ENVIRONMENTAL IMPACT STATEMENT

Maalinao-Caigutan-Biyog Mining Project

Barangay Balatok, Pasil, Kalinga

EXECUTIVE SUMMARY FOR THE PUBLIC

Prepared by:

Environmental Counselors, Inc.

Prepared for:

Makilala Mining Company, Inc.

EXECUTIVE SUMMARY

E.S. 1.0 Project Fact Sheet

Name of Project:
Maalinao-Caigutan-Biyog Mining Project

Location:
Barangay Balatoc, Municipality of Pasil, Province of Kalinga, Philippines.

Project size:
Mining operation will produce approximately 50 million tonnes (MT) of total ore over a 25-year mine life; Initial annual rate is 2.25 MT per year with ability to double production to 4.5 MT per year following initial development. Mineral processing plant will have a start-up capacity of 2.4 MT per annum with the ability to increase capacity to support the mine production.

Project Area:
Primary impact is 31.83 hectares with a secondary impact area of 448.17 hectares including areas for development as part of the Environmental Protection and Enhancement Program (EPEP)

Project Components:
The surface components of mine is about 31.83 hectares, composed of the mine processing, paste and hydraulic backfilling, and administration and personnel pads. While the underground mine surface projection is 600 meters in depth (from 975 masl to 375 masl). The underground mine includes the ore stopes, main decline, sublevel access, ore drives, ventilation raises, and other support infrastructures.
There is no tailings storage facility because tailings will be utilized as a paste fill and hydraulic fill for use as backfill for mine out areas.

Project Exploration Activity:
Exploration activities started in 2006 until December 2021. Exploration Permit is EP-003-2006-CAR approved on January 10, 2006 for an initial area of 2,719.57 hectares. Final area is 2,500.82 hectares after relinquishing an area of 218.7516 hectares outside Barangay Balatoc duly approved by MGB in 2022. Final Exploration Report was submitted to Mines and Geosciences Bureau (MGB) on March 17, 2022

Project Classification per EMB MC 2014-005:
Environmentally Critical Project (ECP), Under Resource Extractive Industries; Sub-project 2.1.2 (Extraction of metallic minerals On-shore) with an extraction rate greater than 100,000 Metric Tons (MT) per annum and Sub-project 2.1.6 (Metallic Mineral Ore Processing) with a processing rate greater than 70,000 MT per annum

Total Project Cost:
For infrastructure facilities and start operations, about P13 Billion is expected to be invested, apart from the cost of exploration.

Total Manpower:
At full operations, employment is approximately 1210 workers, composed of direct MMCI employees, contractor personnel and spot hire.

Project Schedule:
Project construction – mid to late 2023
Project operation – around 18 months later in 2025

Contact Details:
Project Proponent: Makilala Mining Company, Inc. (MMCI)
Address: 20th Flr. Cybersigma Bldg., Lawton Ave., Mckinley West, Taguig City
Contact Person: Atty. Julito R. Sarmiento
Contact Details: +63 9175246563
Email address: jrsarmiento@makilalamining.com

EIS Preparer: Environmental Counselors, Inc. (ECI)
Address: Unit E, 9th Floor, Strata 100 Building, Emerald Avenue, Ortigas Center, Pasig City 1605, Philippines
Contact Person: John Carlo Tria
Contact Details: +63 9209059709
Email address: jcbtria@eci.com.ph

E.S. 2.0 Brief Summary of Project's EIA Process

E.S. 2.1. Background Information

Makilala Mining Company, Inc. (MMCI) has completed its exploration activities after it was issued an Exploration Permit for its mining tenement by MGB in 2006. Previous requirements under EMB regulations required that a mining project should have acquired authority over the area such as a Mineral Production Sharing Agreement (MPSA) or an Application for an MPSA (APSA) prior to application for an Environmental Compliance Certificate (ECC). However, recent regulations by MGB through its Memorandum dated February 22, 2022 Re: Checklist of Requirements for Declaration of Mining Project Feasibility under Exploration Permit now requires an ECC prior to application for an MPSA. Hence, for this project, an Exploration Permit and a Final Exploration Report (FER) will suffice for the determination of the authority over the project area.

MMCI is thus submitting this Environmental Impact Statement (EIS) Report to support its application for an ECC for the activities during construction, development, and operation of the Maalinao-Caigutan-Biyog (MCB) Mining Project in the Municipality of Pasil, Kalinga.

E.S. 2.2. Terms of Reference of the EIA Study

MMCI is applying for an ECC from the EMB-Central Office for the project before it can be issued an MPSA by the MGB. Likewise, the ECC is needed prior to any development in the project site. Pre-requisite to the issuance of the ECC for the project is the conduct of an Environmental Impact Assessment (EIA) and submission of an Environmental Impact Statement (EIS) Report.

This EIS Report used the standard EIS Scoping and Screening Form as a guide in the impact analysis. Likewise, the preparation of this report is based on the various environmental laws and regulations, including Comprehensive Land Use Plan (CLUP) and LGU Profile of Pasil, Kalinga as the legal framework for the study.

E.S. 2.3. EIA Study Team

Environmental Counselors, Inc (ECI) was commissioned by MMCI to conduct an independent EIA study for the Maalinao-Caigutan-Biyog (MCB) Mining Project. ECI will prepare, document, and, on behalf of the proponent, submit to the DENR-EMB all the necessary documents related to the proposed project as contained in this EIS Report. The following table presents the EIA Study Team composition.

ECI Consultant Team Members	Module
Engr. Aldwin A. Camance	Team Leader/Environmental Specialist
Dr. Jovita Saguibo	Sociologist / Social Development/ IEC Specialist
Arnold Alvarez	Geologist
For. Wilfredo Equila	Wildlife Specialist
Engr. Marissa David	Project Manager
Allaine Patricia Unido	Project Assistant
Shelly Mar Bassong	Field Environmental Assistant

E.S. 2.4. EIA Study Schedule and Activities

The EIA study was conducted from April to June 2022 across areas in Barangay Balatoc, Municipality of Pasil, Kalinga. Activities included face to face meetings and presentation with the officials of the Barangay, Municipal, and CPDO and conduct of focus group discussions with the SB and Municipal Council to secure clearances and approvals. Freshwater and flora and fauna surveys, air and water samplings, and perception surveys were also conducted during the period. Preparatory activities were also conducted in 2021. Table below is the timetable of activities within the proposed MCB mining development area:

DATE	ACTIVITY
July to August 2021	Baseline Assessment of the Soil Attributes
July 14 -August 25, 2021	Noise Level Assessment

DATE	ACTIVITY
July-August 2021	Community Profiling for Impact Assessment
July-September 2021	Terrestrial Flora and Fauna Biodiversity Assessment
July-December 2021	Biodiversity Assessment of Aquatic Fauna and Flora
November 2021- January 2022	Meteorological Parameters Assessment
November 25, 2021 and February 21, 2022	IEC Meetings (MMCI MCB Project Presentation to Pasil Sangguniang Bayan and, COE and Barangay Officials Meeting)
April 21, 2022	Public Scoping Meeting
May 10, 2022	Technical Scoping Meeting with EMB and the Review Committee Members at EMB-CO
May 21-29, 2022	Conduct of EIA Field works for Terrestrial/Aquatic Flora and Fauna Assessment, Socio-economic Survey, Surface and Groundwater Sampling, and Seeps and Spring Survey
June 6-10, 2022	Ambient Air and Noise Monitoring

E.S. 2.5. EIA Methodologies

Conduct of the EIA and preparation of the EIS Report was based on the laws and regulations and requirements under DAO 2003-30 (PEISS Revised Procedural Manual), DAO 2016-08 and DAO 2021-19 for the Revised Effluent Standards, DAO 2000-81 and DA0 2005-10 for Clean Air and Clean Water Act, respectively, DAO 2017-015 for the Guidelines on Public Participation under PEIS System, RA 9003 for the Ecological Solid Waste Management Act, as well as requirements in compliance to LGUs, sound engineering practices and other relevant environmental laws rules and regulations.

E.S. 2.5.1. Land Sector Assessment

Investigation of the existing environmental setting was done to compile and assess data for impact identification, prediction and assessment. Environmental component on land includes land use and classification and geology wherein the methodology and approach involve the review of Comprehensive Land Use Plan (CLUPs), review of reports and information from MGB, Philippine Institute of Volcanology and Seismology (PHIVOLCS), Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA), National Mapping and Resource Information Authority (NAMRIA), assess impacts on the compatibility, protection afforded in the area and susceptibility of the area to natural hazards.

E.S. 2.5.2. Water Sector Assessment

For water, the impact assessment on the construction and during operation activities comprises baseline survey for hydrology and hydrogeology where CLUP of the host LGU and other data taken from MGB, NAMRIA and PHIVOLCS were reviewed. Freshwater quality, where water samples were collected and analyzed for physicochemical analyses with reference to the guidelines set by DAO 2016-08.

E.S. 2.5.3. Air and Noise Sector Assessment

Baseline survey for air includes collection and review of existing literature and maps of the project from PAGASA station for meteorology and climatology and conduct of ambient air quality and ambient noise characterization to assess potential impacts of construction and operations on the existing local environment.

E.S. 2.5.4. People Sector Assessment

People sector assessment included perception survey at public scoping, review of CLUP, Ancestral Domains Sustainable Development and Protection Plan (ADSPDPP), and socioeconomic profile, relevant studies from PSA and other critical data were gathered to assess impacts and risks of the project. The Public Scoping for the project was held on April 21, 2022. The meeting was attended by tribal leaders (what is known as the Council of Elders), political leaders, church leaders, and representatives from the EMB-Cordillera Autonomous Region (CAR), Community Environment and Natural Resources Office (CENRO)-Tabuk, NCIP, and PMDC.

E.S. 2.5.5. Public Participation

At the Public Scoping for the project held at Batong Buhay National High School, Bgy. Balatoc. Pasil. Kalinga on April 21, 2022, some of the major points raised by the community included:

- Ensure that the forest will be properly managed
- Prioritize the community in employment
- Errors of the past mining operations (by other companies) will not be repeated
- Ensure that commitments in the final FPIC will be followed by MMCI
- Results of the exploration should be provided to the community
- Study possible effects of on the children in a nearby school

Interview of select and key informants who were chosen randomly, and a perception survey was conducted to determine how acceptable the development of the project will be in the area.

E.S. 3.0 EIA Summary

E.S. 3.1. Summary of Baseline Characterization Results

E.S. 3.1.1. Summary of Land Sector Baseline Information

LAND USE AND CLASSIFICATION Agriculture, forest reserve, communal forest, rivers and creeks, institutional, residential, road network, and other built-up land were among the nine (9) categories of the municipality's existing general land use. The built-up area is only 1.84% of the general land use while majority of the land falls within forest reserve and key biodiversity area which is 95.47% of the total. The site is located in the ancestral domain of Balatoc Tribe in Barangay Balatoc, Municipality of Pasil, Kalinga Province.
GEOLOGY The nearest active fault to the area is the Dacalan Fault which is about 19.0 kilometers southeast. The volcanic hazard assessment shows no nearby active or potentially active volcano. However, there is a nearby inactive volcano, Mt. Binuluan, which may explain the presence of fumaroles in the area.
SEISMOLOGY Earthquake records of magnitude M5 or above in the Philippines during the last 25 years (1994-2020) have been retrieved from the United States Geological Survey (USGS). Most of the earthquakes were associated with the Manila Trench in the west and the Philippines Trench in the east, with hypocenters deepening away from the trenches.
LIQUEFACTION Liquefaction susceptibility maps from PHIVOLCS show that there is no liquefaction hazards in the area.
LANDSLIDES Based on the PHIVOLCS maps, the area is in a high susceptibility area to both earthquake-induced and rain-induced landslide risks.
VOLCANISM The nearest active volcano 147.9 km southwest of Cagua, and the nearest potentially active volcano 260.1 km of Negron; the nearest inactive volcano is 5.3 km northwest (Ambalatungan Group). There is no immediate volcanic hazard but the site is classified as being prone to volcanic ashfall only.
TERRESTRIAL BIOLOGY Thirteen bird species belonging to 13 genera and 11 families were observed during the survey conducted in July 2021. During the survey conducted in May 2022, eight species of birds were observed belonging to 8 genera and 7 families and 2 species of bats and belonging to same family and genera and one rodent. All the fauna species documented in the area have a conservation status of least concern, and their abundance and population status are stable.

E.S.3.1.2 Summary of Water Sector Baseline Information

WATER QUALITY Pasil River is a Class B freshwater. However, highly acidic sulfuric waters from the uncharted fumaroles near the existing culvert area within the proposed project site renders the waters unfit for any aquatic habitation.
DISSOLVED OXYGEN (DO) The concentration of DO measured during the monitoring ranges from 8.87 to 6.71 mg/L. All the DO measurements are within the DENR minimum standard of 5mg/L for class A and Class B waters.
BIOLOGICAL OXYGEN DEMAND (BOD) BOD concentration obtained during monitoring ranges from 79.31 to 1.59mg/L. Momma creek obtains the highest concentration of BOD at 79.31, followed by Furanao creek, Laroy, Kakan, and Caigutan, which is higher than the standard BOD level. A higher BOD value indicates a greater degree of pollution.
pH The water pH of the site is variable, ranging from 2.1 to 8.2. The site is within the area of a dormant volcano. Fumaroles along the river emit sulfur oxide which could contribute to the acidic water at the lower stream. This acidic water favors the growth of aquatic organisms and can also serve as a natural barrier for the migration of aquatic species from downstream towards the study site. Momma creek, Caigutan creek, and Kakan creek were acidic based on the level of acidity and alkalinity.
CONDUCTIVITY Another physical characteristic of water that could affect aquatic organisms' diversity is conductivity. Conductivity obtained during the monitoring ranges from 98.1 to 2280 uS/cm. The highest conductivity is in Momma, Caigutan, and Kakan.
SALINITY Salinity obtained during the monitoring ranges from 43.6 to 1200mg/L. The highest measurement is in Momma creek with a brackish salinity status. Kakan creek and Caigutan creek were in the marginal status of salinity which is apparent in the ecosystems around it (sparse vegetation). The remaining creeks are in the fresh status of salinity, where they can be used for drinking and irrigation.
HEAVY METALS Arsenic was detected in the Kakan, Caigutan, and Momma Creeks that ranges from 0.021 to 0.045mg/L in the study sites. This amount of arsenic is above the World Health Organization (WHO) standard for drinking water at 0.01mg/L. The other creeks have tolerable amounts of arsenic. This can be attributed to the active geothermal activity at Amfertungan area, which is the source of the heavy metals registered in these 3 rivers. The amount of Cadmium is monitored in the study site. It is a residue in plants usually are less than 1 mg/kg. Another heavy metal monitored in this study is Lead (Pb) which is a neurotoxin and an excellent example of a multimedia pollutant. Due to the limited human and industrial activity in the area, lead may have come from the highly mineralized area because this is a part of the formation of porphyry and epithermal systems. Thus, this lead may have come from natural and not anthropogenic sources. Aquatic organisms accumulate lead from the water as well as from dietary exposure. Organic lead is rapidly bioaccumulated and concentrated in aquatic organisms' fatty tissues. Tissues of older organisms usually contain higher lead concentrations, with the majority of accumulation occurring in the bony tissue of vertebrates.
TOTAL DISSOLVED SOLIDS Dissolved solids range from 64 to 1600 mg/L in the sampling stations. This finding indicates the presence of solids carried by water currents due to continuous soil erosions or improper wastes disposal in the area. The sampling stations have a turbidity range of 0.48 NTU at Lutot Creek to 45.57 at Caigutan Creek. Water turbidity has an indirect effect on aquatic diversity because it reduces the amount of sunlight available for algal growth, which is the aquatic ecosystem's principal source of food.
NITRATES Dissolved nitrates are monitored in the different sampling stations. Momma Creek has the highest amount of nitrate concentration at 8.3 mg/L. The other sampling stations have lower nitrates content of 1.1 mg/L to 2.1 mg/L. Sodium is a naturally-occurring dissolved mineral in geothermal waters. Nitrogen is also common in clay minerals, mica and feldspars, which are common alteration minerals related to geothermal,

epithermal and porphyry environments. With limited agricultural processes, the source of nitrates may be due to natural causes with some very limited releases from fertilizers used in the small terraced farms.

EROSION AND LOSS OF TOPSOIL

Landslides and other mass movements are common in the tenement area and surrounding areas due to steep topography and seismicity. High-intensity precipitation inputs amplify these processes, resulting in considerable runoff, erosion, and sediment transport. The water sampling accomplished total suspended solids vary from less than 2.38 to 33 mg/L, highest at the MMCI's camp area where there is considerable residential cluster and lowest at the tributaries of Pasil River draining the known mineralized area.

SEDIMENT QUALITY

Twenty-eight (28) stream sediment samples were collected. This sediment sampling is primarily for prospecting. The samples obtained were analyzed for eight elements (Cu, Au, Pb, Zn, Ag, As, Sb and Mo). The presence of heavy metals in the sediments typified the epithermal style (high-sulfidation) mineralization around the known porphyry mineralization at the BBGMI and Maalinao areas.

E.S.3.1.3 Summary of Air Sector Baseline Information

CLIMATE

The climate within the Project area is under Type III in the Modified Corona's Classification System used by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

WIND SPEED

The prevailing wind direction conforms to the dominant air stream during the different months. The northerly winds affect the project area between September and February. Each year, the area experiences several typhoons with destructive winds and torrential rains.

TEMPERATURE AND HUMIDITY

The monthly mean (23.7°C), minimum (18.9°C) and maximum (28.4°C) temperatures (1981-2010). Relative Humidity were recorded for the past 7 months at the campsite, November 2021 has the highest number of total measurements with 82.46 % average relative humidity.

RAINFALL

For at least four months in a year, there is more than 200mm of rainfall. It was recorded during the month of October where the highest rainfall recorded was 298.5 mm. The recorded total monthly rainfall collected in the area is 1,736.2 mm

AIR QUALITY

Particulate matter was measured by a n E-BAM Plus Rapid Deployment Particulate Monitor which was placed at the campsite in Balatoc. Seven months of data was obtained from the said monitor, the results of which has been condensed in the table. Not all measurements were viable, since many measurements produced error values in the monitor.

NOISE

Noise level measurements were conducted during Morning and Daytime periods. The median (dB) noise level during daytime (9:00 am to 5:00 pm) is usually higher than the median (dB) noise level during the morning time (8:00 – 9:00am). This implies that from 9:00am to 5:00pm at Station 1 (Drill Site) and Station 2 (Drill Camp), the people were busy with their respective activities. For Station 3 (Sitio Maalinao), the implications of higher noise at daytime compared to morning were from the community talking and doing construction activities. Aside from the given source of noise of these stations; there is also an adjacent road along Station 2 (Drill Camp) and Station 3 (Sitio Maalinao) wherein the peak hours of the vehicles passing or traveling by the area was during daytime. Hence, the morning noise levels are lower than day-time noise levels.

E.S.3.1.4 Summary of People Sector Baseline Information

DEMOGRAPHY

The population of Pasil is 9,644, of which 5,073 are males while 4,571 females of all ages. The annual growth rate of population is 0.04 % since 2015 with a crude birth rate of 13.25%. Mortality on the other hand, crude death rate is 3.10 %. The literacy rate of Pasil was 97.28% in 2015 this is attributed by the

presence of primary educational system. There are 5 sub tribes of Pasil that compose of pure Indigenous People.

ECONOMY AND INDUSTRY

Majority of the Pasilians depend on agriculture as their primary source of income. Rice, coffee, citrus, beans, vegetable and high value crops are the major crops produced. Livestock, cattle, poultry, and fish are also produced in the area. Irrigation systems have been constructed to support rice production. Small, micro, medium enterprises are existing in the community along with small scale mining and ecotourism.

INDIGENOUS CULTURE SYSTEM

The community within the project site has unique tradition, culture, beliefs and ritual practices which has were handed down from generation to generation. The Bodong system and Sipat has been practiced in forging peace pact with other communities. Pasil is famous in pottery (Ethnoarcheological project) and heirloom Ulikan rice production. The iPasil tribe are inhabitants of a community headed by Pangat or elder. The community practice the Imong system which is a traditional sustainable forest management system that includes resource use rights and ownership. The use of lands for other productive venture undergoes Free Prior Informed Consent (FPIC) process, IKSP on Forest Resource Management and IKSP in Mineral Extraction.

ENVIRONMENT AND HEALTH

In Balatoc, major environmental concern of the community is solid waste disposal and clean community water. The municipality has no existing solid waste collection, processing and recovery facility, thus households manage their own wastes. Solid waste generation of Pasil was 795.796 tons as of 2015. Biodegradable waste is 837.12 per day or 77% percent of the waste generated. Ninety-five (95%) percent of these waste are from residential and the remaining are from industrial, institutional, and commercial sources.

The main source of drinking water is piped water from communal water point. Most households use flush toilet with septic tank as a toilet facility. Only a few has no toilet facility and practice open defecation.

Major diseases affecting the surveyed households include respiratory diseases, diarrhea, and skin diseases. This may be attributed to bacterial and fungal infection commonly observed during cold months in the locality and possibly due to untreated potable water.

PUBLIC SERVICES

Level II Water supply system is accessed by most households from piped water and only few are Level 1 and Level 3.

On power supply, the community access the KAELCO supplied by National Grid Corporation of the Philippines (NGCP).

In communication sector, Pasil has its own radio station 97.7 mhz Radyo Kasalip but no existing telecommunication structure. There are current PLDT, SMART or Globe cellular base stations but with weak signal. Transportation is accessible through a 62.28 kilometers length road network of which 37.15 or 60% kilometers remain unpaved and some are footways built to access not reachable by vehicles. Crime incidence is low.

The municipality has 20 Elementary Schools and 3 Secondary Schools.

COMMUNITY PROFILE BALATOC

Balatoc ancestral domain is situated at approximately 17.4041, 121.1124, in the island of Luzon. Elevation at this coordinate is estimated at 1371.1 meters or 4498.3 ft above mean sea level.

Barangay Balatoc has total population of 1,646 covering a total number of 402 households with an average household size of 4. Farming and mining are the two major occupation in the barangay but recently, some companies accommodated some unemployed workers so there is an evident progress in the economic development of the barangay.

Based on the baseline survey, majority of the households are from Balatoc proper and belongs to the Ifaratuk tribe. Majority are ages 26-49 years old and most of them are elementary level. Majority of the households own a house and lot and their monthly earning is below the poverty threshold because agriculture is their main source of income. The biggest expense item is food and was found that they have low savings and borrow money from relatives and friends and they joined social organizations, cooperatives. Most of the households use electricity and liquefied petroleum gas for cooking. Piped water or level II was the main access of households and water treatment was done for potable water supply.

Personal hygiene was practiced by frequent hand washing. Open defecation was a common practice but septic tank latrines were built by few respondents. Burying and burning were the waste disposal system.

PERCEPTION SURVEY

Household respondents for the perception survey belong to the Ifaratuk tribe. Majority of the households are females, ages ranging 26-49 years, elementary level with an average monthly income of P 5,000 to 9,999.00. Most of them are residents of Balatoc since birth. The respondents were 100% aware about the project from barangay meetings /assemblies, MMCI meetings and community & neighbors. The households have expectations of improving their community's quality of living, enhanced environment, responsible mining that ensure the safety of the community and increased income because the projects generation of employment. The households strongly agreed the benefits and contribution of the MCB project to the community and agreed the potential negative effects however only 7.7 % has low trust along commitment to social responsibility and may endanger nearby communities. The perceived benefits and project contribution include social-cultural, economic and environment changes either positive and negative shall serve as a basis of support and mitigation plans of the company and LGUs of the area. The long-term benefits as stipulated in the Social Management Development Plan (SMDP) strengthened the100% trust and acceptance of the proposed project.

E.S. 3.2. Summary of Identification and Analysis of Project Alternatives

Project alternatives were considered during the initial phase of the project to determine better alternatives and options in the implementation of the project. The alternatives were considered based on site/location, technological and equipment (technical) alternatives and a no-go alternative. Results of the analysis are briefly presented below.

1. Siting of Mining Area/ Location of Mine Ancillary Facilities

Criteria used in the evaluation included minimization of overall project footprint, avoidance of economic, physical, and cultural displacement impacts and non-encroachment to adjacent tenement. Options considered were: a) Locate Mining Area on the Southern Slope Facing the communities and Pasil; b) Locate Mining Area and Main Facilities on the Northern slope away from Pasil; c) Locate Ancilliary Facilities and Camp near the Main Plant Facilities; and d) Locate Ancilliary Facilities and Camp near the old Tailings Pond. The mine is located where the MCB deposit is. Considering these, underground mining method was preferred to allow backfilling of the produced tailings to mined out areas. The site layout that has the most minimal footprint and earthworks required was preferred. To reduce further damage to the nearest river system, the old TSF of Batong Buhay will be rehabilitated and used as the GAF.

2. Mining Method

In the evaluation of the most appropriate mining method, the Proponent considered: a) Ore geochemistry; b) Ore location and dimensions; c) Ore and host rock characteristic; and d) Production cost. Options considered include block caving (BC), sublevel caving (SLC), and sublevel open stoping (SLOS) with backfilling system. The technique to be implemented for the underground operations is the Sublevel Open Stoping (SLOS) with back-filling. Again, the geometry and mineralization of the MCB deposit is the basis of the selection of this underground mining method over the others, i.e., block caving, etc. Incorporating a backfilling method in the mining process has allowed the safe and sustainable disposal of the majority of the tailings produced, hence, eliminating the need for tailings dam.

3. Technology Selection / Operation Processes

Selection criteria for technology and operation processes included the elimination of the use of tailings impoundment and integration measures to address current community and environmental issues which includes rehabilitation of old BBGMI tailings dam and establishment of flood control system. There is only one option considered, which is the underground back filling.

In addition to the mining trade-off study, the MMCI team has considered, during the earliest stage of the mining study, the community's clamor about their disapproval to a conventional tailings dam because of their experience from the impact caused by the collapsed tailings storage facility (TSF) of the Batong Buhay Gold Mine Inc. (BBGMI) operation. The employment of backfilling in the mining process promotes the safe disposal of tailings while providing a safe workplace underground and reducing the mine tailings disposal footprint on the surface.

4. Resource Utilization

The assessment looked at: a) power and water requirement; b) availability of power and water supply; and environmental considerations. Also considered were the existing power supply, particularly the connection to the grid/ generators, the existing water supply (springs and streams), development of other source of power, such as solar and hydro, and development of other source of water, e.g. dam. Based on more detailed studies, a non-conventional Reinforced Geogrid Earth Dam (Maccaferri, Design report to MMCI, 2021) will be constructed for the two major water management structure for project. The main reason for selecting a reinforced earth dam is due to the topography and the limited space within the project site, as conventional dams typically require larger areas to construct its dam walls. The main power supply for the project will still be a direct connection to the grid. Several alternative power sources may be tapped in the future when various renewable energy projects near the area become operational. Some of these alternative power sources include:

- 120 MW Kalinga Geothermal Power Project of Chevron which is estimated to be in commercial operation by 2026
- 15.68 MW Pasil B and 9.75 MW Pasil C Hydroelectric Power Project of I-Magat Renewable Energy Corporation
- 150 MW Chico River Hydropower Project of Chico JV Prime Metro Power Holdings and San Lorenzo Ruiz Piat Energy and Water which is estimated to be commissioned by 2023

5. No-Go Alternative

An assessment of a no-go alternative was also undertaken which considered the current conditions on site and what will be avoided without development.

A No-Go option will result in the loss of the following development and economic aspects for the area:

- Potential to create up to 1,500 jobs during the full operation not to mention the early requirement of manpower during development stage;
- Royalties and taxes paid locally and shared by provincial, municipal and barangay communities; and
- Social development programs that will benefit the host communities
- Potential to lose in the development of one of the richest copper veins in the country and the benefits that such metal shall have in the development of technologies required for the development of renewable technologies (batteries, for one)
- No development to control any releases from the old tailings and waste pile of the former Batong Buhay Mining venture
- No landslide or erosion control facilities will be built to control and manage these within the project site

Possible negative impacts that may be avoided would include:

- Combustion gases generated from increased traffic and use of generator sets
- Development of about 54 to 55 hectares of land will be avoided (from 31.83 hectares occupied by land components and 23 hectares of the underground mine projected to the surface) which may lead to loss of vegetation or loss of habitats
- Generation of about 200 cubic meters of domestic wastewater per day from workers and employees
- Generation of about 1,000 liters per month in waste oils from construction and operation vehicles, generators, and mechanical devices
- About 1,000 kg per day of domestic wastes from employees and workers.
- The possibility of any long-range impacts to the Balbalasan-Balbalan National Park

E.S. 3.3. Summary of Main Impacts and Residual Effects After Applying Mitigation

E.S 3.3.1 Land Sector

Based on the assessment conducted, potential impacts on the land would include

- Impacts in terms of compatibility with existing land use
- Change in surface landform / geomorphology / topography / terrain / slope
- Soil erosion / loss of topsoil / loss of overburden
- Change in soil quality / fertility
- Enhancement of climate change impacts
- Vegetation Removal and Loss of Habitat
- Threat to the existence and loss of native species
- Threat to abundance, frequency, and distribution of species

Several mitigation, prevention and enhancement actions were identified and are included in the various plans and programs prepared for the project such as Environmental Protection and Enhancement Program (EPEP), Final Mine Rehabilitation and Decommissioning Plan (FMRDP) Erosion Control Plan, Biodiversity Action Plan, Environmental Management Plan. Examples of these are:

- Conduct and implementation of rehabilitation planning
- Use of cemented paste backfill and hydraulic fill composed of tailings that will serve as structural ground support preventing major movement or subsidence in the surface and providing safe working environment
- Strengthening of slopes to prevent erosion using seeding and mulching, silt fences or brush barriers, retaining walls, and/or erosion control blankets or arm
- Placement of Erosion and Sediment Control facilities
- Flood mitigating structural measures that include dams, channel levees and construction of proper drainage and canals in the flood prone site

E.S.3.3.2. Water Sector

Potential impacts on the water sector include:

- Change in drainage morphology
- Change in Water Quality
- Inducement of flooding
- Reduction in stream volumetric flow
- Water resources user / competition in water uses
- Reduction/Depletion of Groundwater Flow
- Enhancement of climate change impacts
- Degradation of surface water quality
- Threat to abundance, frequency and distribution of species

Mitigation, prevention and enhancement measures have been identified, the details of which will be finalized. Examples of these are:

- Continued reforestation activities
- All pumped water from the underground mine will be discharged to the underground water collection pond prior to pumping into the process plant for reuse or release to the Pasil River
- All potential sources of surface water contamination, such as the motorpool, hazardous waste storage, process plant area and Paste and Hydraulic Backfill plant, will have sufficient spill contaminant measures to prevent releases.
- An Erosion Control Plan, incorporating Best Management Practices will be implemented to manage erosion in all development/construction sites that would include details on soil excavation, slope and surface drainage management and stockpiling requirements
- A contact water dam will be installed to collect all surface run-offs and contact waters from the UG mine
- Paste and Hydraulic Backfill used will be engineered to prevent leaching and will effectively immobilize any tailings that are produced.

E.S.3.3.3. Air and Noise Sector

Potential impacts on the air and noise sector include:

- Impacts in terms of change in local microclimate
- Contribution to greenhouse gas emissions
- Degradation of air quality
- Increase in ambient noise level

Mitigation, prevention and enhancement measures include:

- Reduction in vegetation will be minimal since most of the area is sparsely vegetated but reforestation efforts will continue to replace trees.
- Noise barriers will be placed where appropriate especially near the schools to limit sound created by trucks.
- Buffer zones have been determined and created to limit any effects on the local population.
- Fuel and vehicle efficiency will be considered prior to purchase and/or lease of vehicles for construction and operation activities.
- Proper maintenance schedules shall be implemented for vehicles at all times to increase efficiency and reduce emissions
- Maintain the allowable speed limit for heavy equipment, trucks and other vehicles.
- Dust suppression using water will prevent the dust particles from becoming airborne
- Surface blasting activities will be planned to prevent sensitive times as much as possible
- Noise barriers will be placed on the road near the Batong Buhay settlement especially near the school
- Appropriate personal protective equipment (PPE) that conforms to government requirement will be provided to operators and workers who handle heavy equipment that generates high levels of noise

E.S.3.3.4. People Sector

Potential impacts of the project on the People Sector include:

- Displacement of settlers
- In-migration
- Cultural / lifestyle change
- Impacts on physical cultural resources
- Threat to delivery of basic services / resource competition
- Threat to public health and safety
- Generation of local benefits from the Project
- Traffic congestion

While there will be no settlers and infrastructure that will be displaced, the use of the Balatoc Tribe ancestral lands must be considered and compensated as agreed upon between the company and clan leaders and that shall be stipulated in the FPIC-MOA with the tribe that will conclude the FPIC process.

MMCI will work closely with concerned Municipal and Barangay LGUs in the various aspects concerning the community. These would include:

- In-migration policies/guidelines
- Strengthen value-formation among current residents of host communities through seminars and other culturally appropriate forms of meetings
- Support local festivals and traditions by sponsorship and participation as part of CSR and SDMP so that local traditions will be preserved
- Protocols and guidelines for worker behavior for all contracted labor and conduct especially in local host communities.
- The SDMP, among other means of assistance, will augment social services provided by government agencies
- Enhance existing waste disposal systems and methods within communities and also within the plant and construction area by strict compliance to the provisions of RA 9003.
- Work with the LGUs for the establishment of health centers/clinics in the area; Increase provision and/or installation of sanitation or toilet facilities

E.S. 3.4. Summary of Risks and Uncertainties Relating to Findings and Implications for Decision Making

Environmental Aspects	Risks and uncertainties relating to the findings and implications for decision-making
Geohazards	Risks are associated with uncertainties in geotechnical properties of soils and rocks that may be encountered during construction. This can be minimized with the continuation of preventive measures and monitoring.
	The area has high susceptibility to earthquake and water-induced landslides and MMCI will ensure that proper emergency drills are undertaken. Risks cannot be eliminated but can be brought down to a manageable level by mining designs and technologies that will allow safe development and operations.
Terrestrial Vegetation and Wildlife	It is uncertain that remedial and reforestation works will hold in the environment considering the high potential for landslides. Mineralization of the soil is also a factor, as the high levels of metals is not conducive to vegetative growth. This may occur in a vein near the Pasil which explains the sparse vegetation in the area.
Hydrology	The risks anticipated is nil as there is no established groundwater utilized by the community
	The risks of a sudden deluge from the breaching of the freshwater dam will be present but will be mitigated greatly as it will still topple over into the contact water dam. Breakdown of the contact water dam will only swell the Pasil River within 100 to 200 meters
	Phivolcs has indicated that the area is in a very high potential for both earthquake and water induced landslides. Mitigation may temper the effects and MMCI must keep its personnel and the local communities well prepared for disasters Risks cannot be eliminated but can be brought down to a manageable level by mining designs and technologies that will allow development.
Water Quality	Risks are associated with the release of deleterious substances from the process of which were not previously identified in the mine planning and design. The risks will be eliminated by continued technical studies and pilot testing.
	All possible sources of leaks shall be considered, and mitigation measures provided in order to prevent any leaks, including disaster risk planning.
Climate, Air Quality and Noise	Safety should be strictly enforced, and no shortcuts will be tolerated. Risks to personnel including injuries usually occurs in underground mines that have been operating for decades where safety culture becomes lax, this must be considered as the mine progresses further in its development.
	Dust will always be a feature of mines and materials movement, with effects down the line, including worker and community health should be monitored.
Socioeconomics, Public Health and Safety	Risks are associated with negative perception and conflicts with stakeholders (grievance) which may occur if commitments or measures included in the EIS and SDMP are not fulfilled. Other risks are associated with security. These risks could entail provision for additional resources and manpower to handle community- related issues and security, enhanced coordination with stakeholders and government agencies, and additional measures to manage issues and concerns not previously identified in the EIA.

E.S. 3.5. EMF and EGF Commitments

DENR Administrative Order No. 2005-07 instituted that the environmental guarantee fund (EGF) for mining operations and activities is institutionalized in a mechanism that is known collectively as the Contingent Liability and Rehabilitation Fund (CLRF). The CLRF shall be in the form of a Mine Rehabilitation Fund (MRF), the Mine Waste and Tailings Fees (MWTF), and the Final Mine Rehabilitation and Decommissioning Fund (FMRDF). MMCI commits to follow the regulations with regards to the constitution of this CLRF as detailed elsewhere in the document. It is not liable for a MWTF since there will be no tailings pond that will be built as part of this project.

Furthermore, DAO 2015-02, or the Harmonization of the Implementation of the "Philippine Environmental Impact Statement System and the Philippine Mining Act of 195 in Relation to Mining Projects", stipulates that the CLRF together with the funds allocated for Social Development and Management Program (SDMP) and Environmental Trust Funds (ETF), shall be created in lieu of the EGF and the Environmental Monitoring Fund (EMF). The MRF under the CLRF is composed of the Monitoring Trust Fund (MTF) and Rehabilitation Cash Fund (RCF). This MRF is a reasonable environmental deposit to ensure availability of funds for the satisfactory compliance with the commitments and performance of the activities stipulated in the EPEP/AEPEP and are the monitoring and trust funds identified in DAO 2015-02

The EMB however, considers that the mineral processing facilities that are part of the operations is separate from the main mining activities and should be covered by a separate EGF and EMF but this will make the disbursements of funds more complicated and defeat the purpose under DAO 2005-07 and DAO 2015-02. Moreover, DAO 2015-02 even integrates "ancillary facilities" under the same CLRF, ETF, and SDMP fund the mining project. This means that the regulations envision only one set of funds for the entirety of the mining operations and to create a separate set of funds solely for the mineral processing facilities with a different set of rules will not follow the essence of the law. MMCI submits that the CLRF, ETFs, and SDMP funds that will be created for the project will be enough for the EGF and EMF for all aspects and facilities under its mining operations.