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program. ➢ Maintain road surface regularly to avoid corrugations, potholes etc. ➢ Avoid unnecessary idling times. ➢ Minimising the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. ➲ A noise complaints register must be kept.	
8.02	**NOISE IMPACTS GENERATED MAY IMPACT ON THE SOCIAL ENVIRONMENT, ESPECIALLY VILLAGES ADJACENT TO THE MINING AREA AND HAUL AS A RESULT OF HAULING OF ROM TO NEW LIBERTY GOLD MINE**		Construction / Operation / Decommissioning
9	**BLASTING**		
9.01	**ALARM TO PEOPLE INSIDE THEIR HOMES AND POSSIBLE DAMAGE TO BUILDINGS DUE TO THE BLASTING**	➲ The blast timing designs must ensure that the MIC (maximum instantaneous charge mass) will keep ground vibration at a safe limit at artisanal workings. ➲ Notify the artisanal miners of each blast and, if there is a risk that vibration will exceed 5 mm/s for nearby artisanal workings evacuate all people from these workings when blasting. ➲ It will be necessary to stem all blastholes with coarse stemming material (example aggregate) and introduce delays into the presplit holes to mitigate air blast. The mitigation will help to bring the zone of influences to within 100 m from blasting. ➲ Fly rock must be controlled through adequate quality stemming and appropriate stemming length design in each blasthole and control needs to be applied to prevent the occurrence of over-charged holes. ➲ Care should be taken not to under-burden holes. In other words, holes close to free faces that could cause blow-outs from the free face of high energy gas need to be prevented. ➲ All people should be cleared to an exclusion zone of at least 500 m from any blast. However, the exclusion zone may need to be extended beyond 500 m if the rock quality and stemming control measures do not keep fly rock range limited. ➲ Any parts of Bangorma that are outside the pit limits should be relocated to a safer distance from the mine.	Construction
9.02	**HEALTH RISK TO NEARBY PEOPLE AND ANIMALS. HIGH IMPACT GREENHOUSE GAS**		Construction / Operation
9.03	**NITROGEN CONTENT IN GROUND WATER AND RUN-OFF INCREASES AS A RESULT OF STORAGE AND USE OF EXPLOSIVES**		Construction / Operation
10	**SOCIAL**		
10.01	**GENERAL**	➲ A Social Impact Register collating applicable site-specific social constraints and associated mitigation measures shall be developed for the project to help detail implementation and to support the compliance assurance process. ➲ The Registers shall be used to assist the Project's management team in the implementation of social commitments and to serve as tools for ensuring the supervision of implementation.	

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ The Register shall be reviewed and updated annually.	
10.02	**HEALTH AND SAFETY**	➲ A community health and safety committee will be established by BMMC representatives from the community and other relevant stakeholders. The committee will meet at least quarterly to discuss health and safety concerns. ➲ Site security measures will be in place to ensure that community-members only access the site in accordance with the site access plan. ➲ Appropriate signage will be erected across the site, including boundary fences, to inform people of the dangers and risks applicable to the site activities.	Construction / Operation / Closure
10.03	**GRIEVANCE PROCEDURE**	➲ The grievance procedure aims to address, manage, and resolve stakeholder grievances, concerns, complaints, and requests related to the project activities and to ensure that project owners are aware of and respond to stakeholder concerns. ➲ The grievance resolution process was established and is incorporated into this SIMP to mitigate high-risk grievance cases and livelihoods impacts.	Construction / Operation / Closure
10.05	**VULNERABILITY**	➲ Continuously monitor, identify, track, and follow up all vulnerable groups to ensure that they all have equal access to, and can benefit from, project interventions. ➲ Design and implement interventions to ensure that the execution of livelihood activities will minimize negative project-related impacts while being able to accommodate socially displaced groups.	Construction / Operation / Closure
11	**WASTE MANAGEMENT**		
11.01	**SEPARATION**	➲ To encourage the separation of waste at source into general/hazardous and recyclable and non-recyclable fractions of waste, easily distinguishable waste receptacles (skips, drums and bins) will be provided at designated positions within the mine administrative complex. ➲ Waste types will not be mixed, blended or otherwise treated unless it is to improve the potential for the waste to be re-used, recycled, recovered, treated or to reduce the risk associated with the management of the waste.	Pre-construction / Construction / Operation / Closure
11.02	**REUSE**	➲ Access to removed vegetation by local authorities and community members will be managed by the mine in a controlled manner at a designated site indicated on the mine site layout plan. ➲ Opportunities for the reuse of waste streams will be considered on an ongoing basis throughout the life of the operation. Specific waste streams for which reuse opportunities will be considered include the following: ➢ Clean building rubble, bricks and other construction materials; ➢ Wood pallets, wood poles and other clean wood products; ➢ Clean plastic and steel containers; ➢ Uncontaminated run-off water; and	Pre-construction / Construction / Operation / Closure

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➢ Grey water use from sewage package plants. ➲ Following segregation at source, the following waste streams will be temporarily stored and made available for recycling by approved contractors: ➢ Used oil, petrol and diesel; ➢ Scrap metal; ➢ Garden waste; and ➢ Steel containers.	
11.03	**STORAGE**	➲ A safety data sheet will be prepared for each waste stream classified as hazardous and the sheet will be displayed at the most appropriate location in closest proximity to the waste storage facility. ➲ At a frequency dependent on the waste type, drums/bins will be emptied into corresponding skips. Monthly inspections will be undertaken in each section of the mine to ensure that the separation of waste is taking place at source. ➲ Any container or storage facility holding hazardous waste will be labelled to reflect details of the contents and date of storage. ➲ Any hazardous waste which is stored in such a manner that it cannot be labelled will have a record reflecting the date and quantities of waste placed in the waste storage facility and the cumulative quantity of waste stored in the facility. ➲ Records of dates and quantities of all hazardous waste which is temporarily stored and periodically removed offsite will be maintained.	Pre-construction / Construction / Operation / Closure
11.04	**TREATMENT**	➲ On-site treatment of waste will be limited to the following: ➢ Thermal treatment (high-temperature incineration) of waste; ➢ Chemical and physical treatment of water before discharge (if necessary); and ➢ Chemical and microbial treatment of hydrocarbon spills and leaks. ➲ A high temperature incinerator will be used for all combustible waste generated on-site which cannot be re-used or recycled.	Pre-construction / Construction / Operation / Closure
11.05	**DISPOSAL**	➲ Waste material from drains and sumps in vehicle wash bays and vehicle servicing areas will be removed on a regular basis. This material will be managed as hazardous waste.	Pre-construction / Construction / Operation / Closure
11.06	**TRANSPORTATION**	➲ No transboundary transportation of waste will be undertaken. ➲ Waste management contractors appointed, or in-house vehicles selected to remove waste from the site will collect the waste from each applicable storage area/waste receptacle at a time and frequency suitable for the relevant waste type (where applicable). ➲ Site personnel will inspect the waste transportation vehicle/s to ensure that the vehicle is suitable for the type of waste to be transported.	Pre-construction / Construction / Operation / Closure

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ Prior to leaving the site, site personnel will ensure that waste transporters with a hazardous waste consignment have provided a waste manifest document containing the following information: ➢ Name of transporter; ➢ Address and telephone number of transporters; and ➢ Declaration acknowledging receipt of the waste.	
11.07	**TRAINING**	➲ Waste management training summarizing the requirements for the management of non-mineral waste on the site will be included in the site induction training programme.	Pre-construction / Construction / Operation / Closure
11.08	**RECORD-KEEPING**	➲ The waste management records will be retained for a period of at least 5 years and will be available for review and inspection during audits or upon request by government departments. ➲ Waste management records will be maintained for all waste generated on the site. These records will reflect at least the following: ➢ the quantity of each waste generated; ➢ the quantities of each waste that has either been re-used, recycled, recovered, treated, or disposed of; and ➢ location and by whom each waste was re-used, recycled, recovered, treated, or disposed of.	Pre-construction / Construction / Operation / Closure
12	**HAZARDOUS SUBSTANCES MANAGEMENT**		
12.01	**RISK**	➲ A risk assessment approach will be followed for the management of all hazardous substances. This approach will comprise of the following broad steps: ➲ Identify the hazardous substances on-site; ➲ Assess the health and other hazards and risks which the hazardous substances present; ➲ Develop control measures to reduce exposure; ➲ Monitoring and auditing to review the effectiveness of controls; and ➲ Implement changes where necessary.	Pre-construction / Construction / Operation / Closure
12.02	**ENGINEERING CONTROLS**	➲ Secondary containment e.g. drip trays appropriate to the hazardous substance will be provided for all hazardous materials containers, at connection points and at other possible overflow points. ➲ For all above ground storage tanks (including the petroleum tanks): ➲ The tanks will be fitted with gauges to measure the volume inside the tanks; ➲ Dripless hose connections will be used for vehicle tanks and fixed connections will be used with storage tanks; ➲ Automatic fill shutoff valves will be installed on storage tanks;	Pre-construction / Construction / Operation / Closure

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
		➲ Secondary containment structures appropriate to the hazardous substance for which it is designed to safely hold. These structures will be capable of holding the larger of 110% of the largest tank volume or 25% of the combined tank volumes. The secondary containment design will not permit the mixing of incompatible substances; ➲ Provision of overfill or over pressure vents to allow controlled release to a capture point; ➲ Transfer or filling points will have impervious surfaces to prevent loss to the environment.; and ➲ Oil water separators will be installed at all transfer or filling points and an approved contractor will be appointed to clean the separators at an appropriate frequency. ➲ All hazardous materials will be managed, handled, stored and disposed of as per the requirements of the MSDS information.	
12.03	**POLICIES AND PROCEDURES**	➲ Written procedures will be compiled for the handling, transfer, storage and use of all hazardous substances. ➲ Hazard warning signs will be clearly displayed at the entrance to all danger areas, magazines and other areas where hazardous substances are stored.	Pre-construction / Construction / Operation / Closure
12.04	**SAFETY EQUIPMENT**	➲ Fire-fighting appliances and emergency equipment will be provided in such a manner that it is visible, accessible and available for use when required. ➲ Appropriate PPE will be provided to all personnel required to handle hazardous substances on site.	Pre-construction / Construction / Operation / Closure
12.05	**TRAINING**	➲ Hazardous substances training summarizing the requirements for the use of hazardous substances on the site will be included in the site induction training programme.	Pre-construction / Construction / Operation / Closure
12.06	**RECORD-KEEPING**	➲ A hazardous substances register will be maintained on-site with at least the following details: ➢ Product name; ➢ MSDS date; ➢ Classification in terms of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS); ➢ On-site use of the substance; ➢ Procedure to be followed in the case of an accident involving exposure to the substance or release to the environment; ➢ Supplier contact details; and ➢ Storage location.	Pre-construction / Construction / Operation / Closure
13	**OCCUPATIONAL HEALTH AND SAFETY**		

REF	ASPECT/ACTIVITY/POTENTIAL IMPACT	EXPLANATION AND PROPOSED MITIGATION MEASURE	PROJECT PHASE
13.01	**GENERAL**	➲ A Health and Safety Management System will be implemented on-site to ensure effective management of health and safety aspects. ➲ Avoidance measures and engineering controls will be put in place where practicable to try and remove hazards to workers and community members. ➲ All control measures will be based on the hierarchy of control, which requires, in order of preference: ➲ Remove the hazard; ➲ Policies and procedures; and ➲ Personal protective equipment (PPE).	Construction / Operation / Decommissioning / Closure
13.02	**TRAINING**	➲ Health and safety training programs for all employee groups (management, supervisor, new hire, refresher and contractor) relative to the type of work to be conducted will be developed and implemented. ➲ Employees and contractors at the Project site will be trained in all aspects of their work environment, hazard recognition, first aid, personal hygiene, electrical safety, rigging and lifting, vehicle safety, fire safety, safety practices for working around machinery with moving parts and other topics that may relate specifically to a job assignment or physical location at the Project.	Construction / Operation / Decommissioning / Closure
13.03	**PPE**	➲ PPE will be mandatory for all activities based upon a job risk assessment. At a minimum, all employees will be required to wear hard-hats, steel-toed boots, safety glasses and reflective clothing in designated work areas. Rubber gloves, rubber arm protectors, rain suits, face shields, splash goggles, safety belts and lanyards, dust respirators, hearing protectors, welding hoods and goggles and high voltage insulated gloves will be available and required where appropriate.	Construction / Operation / Decommissioning / Closure

14.7 SOCIAL MANAGEMENT PLAN

The Social Impact Assessment and Management Plan (SIMP) plays a critical role in ensuring that the commitments detailed in this ESIA is operationalized through effective management planning.

The SIMP describes the Project framework for social impact management over the life of the project from construction, through operation and closure. The SIMP identifies the likely scale and nature of impacts in relation to land access, livelihoods and construction and mining activities.

It describes the integrated impact management programs which ensure consistent and effective management of social impacts throughout the project:

- Mine Safety;
- Employment and Social Development;
- Environmental Management; and
- Grievance Management.

The SIMP also identifies processes that address associated areas of social impact:

- Stakeholder Engagement Plan
- Social, enviromental and infrastructure management

The SIMP should describe the project's social performance monitoring and compliance assurance, including monitoring, audit, and inspection programs; the establishment of constraints and mitigation measures; and the identification of non-conformances and required corrective actions.

14.7.1.1 Community Disturbances

Standard mitigation measures such as dust suppression by water spraying will be applied where dust generating activities like transport on unpaved roads take place in the immediate vicinity of settlements.

Noise and vibration impact will be assessed through dispersion modelling and may be mitigated by scheduling these activities to the least noise-sensitive times of the day and prior notices means of informing residents prior to such activities.

In terms of blasting, communities situated with 500m of the fly rock will be temporarily removed. Construction mitigations in these circumstances include ensuring that all equipment is not running simultaneously, or for long periods, and that structural surveys are undertaken in advance of works to monitor any unforeseen impacts.

14.7.1.2 Vulnerability

The project will pay particular attention to the needs of vulnerable persons across all areas of project construction and operations. Vulnerable persons may be defined as those people who by virtue of gender, ethnicity, age, physical or mental ability, economic or social status, may be more adversely affected by the project activities more than others, and who may be limited in their ability to claim or take advantage of direct assistance and project-related development benefits. Key groups identified as vulnerable within the project area include:

- Women;
- Physically Challenged; and
- Children.

International statues and guidelines require that the Matambo project is aligned with provisions specifically that attention be paid to the needs of the poor and vulnerable in the project communities. The project will identify individuals and groups whose welfare may be differentially or disproportionately diminished by the project because of their disadvantaged or vulnerable status and, where such groups are identified, propose, and implement measures to mitigate adverse impacts on these groups.

14.7.2 Environmental Management

Mitigation of the impacts of the project on the local environment is discussed earlier in this chapter.

14.7.3 Grievance Management

BMMC has a grievance mechanism policy in place, which provides communities with a means of expressing concerns and formally lodging complaints about any aspect of project activity and a clear channel to redress for adverse impacts. The grievance procedure aims to address, manage, and resolve stakeholder grievances, concerns, complaints, and requests related to the project activities and to ensure that project owners are aware of and respond to stakeholder concerns.

The grievance management framework outlines the principles of grievance management and defines the organizational structure and processes required to implement a functional, effective, and culturally appropriate grievance mechanism that is responsive to stakeholder needs.

The procedure for managing grievances will be updated to incorporate lessons learned or to introduce efficiencies in the procedure. The procedures also outline the methods by which the project owners receive grievances, such as email, letters, text, phone, in-person. The grievance mechanism is communicated in a format and language readily understandable to the local population. To ensure that all stakeholders are aware of how to submit grievances, the project will also create additional grievance communication materials such as posters and pamphlets as well as an engagement plan for the grievance and provide stakeholders a phone number directly to the community relations department.

All grievance information shall be recorded in the Stakeholder and Grievance Management Register (SGMR), which shall include all grievance history as well as current grievances that arise during all phases of the project.

14.8 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring will be undertaken to determine the impact and change of the environment as a result of site activities. A summary of the monitoring that will be undertaken throughout the life of the mine is presented in the sections below.

14.8.1 Inspections

Environmental inspections will be conducted on a daily and weekly basis according to a defined list, compiled according to site-specific activities. On a monthly basis, the Environmental Manager or Superintendent will perform a formal compliance audit of the site. Non-compliances observed during inspections and quarterly audits will be recorded in a non-compliance register that will specify the date on which the non-compliance will have to be corrected. The results of the monthly compliance audits will be recorded in the Project Management Progress Reports, to determine the overall trend in terms of environmental compliance of the site. Incidents and non-conformities identified by the inspections will be recorded in the logs.

14.8.2 Aftercare And Maintenance

A budget will be provided for monitoring and maintenance of vegetation establishment as well as for wastewater treatment and environmental monitoring after closure of the site.

14.8.3 Post Closure Environmental Monitoring

Environmental monitoring data (surface and groundwater, air quality, noise, soils, etc.) will be collected and analysed, and monitoring reports will be compiled for a period of 3 years covering:

- the phase of dismantling and reclamation of the Project; and
- the completion of the decommissioning; and
- closure phase.

14.9 RECORD-KEEPING

The following registers will be kept maintained:

- Project permits and licenses;
- ESIA and ESMP;
- All matters related to compliance monitoring, environmental performance and ESMP implementation;
- HSE attendance records and HSE training material;
- A list of all persons receiving job-related training;
- Environmental monitoring and verification data / reports and results of inspections performed;
- Copies of all written ESMP instructions / approvals / exemptions issued to contractors;
- The approved method statements and codes of practice for specific activities and facilities;
- Waste management files;
- Maintenance records of vehicles and equipment;
- Maintenance and inspection of all safety equipment, e.g. fire extinguishers;
- Photographic documents of the development and restoration of the site;
- A properly completed and signed environmental incident / non-compliance report for each incident or environmental non-compliance reported;
- An up-to-date register of external communications;
- Completed and updated form and register of complaints and external grievances for each external complaint received;
- A register of contacts in case of emergency;
- A register of dangerous substances and the associated Material Safety Data Sheets.

14.9.1 Monitoring Plan

There is a monitoring programme in place within the BMMC-MDA. A summary of the monitoring which will be undertaken throughout the LoM is presented in TABLE 14-2. The details and location of the existing monitoring points within the project area, which will continue to be monitored, are provided in TABLE 14-3 and MAP 14-1, they include 2 additional monitoring points at the WRD East and the low grade ore stockpile, as well as 2 existing wells at the Bangorma village.

TABLE 14-2: MONITORING PLAN FOR KEY ENVIRONMENTAL PARAMETERS

ASPECT	METHODOLOGY	MONITORING LOCATIONS	MONITORING FREQUENCY
SURFACE WATER QUALITY	Grab samples	➲ Pond where dewatered from open pit is stored; ➲ Discharge point of water; ➲ WRD; ➲ Mafa River	Quarterly (Physical and micro-elemental analysis) Quarterly (Bacteriological)
AIR QUALITY (DUSTFALL, PM_{10}, $PM_{2.5}$, NO_2, VOCS)	Dust buckets (Dustfall) Passive diffusive tubes	➲ Accommodation Camp as well as near sensitive receptors along the haul road.	Annual
GROUNDWATER QUALITY	Grab samples	➲ Sampling of groundwater quality should be quarterly. Mine water discharge should, however, be monitored monthly. Also see the monitoring parameters below for further information. ➲ Borehole water level monitoring should be monthly. ➲ Recommended parameters to be analysed are summarised below: o General chemistry such as pH, TDS and EC, alkalinity; o Major and minor inorganic elements such as calcium, magnesium, sodium, potassium, sulphate, nitrate, nitrite, ammonium, fluoride, chloride, ortho-phosphate; and o Trace inorganic elements including aluminium, antimony, arsenic, barium, boron, cadmium, chromium (total), copper, iron, lead, manganese, mercury, nickel, selenium, cyanide (total and free), zinc. o Total Suspended Solids (TSS) in open pit water monthly. o Oil and grease, chemical oxygen demand (COD) and biological oxygen demand (BOD) could be monitored every six months for open pit water.	Quarterly (Physical and micro-elemental analysis) Quarterly (Bacteriological)
NOISE	Noise monitoring equipment	➲ Accommodation Camp	Weekly (Daytime and Night-time)
TERRESTRIAL FAUNA AND FLORA	Field survey	➲ Selected sites across the mine concession areas	Annual
GEOCHEMISTRY	Composite Sampling	➲ Selected streams within the mine concession area	Every 2 years, if changes occur.
PIT WALL STABILITY	Observation and measurement	➲ Pit walls	Quarterly, or as required, depending on the geotechnical conditions

TABLE 14-3: MATAMBO MONITORING POINTS

SAMPLE REFERENCE	DESCRIPTION	COORDINATES	
		LATITUDE	LONGITUDE
NOISE / AIR QUALITY			
AN4	At Korma Sokporjah Village	7.072839	-11.203298
AN1	At Bangorma Village	7.080968	-11.210688
AN3	At Gogoima Village	7.087098	-11.234224
AN6	At Massakpa 2 Village	7.068493	-11.236669
GROUNDWATER			
MHB1	Water level and Quality - Pit 2	7.078855	-11.226282
MHB2	Water level - Pit1	7.081990	-11.215330
MHB3	Water level and Quality – Pit 1 and 2	7.076819	-11.221024
MHB4	Water level - Pit1	7.080170	-11.219755
MHB5B	Water level and Quality – Pit 1	7.078015	-11.210841
MHB9	Water level and Quality – WRD East/Center	7.070970	-11.217385
MHB10	Water level and Quality – Heap leach stockpile	7.072947	-11.223584
MTB-15	Water level - Pit1, Bangorma	7.083619	-11.214594
MTB-17	Water level - Pit1, Bangorma	7.081797	-11.211314
MHB6	Water level and Quality – Pit 3	7.070637	-11.245371
MHB7	Water level and Quality – Pit 3	7.070589	-11.249686
MHB8	Water level and Quality – WRD West	7.074441	-11.245751
SURFACE WATER			
MTB OPC SW01	Korma Village	7.072132	-11.1972
MTB OPC SW02	Korma Village	7.071758	-11.1998
MTB OPC SW03	Gogioma Village	7.088591	-11.2335

SAMPLE REFERENCE	DESCRIPTION	COORDINATES	
		LATITUDE	LONGITUDE
MTB OPC SW04	Massakpa Village	7.064629	-11.2353
MTB OPC SW05	Massakpa Village	7.066785	-11.2342
MTB01	Surface Water	7.072228	-11.1998
MTB02	Surface Water	7.076883	-11.1845
MTB08	Surface Water	7.069353	-11.202
MTB09	Surface Water	7.071186	-11.244
MTB11	Surface Water	7.085109	-11.2171
MTB16	Surface Water	7.0826	-11.2124
MTB18	Surface Water	7.078318	-11.2138
MTB19	Surface Water	7.078085	-11.2191
MTB20	Surface Water	7.075484	-11.2224

14.9.1.1 Vibration and blasting

Vibration amplitudes will depend on the charge mass per hole, the initiation system used, and the design applied by a blasting engineer. The engineer must control these variables so that the vibration amplitudes are lower than 6 mm/s for people sensitivity and 12.7 mm/s at any building.

14.9.1.2 Groundwater monitoring

Monitoring boreholes

Proposed (tentative) monitoring localities for the Matambo Mine Project are indicated in **Error! Reference source not found.**. The proposed monitoring boreholes are also listed in TABLE 14-3. Additional monitoring points at the WRD East (Center), the low-grade ore stockpile, as well as 2 existing wells at the Bangoma village is included in the proposed monitoring locations.

Monitoring frequency

Sampling of groundwater quality should be quarterly. Mine water discharge should, however, be monitored monthly. Also see the monitoring parameters below for further information.

Borehole water level monitoring should be monthly.

Monitoring parameters

Parameters and elements to be monitored for should comply with the international (IFC) and local (Third Schedule Part B – EPA, 2018) water quality standards. Time-series data should be plotted to identify potential water quality deterioration trends.

Recommended parameters to be analysed are summarised below:

- General chemistry such as pH, TDS and EC, alkalinity **in monitoring boreholes**;
- Major and minor inorganic elements **in monitoring boreholes** such as calcium, magnesium, sodium, potassium, sulphate, nitrate, nitrite, ammonium, fluoride, chloride, ortho-phosphate; and
- Trace inorganic elements **in monitoring boreholes** including aluminium, antimony, arsenic, barium, boron, cadmium, chromium (total), copper, iron, lead, manganese, mercury, nickel, selenium, cyanide (total and free), zinc.
- Total Suspended Solids (TSS) **in open pit water** monthly.
- Oil and grease, chemical oxygen demand (COD) and biological oxygen demand (BOD) could be monitored every six months for **open pit water**.

14.10 EMERGENCY PREPAREDNESS AND RESPONSE PLAN

BMMC is required to develop an Emergency Preparedness and Response Plan (EPRP) for the Project. The section below outlines the objectives of the EPRP as well as the scope and responsibilities associated with such a plan.

14.10.1 Objectives

To create and sustain an emergency response plan and service in line with international standards which can effectively control and manage any given emergency on the mine. Also, to be able to provide a suitable emergency response plan for BMMC employees, contractors, and visitors during an emergency.

It is also expected to provide a planned, structured, and disciplined response to emergency situations in order to:

- Prevent loss of life and injury;
- Provide prompt and efficient treatment for the injured;
- Avoid or reduce panic;
- Provide adequate control for any chemical release to the environment;

- Minimize property and equipment damage;
- Minimize production losses;
- Maintain good relations with the press and public;
- Comply with the provisions of the local legislations;
- Return to normal operations as soon as possible; and
- Define roles and responsibilities during emergency situations.

The emphasis during emergency management will always be on personnel safety when dealing with an emergency. Employees are not to be placed at undue risk and must never be expected to perform any task to protect people, plant, equipment, or process to the detriment of their personal safety.

14.10.2 Scope

This policy applies to all employees, contractors, and visitors at BMMC and covers all mitigation and disaster planning efforts.

14.10.3 Responsibility

It is the responsibility of the BMMC Management Team to ensure that this policy and the associated procedure in addition to this policy are adhered to.

It is the responsibility of the H&S Manager, Line Managers and Supervisors alike to ensure that all possible emergencies are identified with applicable mitigation plans, training, measuring, and monitoring conducted as required.

It is the responsibility of each Manager to ensure that site specific disaster and emergency plans are in place. The mine needs to have a dedicated emergency control room with adequate communication devices; emergency lighting; emergency procedures and responsibilities displayed; and updated area maps / plans displayed.

14.10.4 Management

The Implementation of the EPRP will involve:

- Distribution of copies to all individuals designated by the managing director at all mine locations. Copies should also be placed at strategic locations and kept up to date with responsible parties and contact details.
- All individuals responsible for the implementation of the plan should undergo required training.
- Training should be given to all employees for general emergency notification and evacuation procedures.
- Annually onsite and offsite emergency drills should be implemented.
- All emergency equipment should be maintained, and materials and supplies should always be in good working condition.

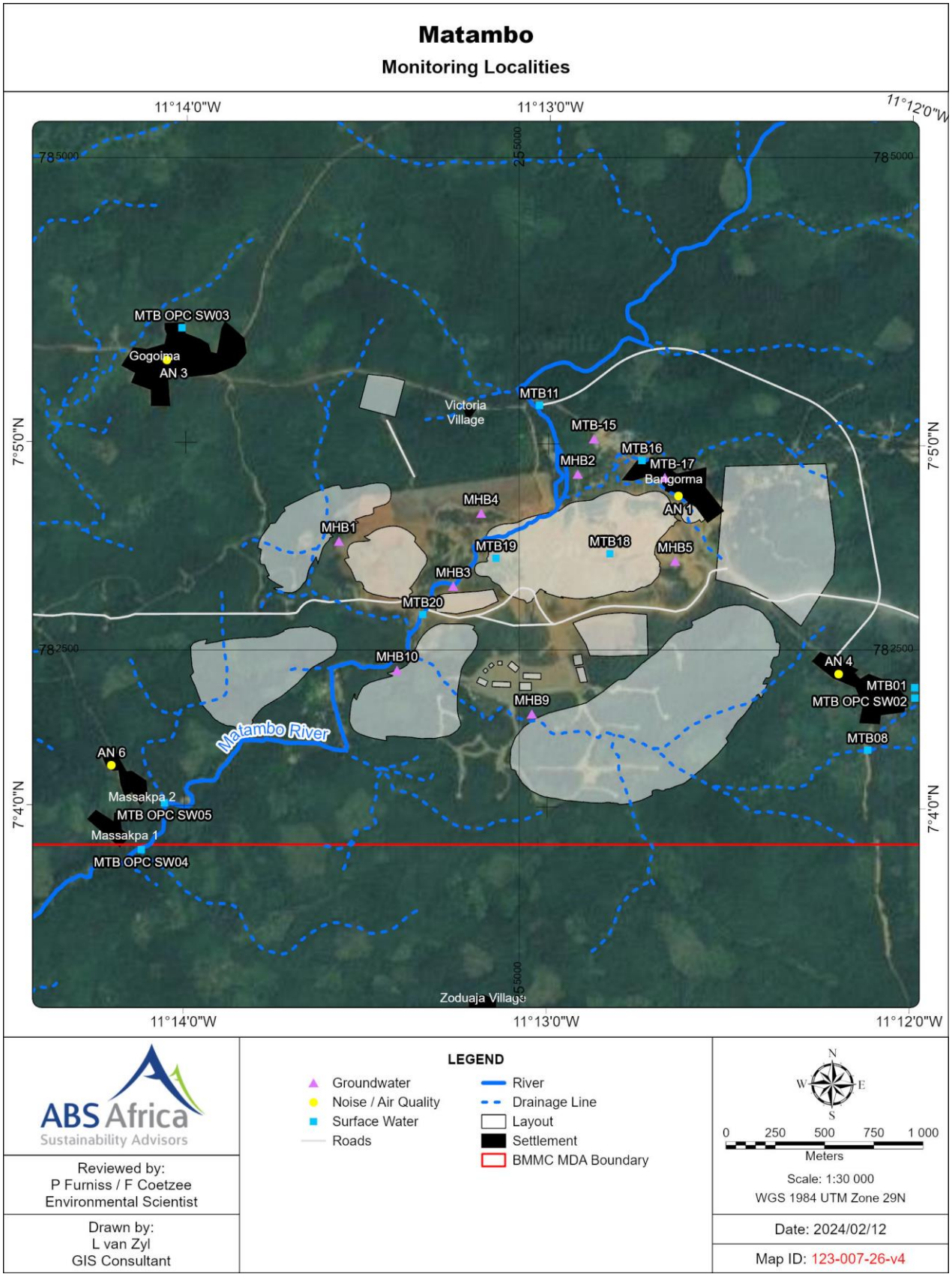
14.10.5 Aspects To Be Incorporated into the EPRP

The following aspects need to be addressed in the EPRP:

- Emergency “Call Out” Procedure (Radio or Phone – Security department)
- Emergency Alarm & Evacuation Drills
- Incident Classification and Protocol
- Major Personnel Injury/Fatality (Single or Multiple)
- Offsite chemical and/or fuel spill
- Onsite chemical and/or fuel spill
- Extreme Drought

- Extreme Precipitation
- Site and Bush Fires
- Water Safety and Drowning
- Earthquakes
- Fall from Height
- Civil Disorder and Illegal Occupancy Guideline
- Bomb Threat
- Chemical Release Guideline
- Disease Outbreak
- Conducting exercises and reviewing

MAP 14-1: MONITORING POINTS AT MATAMBO



CHAPTER 15
FRAMEWORK FOR REHABILITATION AND MINE CLOSURE PLAN

TABLE OF CONTENTS

15 FRAMEWORK FOR REHABILITATION AND MINE CLOSURE PLAN 2

15.1 POLICY GUIDELINES AND LEGISLATIVE REQUIREMENTS 2
15.2 POST CLOSURE LAND USE OBJECTIVES 3
15.3 SOCIAL TRANSITION 3
15.4 RECLAMATION AND CLOSURE COMPLETION CRITERIA 4
15.5 CONCEPTUAL REHABILITATION AND CLOSURE PLAN 5
15.5.1 General Reclamation and Closure Activities 5
15.5.2 Reclaim and Closure Activities Applicable to Specific Infrastructure Areas 6

15 FRAMEWORK FOR REHABILITATION AND MINE CLOSURE PLAN

The International Council on Mines and Mining (ICMM) recommend that mine closure planning should be proactive, commence early, and become progressively more detailed as the end of the life cycle of a mining operation approaches.

In the planning and implementation stages of the Matambo Mine Project (the Project), the focus of reclamation and closure planning is to ensure that:

- The proposed post-closure land use(s) for the site are defined and agreed with the regulatory authorities and local communities;
- The nature, scale and cost of the works required to return the site to a condition consistent with the requirements of the post-closure land use(s) are defined and understood;
- The necessary financial provisions are made for closure and that these are included in the assessment of the project's economic viability;
- A plan is developed for the implementation of the reclamation and closure works to ensure that the process proceeds concurrently with mining operations wherever possible; and
- The build-up in reclamation and closure liabilities over the life of mine is limited through appropriate mine planning and concurrent reclamation to mitigate as far as possible the impacts of premature or unplanned closure.

The framework within which the conceptual reclamation and closure plan has been developed is described below in terms of the expected life of mine, post closure land use objectives, legislative requirements and policy guidelines.

15.1 POLICY GUIDELINES AND LEGISLATIVE REQUIREMENTS

Decommissioning, reclamation, and closure will be carried out in accordance with the provisions of the Minerals and Mining Act (2000) and the Environmental Protection and Management Law (2002), and in compliance with the conclusions and recommendations of the Environmental and Social Impact Assessment (ESIA) and the related Environmental and Social Management Plan (ESMP).

A mine closure plan will need to be developed, in accordance with the requirements of the legislation in Liberia including provisions in the Environment Protection and Management Law (2002), Environmental Protection Agency Act 2003, and the constitution of Liberia.

No mine closure regulations or guidelines have been promulgated for Liberia at this time.

For the purpose of the Matambo Mine Project closure planning, consideration has thus also been given to the application of relevant good international industry practice such as that published by the IFC.

Central to the closure plan is the development of a progressive rehabilitation plan which will ensure:

- The post-mining 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; and
- The success criteria are agreed with relevant stakeholders, monitored, and reported to stakeholders.

The development of a mining operation, including associated processing facilities and infrastructure, usually involves the permanent alteration of existing landforms, disturbance to vegetation and flora, disruption of fauna habitats, hydrological impacts and potentially some level of contamination.

The reclamation and closure plan are required to address these changes and ensure a stable, safe landform that requires no further maintenance once the closure works have been completed.

15.2 POST CLOSURE LAND USE OBJECTIVES

The BMMC objective for the rehabilitation and closure of the mine is to ensure that the site is left in a condition that is safe and stable where long-term environmental impacts are minimized and any future liability to the community and future land use restrictions are minimized. The final post-mining land use will be determined in consultation with the local communities, Ministry of Mines and Energy (MME), Environmental Protection Agency (EPA) as well as other departments responsible for environmental and social aspects.

The likely land uses to be identified during this process are likely to include:

- Areas for agriculture;
- Areas for livestock grazing; and
- Wildlife habitat.

For health and safety reasons as well as the protection of specific rehabilitations works, specific areas within the mine lease may be designated as exclusion zones. Natural soil covers and vegetation will as far as possible be re-established over these areas but access by humans and / or livestock will be prohibited.

The following closure objectives form part of the conceptual closure plan:

- All structures not desirable or usable post closure will be demolished and building material removed or disposed of;
- Hazardous material, equipment and contaminated soils and steel structures will be disposed of safely and in an environmentally acceptable manner;
- The areas used for the handling and storage of hazardous materials will be decontaminated; and
- Rehabilitation of disturbed areas to a final land use capability that is practical and best suited for the final landform, taking into consideration the socio-economic activities of the receiving communities.

At the end of the mine life, the residual facilities for the Project will include the open pits and WRDs. Certain roads and structures (e.g. accommodation camp and water and power infrastructure) may also remain if this is agreed with authorities and local communities.

The ultimate end-use of the rehabilitated areas is considered to have three major objectives. The first is the re-establishment to the greatest feasible degree of vegetation on the disturbed areas within the concession. The second is the re-integration of the disturbed areas outside the project footprint into the agricultural and other prevalent economies. Thirdly, by working with and involving local people in the re-development of the disturbed land to assist them in working towards a more sustainable form of livelihood.

15.3 SOCIAL TRANSITION[1]

The socio-economic impacts of mine closure can be significant, particularly if no plan has been established to manage these impacts.

- Financial provision for at least the following measures should be made by BMMC as part of operational expenditure planning:
- Establish a joint labour management committee at mine site level that will focus on labour planning aspects associated with mine rehabilitation and closure;
- Compliance with all relevant legislation if retrenchments are unavoidable, including comprehensive consultation with all parties;
- Implementation of mechanisms to manage and, wherever possible, minimise the social and economic impact that a retrenchment exercise has on individuals, regions, and economies; and

[1] International Council on Mining and Minerals, 2019. Integrated Mine Closure: Good Practice Guide. 2nd Edition. Page 43-46.

- Development of mine closure strategies, incorporating the principles of consultation, capacity building, mentorship, and skills portability.

Social transition for mine closure recognises the risks associated with the local dependence on the mine and consequently creates opportunities to encourage the development of sustainable post-closure options.

Social transition planning should be an integrated and iterative process involving multiple mine departments and stakeholders. This planning process must be incorporated into the overarching mine closure plan. The social transition planning should integrate the identification of social risks and their mitigation measures into the earliest phases of mine planning. By incorporating the correct specialists and stakeholders early in the selection of objectives, can assist in ensuring that the overarching closure plan includes the necessary social transition objectives.

The company's approach to social transitioning should require the consideration and management of the following aspects:

- How planned or unplanned developments, such as mine expansion or construction of new infrastructure, can change the mine's zone of influence which can result in changes to the project's stakeholders and the nature of the mine's social and environmental setting;
- The operating life of surrounding local mine operations and other industries;
- Implications of local procurement policies during operations and subsequent impacts on suppliers post-closure;
- Workforce recruitment and retrenchment planning; and
- Interest, availability, and capacity of local community representatives in participating in the social transition planning process and the type of future leadership roles they can take on.

Social investment for closure includes those aspects of social investment that focus on generating post-closure economic and social returns in local communities and on building community resilience to the impacts of mine closure.

15.4 RECLAMATION AND CLOSURE COMPLETION CRITERIA

The objective of the rehabilitation closure process is to restore as much as possible of the area disturbed during the operation of the development and mine to a land use. While the total area disturbed may ultimately be different to that surveyed, the objective would be to maintain the balance of land use and return as much of the area disturbed to productive use.

Rehabilitation and closure of areas disturbed in mining and related operations will be considered to be complete when:

- All structures, equipment and infrastructure not consistent with the post closure land use have been decommissioned, demolished and removed from site;
- Ownership of all remaining infrastructure and services required to support the proposed post closure land use have been formally transferred to the local authority responsible for the administration of the area;
- The area has been made safe for all post closure land users;
- Community development projects and associated infrastructure are transferred to the relevant authorities or community organisations;
- The closure management commitments with respect to skills training, retrenchment and financial provisioning that was agreed with employees prior to the closure date have been fully met;
- All surface disturbances and remaining landforms are structurally and ecologically stable and have sustainable soil and vegetation covers, where applicable;
- Surface water management structures are in place and are free of damage due to erosion; and
- All surface and groundwater discharges from the site satisfy agreed target water quality objectives.

15.5 CONCEPTUAL REHABILITATION AND CLOSURE PLAN

As various facilities reach the end of their period of use, BMMC will initiate rehabilitation activities concurrent with on-going mining operations where possible. Rehabilitation activities will be undertaken during all phases of the project in order to restore the land back to a sustainable usable condition.

The key activities and actions are described below.

15.5.1 General Reclamation and Closure Activities

15.5.1.1 Protection and Harvesting of Resources to be Used During Rehabilitation

Design and construction activities will be undertaken with a view to ensuring the following:

- Optimising the layout to ensure that the area occupied by mine infrastructure is limited to a minimum;
- Ensure that construction crews restrict their activities to the planned areas;
- Pre-stripping and separate stockpiling of topsoil and overburden material (predominantly saprolite) from areas earmarked for development with a view to be used during final rehabilitation. This is to be undertaken taking into consideration soil depths and soil stripping guidelines; and
- Establishing a nursery with a view to be used during rehabilitation activities.

15.5.1.2 Rehabilitation Trials

Concurrent reclamation activities will be used to experiment with different rehabilitation and revegetation options, determining the optimal subsoil and topsoil placement requirements, vegetation to be used as well as maximum slope angles to be used. Early revegetation trials will determine the species to be included in the nursery.

15.5.1.3 Preparation and Placement of Topsoil

The following activities will be undertaken as part of the soil placement process:

- Disturbed areas will be graded and ripped to ensure the area is ready for the placement of overburden and topsoil material, where viable;
- Compaction will be avoided through the use of suitable equipment and methods and the placement of subsoil and topsoil to a suitable depth; and
- Where natural revegetation is not possible, the soils should be tilled to produce a seed-bed suitable for the plant species selected for seeding.

15.5.1.4 Re-Vegetation

Prior to initiating the proposed rehabilitation vegetation plan, BMMC will evaluate growth medium replacement depths for various exposures by conducting re-vegetation trials to arrive at a specification that accounts for location and soil type.

- Where possible, self-succession of vegetation will be allowed to occur and if this does not happen, then suitable indigenous vegetation will be replaced;
- Species selected for rehabilitation must meet the biodiversity objectives;
- Rehabilitation species selection must be based on practical considerations;
- Appropriate methods will be used for vegetation establishment;
- Planting should be done when climatic conditions are most likely to ensure success;
- No specialized biodiversity objectives have been set for the mine rehabilitation footprint area but should these be identified during the detailed closure planning process; and
- The revegetation objectives should be set to meet the post-closure land uses that have been agreed for the site. These could be the re-establishment of the native vegetation, erosion control for the protection of water resources, establishment of high-quality grazing or the preparation of lands for arable use.

15.5.1.5 Contaminated Soils

Contaminated soil from solvents and lubricants and other hydrocarbon sources will be removed and placed in an approved disposal facility, most likely on the TSF at NLGM. Alternatively, the soils will be treated and when considered remediated, used as part of the rehabilitation process.

15.5.2 Reclaim and Closure Activities Applicable to Specific Infrastructure Areas

15.5.2.1 Mine Accommodation Camp, HME Workshop and Associated Structures

- All infrastructure which cannot be used by alternative land users will be demolished and then loaded for removal using mechanical equipment;
- Infrastructure will be removed to a depth of ~0.5 m below ground level, alternatively foundations will be covered to a depth of ~0.5 m, provided this does not affect surface water runoff;
- Contaminated material will be assessed for degree of contamination and with permission from the appropriate authorities, either disposed of on the NLGM TSF or alternatively disposed of at a licensed waste disposal site;
- The final site will be contoured to return the rehabilitated area to as close to the pre-mining environment as possible. This will be undertaken by carrying out the following rehabilitation activities:
  - Excavation and suitable offsite disposal of contaminated soils to the depth of contamination;
  - If necessary, the final site will be contoured to allow for a free draining landscape;
  - Self-succession of vegetation will be allowed to occur and if this does not happen, then suitable indigenous vegetation will be replaced;
  - If necessary, erosion control and floodwater run-off control measures will be implemented; and
  - If necessary, erosion will be repaired when it occurs.

15.5.2.2 Waste Rock Dumps

The WRDs will remain as prominent features of the landscape.

The WRDs will be constructed to specified design parameters with benches at vertical intervals to provide an overall slope that is stable.

Grading will minimize potential for slope failures or rill erosion, facilitate rehabilitation activities (seeding, mulching), and provide a surface that will enhance water retention and support vegetation.

Rehabilitation of the side slopes will be carried out concurrently once each lift is completed where possible. At closure the final slopes and crest will be rehabilitated. The top of the WRD and remaining safety benches will be graded to promote runoff of water (free draining), prevent ponding or impounding of water and limit erosion. Angular features, including tops and edges of the WRD, will be rounded.

The following specific measures will apply to the rehabilitation and closure of the WRDs:

- Stable slopes and surfaces free from rock and soil movement and erosion;
- No Acid Rock Drainage or associated metal leaching conditions expected; and
- Water run-off managed effectively.

15.5.2.3 Open Pits

The Pits will cause a permanent change in landform in the proposed Project area and will remain a permanent feature.

During the decommissioning of the pits the following will be carried out at closure:

- Decommission pipelines, pumps, and electrical lines;
- Remove dewatering equipment;

- Block access ramps;
- Evaluate the stability of the pit slopes and where required, re-shape or stabilize pit slopes;
- Reshaping the pit edges to the final decant level;
- Realign water diversion channels to facilitate flooding of the open pit;
- Construct a safety berm around the pit; and
- Assess the water quality in the open pit and groundwater at the pit and if required, provide water treatment systems to improve water quality in the open pit.

In the post operational environment, the water level within the mined-out pits will continue to recover. In conjunction with this the groundwater levels within the aquifers surrounding the pit will also recover.

The recovering water levels will allow the groundwater flow patterns in the area to recover to near pre-mining levels..

Decant from the pits is expected. The decant qualities are expected to reflect the chemical character of the leach test results and is expected to be suitable for release.

Potential issues related to public safety at the open Pit following active mining include individuals falling from heights as well as the presence of large water bodies.

To mitigate concern for public safety associated with the hazards that may be present due to the open pit, BMMC will implement the following measures:

- Conducting Public Awareness Programmes – Prior to mine closure, a campaign will be conducted to make the public in the surrounding communities aware of the open pit closure process as well as inform the communities of the potential dangers associated with the open pit area; and
- Suitable fencing or berming and signage to prevent people gaining access to the open pit.

15.5.2.4 Ore Stockpiles

The Resampling Stockpiles (RSP), CIL Stockpile and HL Stockpile will be removed by the end of the mine life and the stockpiled areas will be reclaimed by grading and revegetating to blend with the natural landscape.

15.5.2.5 Rehabilitation Monitoring, Aftercare and Maintenance

Provision has been made for ongoing monitoring and maintenance following the completion of the final rehabilitation and closure activities. Monitoring typically includes the following aspects:

- Alignment of the actual final topography to the agreed planned landform, which is free draining;
- Actual depth of topsoil placement, as well as the chemical, physical and biological status of the replaced soil;
- Presence of erosion and the actual cause of the erosion;
- Surface water quality, as well as the presence of ponding in low-lying areas, resulting in breeding areas for mosquitos;
- Groundwater quality at agreed monitoring locations;
- Vegetation basal cover;
- Vegetation species diversity; and
- Crop growth and yield (on sites rehabilitated to agricultural end-uses).

CHAPTER 16
CONCLUSION

TABLE OF CONTENTS

16 CONCLUSION 16-1

16 CONCLUSION

The Environmental and Social Impact Assessment (ESIA) process is a planning tool that is used to assess the potential impacts of a development on the physical, biological and socio-economic environment in which the land use and infrastructure development is proposed.

The process strives to identify and, where possible, quantify the negative impacts of a development before it takes place so that these negative impacts can ideally be avoided or at least reduced through engineering design modifications, operational controls or other mitigation measures. The process also seeks to identify opportunities for enhancing the positive impacts of a development. In addition, the process seeks to inform and consult those who may be affected by the proposed development and to provide an opportunity for people to be involved in the decision-making process regarding the proposed development.

The Matambo Open Pit Mine Project ESIA has considered the proposed development of the Project infrastructure components against the relevant biophysical, social and economic aspects, as well as the relevant Liberian legislative requirements.

Key findings of the ESIA are as follows:

- The need and desirability of the proposed Project development has been established;
- The Project has the potential to create significant employment and economic development opportunities for local communities during the construction and operational phases of the Project;
- BMMC contributions to the Matambo Corridor Development Fund and the Community Development Fund in the MDA have the potential to improve local infrastructure and access to services and this may result in an improved quality of life for local communities for the long-term;
- Identified potential negative impacts to communities include migration of job seekers into the Project area and surrounding towns and village; damage to property and infrastructure because of mining activities; decline in the quality of life due to air, noise, land and water pollution and increased traffic. Mitigation measures for these impacts have been recommended.
- Impacts to noise levels, air quality, soil utilisation and natural habitat have been assessed to be the most significant biological and physical potential negative impacts associated with the proposed mine site development. Mitigation measures for these impacts have been recommended including ongoing monitoring throughout construction, operation and closure. With the implementation of the mitigation measures, the impacts are minimised; and
- The BMMC objective for the rehabilitation and closure of the mine is to ensure that the site is left in a condition that is safe and stable where long-term environmental impacts are minimised and any future liability to the community and future land use restrictions are minimised.

Establishment of site procedures and the implementation of the mitigation measures described in the Environmental and Social Management Plan, including a commitment to the regular updating and review of the risks and impacts which the development poses to the receiving environment, will be important to ensure the environmental performance of the Matambo Project. In conclusion, from an environmental and social perspective it is considered that the proposed development can proceed, provided that the relevant environmental and social mitigation and management measures are implemented.

CHAPTER 17
REFERENCES

TABLE OF CONTENTS

17 REFERENCES.....17-2

17 REFERENCES

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