AGATA

Processing, Inc.

ENVIRONMENTAL IMPACT STATEMENT
Agata Limestone Project

MAIN REPORT

December 2020 Revision 01

Post 1st EIARC Review

Agata Processing Inc. · EIS Limestone Project

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

List of Annexes

Agata Processing Inc. · EIS Limestone Project

List of Tables

Table No Title Page No.

Table of Contents

Table of Contents

Agata Processing Inc. · EIS Limestone Project

List of Figures

Table of Contents

Table of Contents

Executive Summary

E.1 Project Fact Sheet

Pertinent Project Information in support of the ECC request is provided in **Table E-1**.

Table E-1 Basic Project Information

Item	Information
Project Name	**Agata Limestone Project (ALP)**
Project Location	Brgys. Lawigan, Tinigbasan, Municipality of Tubay; Brgy. Colorado, Municipality of Jabonga; Brgy. E. Morgado, Municipality of Santiago Province of Agusan del Norte, Caraga Region
Nature of Project	Limestone Quarry Operations
Maximum Disturbed Area	554.4 hectares
Mineral Production and Sharing Agreement	MPSA No. 134-99-XIII 4,995 hectares Issued May 26, 1999
Project Proponent	Agata Processing Inc. (API) Agata Mining Ventures, Inc. (Project Operator)
Address	22/F BDO Equitable Tower Paseo De Roxas, Makati City
Contact Person	Emilio T. Figueroa III General Manager- Agata Limestone Project Email: emilio.figueroa@ agatamining.com.ph
Telephone No./ Fax No.	(02) 728 84 91 (AMVI Makati)

E.1.1 Ownership

The Project is covered by Mineral Production Sharing Agreement (MPSA) No. 134-99-XIII acquired by Minimax Mineral Exploration Corporation (Minimax) and has a total area of 4,995 hectares. It was approved by the Department of Environment and Natural Resources (DENR) on May 26, 1999 and registered with the Mines and Geosciences Bureau on June 17, 1999.

A Memorandum of Agreement (MOA) was signed by and between Mindoro Resources Limited (Mindoro) and Minimax on January 19, 1997, allowing Mindoro to conduct mineral exploration and development activities in the Contract Areas of Minimax in Surigao del Norte and Agusan del Norte including the MPSA-134-99-XIII tenement. Later, a Deed of Assignment was executed by and between Mindoro and MRL Nickel Philippines, Inc. (formerly MRL Gold Phils., Inc.) [MRL] and was signed on June 27, 1997 wherein the rights of Mindoro were assigned to MRL.

On September 25, 2012, MRL Nickel Philippines, Inc, Minimax Mineral Exploration Corporation, TVI Resource Development Phils., Inc. entered into Agata Processing Option and Joint Venture Agreement whereby Minimax will transfer the tenement to Agata Processing Inc., a joint venture Company between TVIRD (60%), MRL (15%), and Minimax (25%).

Minimax entered into an Operating Agreement with Agata Mining Ventures, Inc. (AMVI), wherein Minimax appointed AMVI as the sole and exclusive operator of the mining property and it was approved by the MGB on September 18, 2014. AMVI is also a joint venture Company between TVIRD (60%), MRL (15%), and Minimax (25%).

On April 22, 2014, a Deed of Assignment was executed between Minimax and Agata Processing Inc. (API) assigning, transferring and conveying to the latter all rights, interests and obligations of the former under the approved MPSA. This Deed of Assignment was approved by the MGB last June 21, 2016.
All legal documents pertaining to transfer of MPSA is included in the **Appendices.**

E.2 Process Documentation

E.2.1 EIA Team

The EIS Report was completed through the joint effort of the in-house Environmental Management Team of API, and two (2) third-party consultant groups. The list of the EIA Team members is presented in **Table E-2**.

Table E-2 Agata Limestone Project EIS Preparers

No.	Name	Field of Expertise
Mr. E. Applied Environmental Sciences Consulting		
1	Ruben Estudillo	Marine Biology
Green Environment Defenders Consultancy		
1	Dr. Romell A. Seronay	Aquatic Ecology
2	Dr. Meljan T. Demetillo	Terrestrial Ecology (Flora)
3	Dr. Eve F. Gamalinda	Terrestrial Ecology (Fauna)
4	Engr. Arnold Apdohan	Hydrology, Watershed specialist
5	Mr. Leo Jude Villasica	Soil Science / GHG specialist
API In-house Technical Team		
1	Emilio T. Figueroa III	Mining Engineering, Planning and Design
2	Edsel M. Abrasaldo	Geology
3	Maria Krystell Banaag	Environmental Planning and Management
4	Jesalyn A. Guingguing	Environmental Planning and Management
5	Mary Jul S. Libarios	Environmental Science
6	Dhana Mae C. Ellarina	Mining Engineering
7	Renell V. Palaruan	Mining Engineering
8	Marichu L. Batingal	Mining Engineering
9	Neil Adrian S. Aynera	Mining Engineering
10	John Darwin S. Amag	Mining Engineering
11	Aldrin B. Arieta	Safety and Health
12	Jonathan Bañez	Social Development

There is no Disaster Risk Reduction and Climate Change Adaptation Training available yet to be attended by the preparers prior to the preparation of this document. A request for in-house online training from EMB-13 will be explored by the proponent to comply with the DRR-CAA training requirement for the preparers.

The Sworn Accountability Statement of the preparers is provided in the **Appendices.**

E.3.2 EIA Study Schedule

In conformance to the procedural requirement prescribed in revised Procedural Manual for DAO 2003-30 and the public participation requirements of DAO 2017-15: Guidelines on Public Participation under the Philippine EIS System, API have conducted a series of information, education, and communication (IEC) activities for the identified primary and secondary impact communities of the Agata Limestone Project in February and March 2020. Also, in February 2020, a Perception Survey among the residents of the identified impact communities was completed.

The consolidation of requirements to request for a Public Scoping Activity with the Environmental Management Bureau was already towards completion when the government put the National Capital Region and eventually the rest of Luzon under an Enhanced Community Quarantine (ECQ) in response to the threat of COVID-19 pandemic. This resulted to the suspension of the API's head office operation, as well as of the DENR and its line bureaus. Strict work suspension in Metro Manila under the ECQ status lasted until May 15.

Consultations with the EMB-case in the second half of May indicated that EMB was then developing a modified guideline for public scoping activities given the restrictions on mass gatherings imposed by the quarantine regulation. While waiting for the guidelines to be finalized, EMB allowed the proponent to proceed to the Technical Scoping to discuss the Terms of Reference. This will also allow the environmental impact assessment activities to commence, on the extent possible. The request letter for Technical Scoping was formally submitted by API last June 5, 2020. Attached to the request is a copy of the Project Description Report for Scoping, aerial photos of the Project site, proof of conduct of IEC activities, and the Initial Perception Survey Report. On July 9, the Technical Scoping Meeting was done via online conference (Zoom). The Technical Scoping Checklist signed by the EIARC, with the comments of the EIA Review Committee is included in the **Appendices**.

Later on, the interim guidelines for the public participation in the EIS process was released and the proponent was able to conduct the Public Scoping Activity on September 25, 2020. The summary of the issues and concerns during this activity is summarized in

Given the Technical References for the EIA study, the baseline data gathering, impact assessment and development of corresponding mitigating measures were documented in the EIS Report. The baseline environmental conditions presented in the EIS Report are based on the results of the environmental monitoring programs being implemented for the Agata Nickel Laterite Project (ANLP) given that the proposed ALP ECC area will overlap with the existing ECC coverage of the nickel project.

The overall schedule for the EIA activities is presented in **Table E-3.**

Table E-3 EIA Activities Schedule

Period	Activity
February 2020 to March 2020	IEC Activitities and Initial Perception Survey for Brgy. Tinigbasan and Brgy. Lawigan in Tubay
June 05, 2020	Submission of Project Description Report and Request for Technical Scoping
July 09, 2020	Project Briefing and Technical Scoping Activity with EMB and EIARC
Year 2019- present	Baseline data gathering through ANLP Monitoring Program
July- August 2020	EIS Report Preparation
August 2020	First Draft Report Submission
September 25, 2020	Public Scoping Activity
October 25, 2020	Second Draft Report Submission

The relevant environmental studies and monitoring data included in the impact assessment for ALP is summarized in **Table E-4.** Results of these studies will be discussed in **Section 2** of this report.

Table E-4 EIA Studies Completed

Date of Implementation	Environmental Study	In Charge/ Data Source
July 2020	Geohazard Assessment	API (In-house)
July 16-19, 2020	Terrestrial Flora and Fauna Study	Green Environment Defenders Consultancy
Year 2014-2019	Stteamflow Discharge Measurement	API (In-house)
Year 2012	Ocean Profile, Bathymetric Survey	Gaia South Inc.
Year 2019	Water Quality	API (In-house collection); Fastlab Testing
July 16-17, 2020	Freshwater Ecology Study	Green Environment Defenders Consultancy
Year 2014- 2016	Marine Environment Assessment	Mr. Ruben Estudillo
Year 2018- 2019	Air Emissions	API (In-house)
Year 2019	Meteorology	API (In-house)
Year 2019, Year 2020	Ambient Air and Noise Quality	Air Emission Estimation Training by EMB-13 Ambient Air and Noise Testing by Berkman Systems Inc.
Year 2018 to March 2020	Social Preparation	API (In-house)
February 2020	Perception Survey	Caraga State University

E.3.3 EIA Study Area

This proposed Agata Limestone Project area is within the 4,995 hectare MPSA area, designated as MPSA –134-99-XIII, granted to Minimax Mineral Exploration Corporation. The mining claim falls within the political jurisdictions of Brgys. Lawigan, Tinigbasan, Municipality of Tubay; Brgy Colorado, Municipality of Jabonga and Brgy. E. Morgado, Municipality of Santiago, Agusan del Norte in Caraga Region. The overall MPSA Contract Area, encompassing the Agata Project, is bounded by geographical coordinates 9°10'30" and 9°19'30" north latitude and 125°29'30" to 125°33'30" east longitude. The location of the MPSA and its technical coordinates are shown on **Table E-5.**

The EIA study for the Agata Limestone Project (ALP) is focused within a 554.4-hectare area, including the proposed quarry area, processing plant, stockyards, and the support facilities. The area is within the MPSA and overlaps with an Environmental Compliance Certificate (ECC) currently issued for the Agata Nickel Laterite Project (ANLP). The technical coordinates of the proposed ECC area for the ALP is presented in **Table E-6**. Its location relative to the MPSA and the ECC of ANLP is shown on **Figure E-1.**

Table E-5 MPSA 134-99-XIII Corner Points Survey and Geographical Description

Corner	Latitude	Longitude	Notes
1	9° 10' 30"	125° 32' 00"	
2	9° 11' 00"	125° 32' 00"	
3	9° 11' 00"	125° 33' 00"	Parcel I
4	9° 10' 30"	125° 32' 00"	
1	9° 12' 30"	125° 31' 22.5"	
2	9° 13' 15"	125° 31' 22.5"	
3	9° 13' 15"	125° 31' 00"	
4	9° 13' 30"	125° 31' 00"	
5	9° 13' 30"	125° 30' 52.5"	
6	9° 14' 22.5"	125° 30' 52.5"	
7	9° 14' 37.5"	125° 30' 30"	Parcel II
8	9° 14' 37.5"	125° 30' 22.5"	
9	9° 15' 45"	125° 30' 22.5"	
10	9° 15' 45"	125° 30' 30"	
11	9° 16' 30"	125° 30' 30"	
12	9° 16' 45"	125° 30' 22.5"	
13	9° 18' 00"	125° 30' 22.5"	
14	9° 18' 30"	125° 30' 07.5"	
15	9° 18' 30"	125° 30' 00"	
16	9° 19' 00"	125° 30' 00"	
17	9° 19' 00"	125° 29' 45"	
18	9° 19' 30"	125° 29' 39.3"	
19	9° 19' 30"	125° 30' 00"	
20	9° 19' 00"	125° 30' 00"	
21	9° 19' 00"	125° 31' 30"	
22	9° 18' 30"	125° 31' 30"	
23	9° 18' 30"	125° 33' 30"	
24	9° 16' 00"	125° 33' 30"	
25	9° 16' 00"	125° 33' 00"	
26	9° 16' 30"	125° 33' 00"	
27	9° 16' 30"	125° 32' 30"	

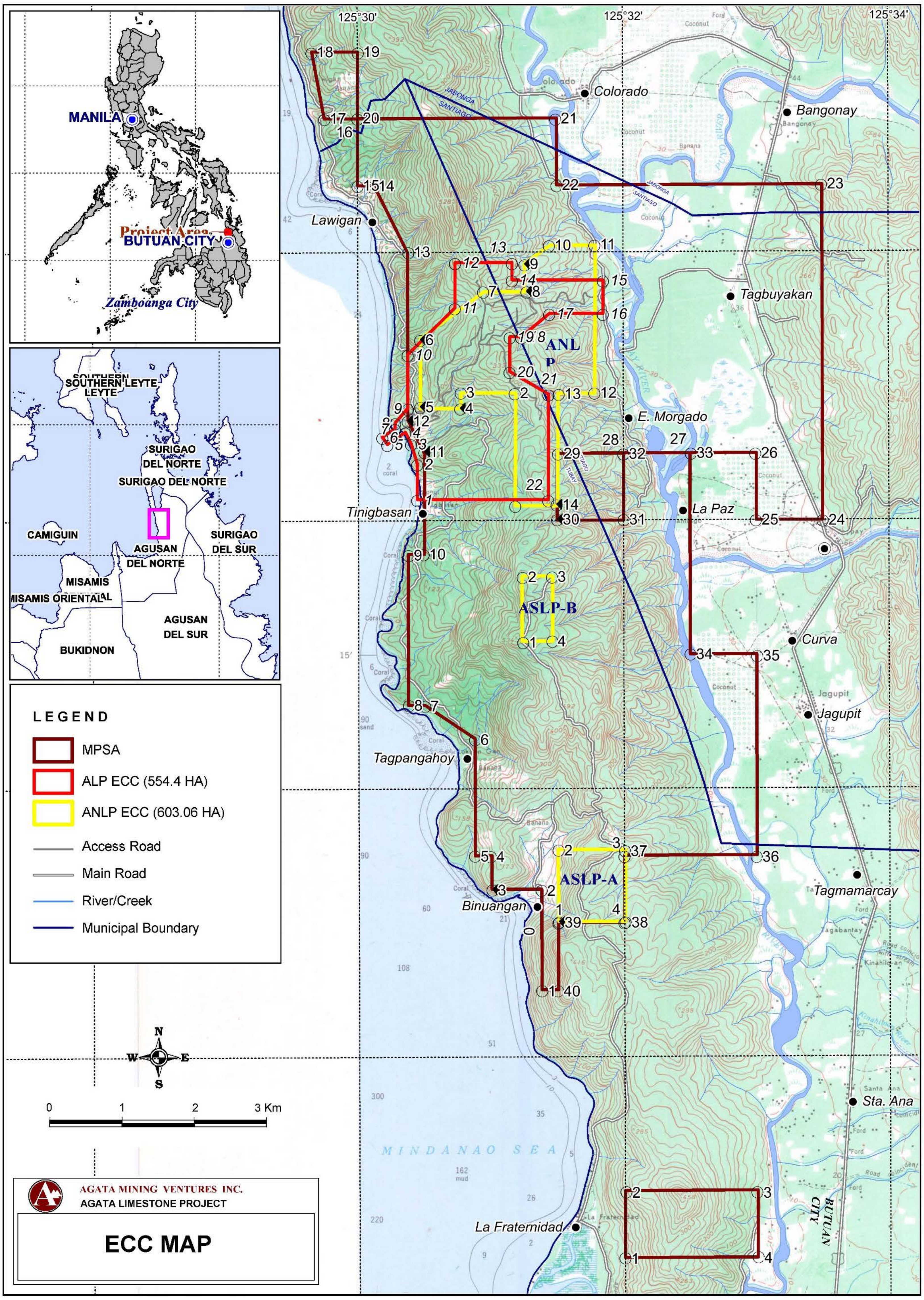
Table E-5 MPSA 134-99-XIII Corner Points Survey and Geographical Description (continued)

Corner	Latitude	Longitude	Notes
28	9˚ 16' 30"	125˚ 32' 00"	Excluded
29	9˚ 16' 30"	125˚ 31' 30"	
30	9˚ 16' 00"	125˚ 31' 30"	
31	9˚ 16' 00"	125˚ 32' 00"	
32	9˚ 16' 30"	125˚ 32' 00"	Parcel II
33	9˚ 16' 30"	125˚ 32' 30"	
34	9˚ 15' 00"	125˚ 32' 30"	
35	9˚ 15' 00"	125˚ 33' 00"	
36	9˚ 13' 30"	125˚ 33' 00"	
37	9˚ 13' 30"	125˚ 32' 00"	
38	9˚ 13' 00"	125˚ 32' 00"	
39	9˚ 13' 00"	125˚ 31' 30"	
40	9˚ 12' 30"	125˚ 31' 30"	

Table E-6 Agata Limestone Project ECC Corner Points Survey and Geographical Description

Corner	Latitude	Longitude
1	125° 30' 29.9988"	9° 16' 09.4944"
2	125° 30' 29.9988"	9° 16' 30.0000"
3	125° 30' 22.5000"	9° 16' 45.0012"
4	125° 30' 22.5000"	9° 17' 14.4816"
1	125° 30' 43.8948"	9° 17' 35.3508"
2	125° 30' 44.0388"	9° 17' 55.4676"
3	125° 31' 09.7788"	9° 17' 55.2876"
4	125° 31' 09.7248"	9° 17' 47.6556"
5	125° 31' 50.9412"	9° 17' 47.3640"
6	125° 31' 50.8332"	9° 17' 32.4528"
7	125° 31' 26.6520"	9° 17' 32.6220"
8	125° 31' 13.9728"	9° 17' 22.2072"
9	125° 31' 08.7096"	9° 17' 22.2432"
10	125° 31' 08.5980"	9° 17' 06.6804"
11	125° 31' 26.1480"	9° 16' 56.4492"
12	125° 31' 25.8960"	9° 16' 09.1452"
13	125° 30' 29.9988"	9° 16' 09.4944"
14	125° 30' 29.9988"	9° 16' 30.0000"
15	125° 30' 22.5000"	9° 16' 45.0012"
16	125° 30' 22.5000"	9° 17' 14.4816"

Figure E-1 Proposed ALP ECC and ANLP ECC Location Map



E.3.4 EIA Methodology

The environmental baseline reflected in **Section 2** of this EIS Report include third-party study conducted recently and results of the monitoring activities regularly conducted for the Agata Nickel Laterite Project. Various data were also collected from local, regional and national government agencies to supplement the monitoring data collected on site. Specific methodologies and data sources used in the EIA study relative to land, water, air and noise aspects are summarized in **Table E-7.**

Table E-7 Methodology of Environmental Baseline Studies

Environmental Study	Sampling and Analytical Method/ Data Source
Soils and Land Use	Mapping data from NAMRIA; Land Use and Classification Maps from DENR Land Use Plan from LGU
Geohazard Assessment	Geohazard Mapping based on Local Government Agencies (MGB, Phivolcs) data
Geology	Geological Information from In-house reports and Secondary sources (published reports, database of MGB, Philvocs)
Terrestrial Ecology (Flora and Fauna)	Flora: Quadrat Sampling and Transect Method Fauna: Transect Method , Observation, and Species collection
Hydrology	On-site observation (rainfall monitoring data); Secondary data sources (PAGASA, published reports) Watershed Mapping and Streamflow measurements
Oceanography	Bathymetric Survey
Water Quality	Water quality sampling based on EMB Water Quality Monitoring Manual; In-situ measurements (pH, temperature, DO) using portable equipments; Third party laboratory analysis a. Metals- Atomic Absorption Spectrophotometry (AAS) b. Solids (TSS)- Gravimetric Methods c. Bacteriology- Multiple fermentation tube technique d. BOD- BOD Analyzer e. Chloride- Titrimetric Method f. Color, Nitrate, Phosphate- Colorimetric Method g. Oil and Grease- Hexane extraction and gravimetry
Freshwater Ecology	Reach-wide benthos (Multihabitat) procedure of SWAMP (2007) Paleontological Statistics Software (PAST®).
Marine Environment	SCUBA Diving to determine a. Coral Cover- Photo Quadrat/ Coral Belt Transect Survey b. Associated Reef Fish- Fish Visual Census/ Transect Survey c. Macrobenthic Invertebrates- Coral Belt Transect Survey d. Siltation Rate- sediment trap monitoring e. Colony Size- Photo Quadrat/ Coral Belt Transect Survey
Climatological data	On-site observation (rainfall monitoring data) Secondary data sources (PAGASA, published reports)
Ambient Air and Noise	Noise level: Sound level meter TSP: High Volume- Gravimetric Method PM10: Gravimetric Method
People	Perception Survey Focused Group Discussion Secondary data sources (Brgy. Development Plan)

E.3.5 Public Participation

Following the Public Participation Guidelines under the Philippine EIS System set by DAO 2017-15, the EIA process started with stakeholder identification to determine the target participants for the series of Information, Education, and Communication (IEC) activities to be conducted for the project awareness.

Information dissemination regarding the Agata Limestone Project was conducted as early as September 2018 when the company first initiated for a conduct of Public Scoping. The Community Relations Office (CRO) of API was able to conduct project presentation to the Mayors of the three (3) LGUs (the Municipality of Tubay, Jabonga, and Santiago) with the jurisdiction over the MPSA area. Also included in this general IEC are the following barangays, namely Brgy. Tinigbasan and Brgy. Lawigan in Tubay; Brgy. Colorado in Jabonga; and Brgy. E. Morgado in Jabonga. A Perception survey done to these barangays indicated positive acceptance to the project as early as 2018. The company was preparing for a larger Public Scoping activity around June 2019 when the demand of the prospect off-take buyer has significantly changed, leaving the ALP with no reliable market for its limestone products. The ECC application, along with the scoping request was then deferred by API.

When the market for Limestone improved, the company decided to revive the ECC application starting with the series of IEC activities. The Regional Directors of DENR-MGB 13 and DENR-EMB 13 were visited for a project presentation. At this point, the impact area of the project is more defined, and which identified Brgy. Tinigbasan as the host community and Brgy. Lawigan, as the neighboring community. Both are located within the Tubay municipality. The map of the impact area is shown **Figure E-2.** The CRO relaunched a more detailed project presentation and focused group discussion and covered the LGU officials of the municipality of Tubay, Brgy. Lawigan and Brgy. Tinigbasan. In addition, a Perception Survey were also conducted among 192 residents of the two impact barangays. The result of the survey indicated awareness and positive acceptance from the community.

A summary of the IEC Activities conducted for the project is presented in **Table E-8.** Documentation of IEC Activities are attached in the **Appendices.**

Table E-8 IEC Activities for ALP

Period	Activity
September 2018	IEC Activitities and Initial Perception Survey for Brgy. Tinigbasan and Brgy. Lawigan in Tubay; Brgy. Colorado in Jabonga; and Brgy. E. Morgado in Jabonga.
July 2019	Withdrawal of ALP ECC Application
February 2020 to March 2020	IEC Activitities and Initial Perception Survey for Brgy. Tinigbasan and Brgy. Lawigan in Tubay
July 09, 2020	Project Briefing and Technical Scoping Activity with EMB and EIARC
September 25, 2020	Public Scoping Activity

The Public Scoping Activity was supposedly scheduled after the submission of Scoping Request in June 2020, however due to the community quarantine restrictions in mass gatherings, the EMB Central Office allowed ALP to proceed to the Technical Scoping Meeting. An interim guideline on the public participation in EIA process was released on July 29, 2020, allowing the conduct of Public Scoping Activity either through online platform (i.e. video conference) or small group discussion following the minimum health protocols prescribed by the Inter-Agency Task Force (IATF) for COVID -19 management. The proponent chose the latter and conducted the Public Scoping Activity last September 25, 2020 at Loreta Convention Hall in Cabadbaran City, Agusan del Norte.

The public scoping event, aimed to provide an information regarding the proposed project and solicit concerns from the stakeholders, was conducted in two sessions to maintain a small group of attendees. Around 70 people responded to the invitation for public scoping, including the representatives from the host communities (Brgys. Lawigan and Tinigbasan), local people's organization, civil society groups, regional regulatory agencies (DENR, EMB, NCIP), and from the company.

The concerns raised during the open forum are mostly related to the employment opportunities arising from the Project, particularly on who must be priority for hiring and what are the skills requirement to be qualified. There were requests for the Company to provide skills enhancement training to improve the employability of the community members. The Company assured the audience that there is a process followed in hiring and that skills training program can be included in the current SDMP and implemented next year.

For the environmental impacts, the concerns mentioned are related to the air and noise pollution from mining and blasting activities, possibility of landslide from irresponsible mining protocols, and the possible adverse effect of the project to the water sources. To which the company representatives responded by assuring that these are all included in the impact assessment study, and that findings and the proposed mitigation will be presented in the Public Hearing activity.

A summary of the issues and concerns raised during the Public Scoping Activity is presented in **Table E-10**, while the documentation of the Public Scoping activity is included in the **Appendices.**

Figure E-2 Project Impact Areas Map

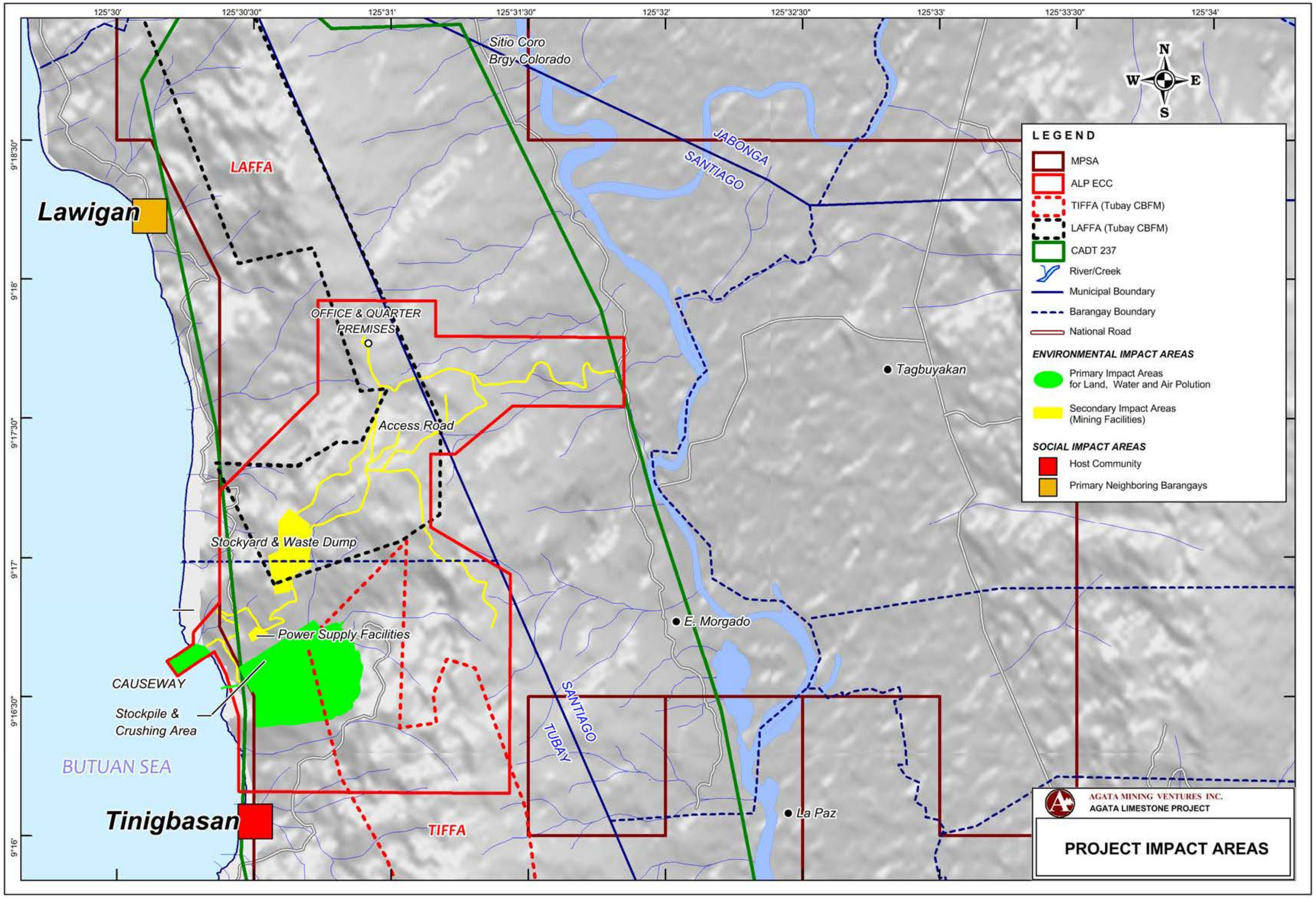


Table E-9- Summary of Issues and Concerns- Public Scoping Activity for Agata Limestone Project

Raised By	Issue/ Concern	Respondent	Response
Morning Session			
Ms. Edgielit Pajarillo, NCIP Santiago OIC	Ms. Pajarillo asked if the IPs were already informed and are aware of the new project, i.e. if they are aware on the possible effects of limestone mining, whether the impactswill be the same with nickel mining. Ms. Pajarillo also asked for the technical description of the Agata Limestone Project to ensure if the project area covers either CADT 237 or CADT 092. Lastly, she stressed out the importance of the IPs being informed about the new project. Ms. Pajarillo asked for a copy of the MOA to check if the proposed other minerals apart from nickel is mentioned or is part of it.	Mr. Jonathan Bañez, API CRO Manager	Mr. Bañez assured that the IPs are already informed about the limestone project. He also clarified that the limestone project area is within CADT 237 and is way far from CADT 092. He added that this sectoral concern will be further discussed in the afternoon session where the IPs are among the attendees. Mr. Bañez agreed to officially transmit a copy of the MOA and the technical description as requested by Ms. Pajarillo.
Kagawad Glen Capon, Brgy. Tinigbasan	Kagawad Capon asked for the mitigating measures that will be implemented to address air and noise pollution. He mentioned that these impacts are inevitable since there will be blasting activities.	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg assured that although the limestone project will involve blasting, the controlled blasting will be employed, similar to the practice in the visited Limestone Operations in Bohol. Ms. Guingguingg continued by citing specific mitigation measures that will be implemented such as, blasting only when necessary and advanced public notification of blasting schedule. These measures will be provided in detail during the Public Hearing activity. She concluded by mentioning a possible learning visit to the Bohol Limestone operation, for benchmarking so they can better imagine how the limestone project will be operated.
Brgy. Captain of Dante Mandam, Brgy. Tinigbasan	Capt. Mandam pointed out that he is most concerned about the welfare of his constituents. He suggested if the company and the barangay can make an agreement that every demand and request of his people will be addressed. He also requested if people from Tinigbasan can be prioritized for employment.		

Table E-10 Summary of Issues and Concerns- Public Scoping Activity for Agata Limestone Project (continued)

Raised By	Issue/ Concern	Respondent	Response
Brgy. Captain Mordeno, Brgy. Lawigan	Capt. Mordeno requested that that the presentation should not only focus on the host barangay, but should also include the neighboring barangay.	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg apologized for not including the neighboring barangay in the presentation, but assured Capt. Mordeno that in the report discussion, both the host and neighboring barangays are included. She also clarified that Brgy. Tinigbasan is the host community of the limestone project and Brgy. Lawigan is a secondary impact community.
Kagawad Richard Abgao, Brgy. Tinigbasan	Kagawad Agbao expressed his concern regarding the skills qualification of their constituent for the project. He suggested that being the host community, the company should conduct TESDA Training in their barangay to help the people become qualified for the job.	Mr. Jonathan Bañez, API CRO Manager	Mr. Bañez mentioned that the company follows a process regarding skills training. In fact, the company is already looking for trainings that are suitable for the skills needed for theproject.
Afternoon Session			
President of Women's Association of Brgy. Tinigbasan	Madame President expressed his concern on the karstic characteristic of limestone, wherein it forms holes or cavities. She is worried that landslide will occur in Brgy. Tinigbasan should the excavation reached its maximum capacity	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg reiterated that the purpose of the public scoping is gathering of concerns. The technical team of API, in charge of planning and design will be providing a more detailed explanation on this impact, as well as corresponding measures, during the Public Hearing activity. Ms. Guingguingg added that similar to what has been done to the nickel operation, proper benching and drainage system will be in place. She reiterated that the detailed plan will be presented during the public hearing.
		Engr. Renell Palaruan, API Mining Engineer	Engr. Palaruan assured the audience that proper mine planning and design is employed to determine how to mine the area responsibly. He added that stability of the soil is considered in mine planning, same as the type of the underlying rock for the proper bench design. Drainage will also be installed to ensure stability of the soil and prevent the occuence of landslides. Engr. Palaruan also ensured that they will take note of this concern and propoerly study the area so that land slides will be prevented.

Table E-10 Summary of Issues and Concerns- Public Scoping Activity for Agata Limestone Project (continued)

Raised By	Issue/ Concern	Respondent	Response
Afternoon Session			
		Mr. Raymond Deguerro, EMB-13	Mr. Deguerro informed the audience that in case that mitigation measures are in place and still landslide occurred due, the Environmental Guarantee Fund (EGF), which is required by EMB to be set up by the proponent, can be used to compensate for damages resulting from such incidents. He however clarified that the fund will only be available to compensate damages from the failure of the company's mitigating measures, and not from natural phenomenon unrelated to Agata operations.
Mr. Narciso Dela Sala Officer, Tinigbasan Farmers and Fisherfolks Association (TIFFA)	Mr. dela Sala first shared how he witnessed Agata has helped Brgy. Tinigbasan. He cited the significant contribution of the company in the livelihood assistance, particularly by giving out motorized boats that they are able to use for their livelihood. For his question, Mr. dela Sala asked what is the percentage of employment will likely be coming from Brgy Tinigbasan.	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg mentioned that similar concerns on employment and skills development were raised during the morning session an that it was mentioned that there should be trainings for the people of the barangay so they can acquire the necessary skills to be qualified for the job to be offered by the project. She mentioned that as of now, the company cannot give a definite percentage, especially now that the project is still under study. But she assured that this concern will be looked at in the project planning.
	In his follow up question, Mr. dela Sala asked what will be the benefits of the TIFFA from the Project. He mentioned that if there is no direct benefit, it is fine as long as the rate of employment in the Barangay will increase. He added that he went to Garcia Limestone Project site in Bohol and saw that their expection from a blasting activity is really far from what they saw in actual operations. He saw that the air pollution he's expecting from the use of dynamite in blasting is not really a problem for a limestone mining. He then recommended if the company can also bring the people from Tinigbasan, especially the senior citizens and anti mining groups, to the Garcia Bohol limestone site so they can see the actual operation.	Mr. Jonathan Bañez, API CRO Manager	Mr. Bañez responded that the tour is already scheduled this year but then COVID-19 happened, making it difficult to travel there. He said that when travel restrictions are no longer in place, the company will ensure that the mine tour will go as planned. He then commended TIFFA for being supportive of the Agata program activities since the beginning and he hoped for a continued support from them for the Limestone Project.

Table E-10 Summary of Issues and Concerns- Public Scoping Activity for Agata Limestone Project (continued)

Raised By	Issue/ Concern	Respondent	Response
Afternoon Session			
Mr. Prudencio Gayo President, TIFFA	Mr. Gayo expressed his confidence with the Agata's MEPEO Manager on how she is able to manage environmental impacts using a macro perspective, and how he is not worried of the landslide issue raised by the President of Women's Association. His concern is more on the employment. He recommended that it is better to prioritize hiring the existing workers when the Limestone Project commences. And he also suggested that if possible, better if the company can provide skills training for the barangay, for instance heavy equipment operation to upgrade their skill and employability. As a follow up, Mr. Gayo asked if the SDMP from the nickel laterite operation will be continued during the limestone project.	Engr. Anthony Quijano, API Assistant General Manager	
Ms. Cora Vertido representative of St. Anne Parish	Ms. Vertiddo asked what are the skills and trainings needed for the limestone project so that the community can prepare to improve their employability.	Engr. Anthony Quijano, API Assistant General Manager	AGM Quijano mentioned that skills immediately needed will be related to the crushing plant and heavy equipment oeration. Moving forward, the company will look into forecasting the necessary skills for the projects so that they can be developed, say through tarining and scholarship.
Mr. Carlito Belleza representative of Senior Citizens of Brgy. Tinigbasan	Mr. Belleza asked if Brgy. Tinigbasan will be the primary impact area, why the other barangays are also invited in the public scoping. He thinks that others will easily accept the project being not directly affected. He said that the Brgy. Tinigbasan community will be supporting the project since it is inevitable but company should ensure that people from Tinigbasan should benefit from employment opportunities.	Mr. Jonathan Bañez, API CRO Manager Ms. Jesalyn Guingguingg, API MEPEO Manager	Mr. Bañez responded that Brgy. Tinigbasan may be the primary impact area but there are also neigboring communities who will be affected so they have to be invited in the public scoping. Ms. Guingguingg added by explaining that the PD 1586: Philippine Environmental Impact Statement System requires that the neighboring communities be identified as well. She defined primary impact community as where the project will be situated, that is Brgy. Tinigbasan, while secondary impact areas are where downstream impacts such as dust pollution and impacts from the loading vessel may be experienced, hence should be considered as well. She emphasized that Brgy. Tinigbasan being the primary impact area will be getting a bigger share of the benefits, but the identified neighboring communities will benefit from the project as well.

Table E-10 Summary of Issues and Concerns- Public Scoping Activity for Agata Limestone Project (continued)

Raised By	Issue/ Concern	Respondent	Response
Afternoon Session			
Senior Citizen representative	He espressed concern on water resources being affected by the project operation and appealed if the company can look after air and water resources to ensure they will not be adversely affected.	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg explained that the water source of the community is distantly located in the limestone mining area. However, this will still be part of the study of the project impacts. The findings on the potential water pollution, as well as the monitoring and mitigation will be included in the Public Hearing activity.
Father of St. Anne Parish	Father reminded everyone in the audience to think of the long-term benefit that they will be getting from the project. He explained that it is easy to get overwhelmed with the immediate benefits such as salary and SDMP programs that the project will give the community but in the end, the project will only be 15-years. The more important aspect is for the community to use the benefits in preparation for a more sustainable development of the community and livelihood so that the benefits can be continuously reaped even after the project ends.		
Datu Raymond Moron, IP Sector	Datu Moron clarified if another Certificate of Precondition is required from the company since the CP obtained before is for the nickel laterite operations.	Mr. Raymond Deguerro, EMB-13 Mr. Jonathan Bañez, API CRO Manager	Mr. Deguerro referred to the NCIP statement that if the original CP only refered to the nickel laterite project, then it has to be amended. Mr. Bañez reiterated that CADT 092 is very far from CADT 237, and the project is only covered by the latter. With regards to the CP, he added that the CP and the MOA did not specified a particular mineral but instead mentioned “all minerals”.
Mr. Narciso Dela Sala Officer, Tinigbasan Farmers and Fisherfolks Association (TIFFA)	Mr. Dela Sala clarified if the TIFFA will be receiving other share aside from the SDMP, since most of the people from Brgy. Tinigbasan are members of TIFFA.	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg mentioned that this can be for further discussion and may be included as part of the agreement with the Brgy. Tinigbasan LGU.
Mr. Carlito Belleza representative of Senior Citizens of Brgy. Tinigbasan	Mr. Belleza reiterated the need to prioritize residents from Brgy. Tinigbasan in the project hiring, being the promary impact community.	Ms. Jesalyn Guingguingg, API MEPEO Manager	Ms. Guingguingg noted this request.
Mr. Flores	Mr. Flores expressed he is hopeful that the technical skills training can start soon so the people of Brgy. Tinigbasan can be prepared to apply soon.	Mr. Jonathan Bañez, API CRO Manager	Mr. Bañez noted the request and mentioned that the company will start to look for trainings that can be offered for the community by the following year.

E.3 EIA Summary

E.3.1 Project Alternatives

There are no alternatives identified for the project site location as it was determined by the setting of the deposit. The processing facility was strategically chosen to be situated near the mineralized area to minimize the hauling distance from quarry to plant facility. Moreover, the chosen site is also near the causeway, where the loading activities will be performed, minimizing handling and hauling cost. There are also no siting alternatives considered for the auxiliary facilities as most of them are existing facilities of the ANLP and will be continuously used during ALP operations.

The project siting, water, and power source considerations are summarized in **Table E-11**.

Table E-10 Project Siting and Resource Alternatives

Component	Alternatives	Decision Criteria
Ore Resource	Alternative 1: Nickel Laterite Deposits	• Agata North Laterite Project (ANLP) is ongoing; Nickel Laterite deposit is near depletion.
	Alternative 2: Gold and Copper Deposits	• Gold deposits within the MPSA boundary are currently deemed not economically feasible to mine. • Further exploration work is needed.
	Alternative 3: Limestone Deposit ***(selected)***	• The limestone deposit is found to be a high-grade resource of $CaCO_3$/CaO. • Project can promote continuity of employment opportunities for the community after the ANLP ends. • Project can supplement the demand for aggregates and cement industries in Mindanao and nearby regions.
Mine Site	Payongpayong, Brgy. Tinigbasan, Tubay ***(selected)***	• Location of the limestone ore deposit. • Site is considered with low flood susceptibility but with high landslide susceptibility according to the Mines and Geosciences Bureau; therefore, ground stability techniques should be utilized.
Crushing Plant Site	Alternative 1: Flat area north of deposit	• Identified location of the stockpile area. • Location far from the causeway, increasing hauling costs.
	Alternative 2: Northwest of deposit ***(selected)***	• Location is near relative to both the deposit and the causeway. • Streamlining the transport of ore from mining to product delivery.
Resource Utilization (Power)	Power Alternative 1: Local grid ***(selected, main)***	• Current ANLP project is tapping ANECO for the power source. • ALP can expand the existing infrastructures up to the crushing plant.
	Power Alternative 2: Generator sets ***(selected, secondary)***	• Generator sets will be used in case of power interruptions or as additional source of power.

Table E-11 Project Siting and Resource Alternatives (continued)

Component	Alternatives	Decision Criteria
Resource Utilization (Water)	Water Alternative 1: Payongpayong creek ***(selected)***	• Payongpayong Creek will be the source of freshwater for water lorries and Land Craft Transport (LCT)
	Water Alternative 2: Payton Creek ***(selected)***	• Payton Creek will be the source of water for the campsite/ domestic water requirements.

For the mining method, quarrying which is the most widely accepted method on limestone deposit recovery is selected. Crushing and screening will also be carried out to produce the desired sizes of limestone products. The method and technology selection criteria are summarized in **Table E-12** below.

Table E-12 Technology and Process Alternatives

Component	Alternatives	Decision Criteria
Mining Method	Surface Mining (Quarrying) ***(selected)***	• The geology and mineralization within the area is shallow and suggests a surface mining approach following technical and economic considerations. There is no other method considered given this type of deposit.
Blasting	Alternative 1: Electrohydraulic blasting	• This blasting method is still unproven. • Requires large amount of water and power utilization.
	Alternative 2: Conventional rock blasting ***(selected)***	• Site is not considered an area susceptible to liquefaction according to PHILVOCS. • Controlled blasting to be implemented to minimize effects of noise, vibrations and dust.
	Alternative 3: Dozer ripping (or no blasting)	• Ripping will be done when competence of the ore will not require blasting.
Comminution	Crusher Alternative 1: Jaw crusher	• Jaw crusher is a commonly used primary crusher and is best suited for high hardness rocks.
	Crusher alternative 2: Impact crusher ***(selected)***	• Impact crusher is used to minimize production of unwanted fine products. • Impact crushers have higher crushing efficiency than jaw crushers.

E.3.2 Summary of Baseline Characterization

The summary of the baseline data for the Agata Limestone Project is presented within this section. The baseline characterization focuses on the existing environmental and social conditions relative to the land, water, air and noise, and people resources.

The majority of the baseline information is from the latest monitoring data of the ongoing Agata Nickel Project considering that the proposed limestone project will be situated in the same area as the nickel operations, and that some of the existing facilities will be continuously utilized in the proposed project. Supplemental information is gathered as necessary, through in-house monitoring, third party consultants, and data from government agencies, both local and national.

E.3.2.1 Land Resources

A. Land Use

The project is in the coastal Municipality of Tubay, Agusan del Norte with a total land area of 13,800 hectares and constitutes 5.06% of Agusan del Norte's total area. The urban area covers 2.97% of the total area, while the rural areas cover the dominant 97.03%. The municipality has 13 barangays, with the primary impact area in Barangay Tinigbasan while the secondary impact area includes Barangay Lawigan.

The Agata Limestone Project area is generally characterized by three ecosystem types; forest over ultramafic rocks, tropical lowland evergreen rain forest and plantations. The ultramafic forest is the primary vegetation type with only a few tall and large trees. The tropical lowland evergreen forest is found in patches throughout the Project area and may be remnants of the vegetation that previously existed. The forest patches are generally found along the ridges and the streams/valleys within the Project area.

Based on the 2019 Land Classification Map from PENRO Agusan del Norte and the Forest Land Classification Map from the community, the location of the Agata Limestone Project is classified as Timber Land-Production Forest. This type is defined as areas of forest lands that can be made available for timber and agroforestry production, range lands for grazing, and other forest lands special uses. In terms of the land and forest cover, the largest portion of the Project area is agricultural land planted with either annual or perennial crops.

B. Geology and Geomorphology

The Project site is largely underlain by the Cretaceous basement rocks of the Humandum Serpentinite and the Concepcion Greenschist. The former, believed to be a dismembered part of the Dinagat Ophiolite, is found in thrust contact with the latter and other metamorphic rocks. Humandum Serpentinite rocks include peridotite, pyroxenite, dunite, serpentinite and minor distribution of gabbro. On the other hand, Concepcion Greenschist is an interbedded metasedimentary and metavolcanic sequence. Within the metasedimentary succession are calcareous layers where the recrystallized limestone deposit is located.

There are several styles of mineralization that occur on the Agata property. These include Au oxide mineralization in saprolite that is developed over shallowly-buried intrusions, Cu and Au mineralization associated with quartz veinlet and pyritic stockworks along the margins of monzonitic to dioritic plutons, Au associated with horizons of disseminated pyrite in sooty carbonaceous limestones, and nickel mineralization generated by surficial zones of nickel enrichment in laterites that are developed on ultramafic protoliths.

The limestone deposit is compact and is situated in a single ridge located at Payongpayong area. This setting conveniently limits the excavated area within 52-hectares at most. The quarry will also have an additional 14.94-hectare buffer area around the 52-hectare excavation to allow for noise and vibration effects to be minimized, if not eliminated. The steep slopes at the Payongpayong ridge will be transformed into moderate, benched terrains that will be engineered to reduce susceptibility to landslides and erosions.

Geologic hazard assessments done for the Project area focused on six risk categories; tectonic characteristics, regional seismicity, fault ruptures, liquefaction potential, landslides and flood hazards.

Due to the location of the project area within a seismically active area, the risks associated with potential earth movement are the highest and of most concern.

The Project area is located within a seismically active region characterized by the close proximity of the Philippine Fault Zone. Consequently, the northern Mindanao region, including the Agusan and Surigao Provinces is susceptible to earthquake generated by the Philippine Trench and its related subduction zone structures, and by the Philippine Fault System and its associated structures. The western traces of the Lake Mainit Fault bound the eastern side of Malimono Ridge, making the area prone to strike-slip earthquakes.

The area around Malimono Ridge and the whole Agusan Valley has been host to a number of destructive earthquakes in the past. The proximity of the Philippine Fault to within a 2 km distance from the Project area presents a risk of a potentially large magnitude earthquake occurring in the future. The Philippine Trench is another source of earthquakes that would likely affect offshore Mindanao. When the epicenters move inland, these earthquakes tend to be of deeper hypo central depths due to the inclination of the subduction zone.

The rupture hazard may arise during large earthquakes, with the ground being displaced along the fault that causes the seismic event. The hazard of rupture therefore is centered, expected along the trace of the active fault. In the case of the Project area, this hazard can be sited on the trace of the Philippine Fault along the western edge of the valley located east of the Project site.

Landslides that may accompany intense seismic shaking can potentially occur along steep slopes, particularly in areas where thick soil or deposits of loose rocks may be present. This threat may also be present during intense rainfall events, when the soil is saturated with water, and when pore pressures from water percolating into the ground may render some areas unstable. Ground slopes within the Project area range from flat to greater than 50%. Based on the earthquake triggered landslide map from Mines and Geosciences Bureau (MGB), the Project site is moderate to highly susceptible to landslides.

Based on the same map from MGB, the prospect area is not considered as flood prone. However, the coastlines of Sitio Payong-payong were mapped to be prone to storm surges.

C. Pedology

Three (3) soil types and seven (7) soil mapping units were identified and mapped within the MPSA area. The three (3) soil types consisted of the Malalag clay loam, the Kabatohan sandy clay loam and the Umigan clay loam. Ground slopes within the Project area range from flat to greater than 50%. Both the Malalag and Kabatohan soil types can be found on slopes within this range. The Payongpayong limestone site is part of the Malalag Clay loam at 30-50% slopes and is considered an area with high susceptibility to erosion.

D. Terrestrial Ecology

Based on a Terrestrial Flora and Fauna Assessment conducted within the limestone quarry project site and within the adjacent watershed in Brgy. Tinigbasan, the Project area is generally characterized by three ecosystem types; forest over ultramafic rocks, tropical lowland evergreen rain forest and plantations. The ultramafic forest is the primary vegetation type with only a few tall and large trees. The tropical lowland evergreen forest is found in patches throughout the Project area and may be remnants of the vegetation that previously existed. The forest patches are generally found along the ridges and the streams/valleys within the Project area.

The assessment of plants recorded a total of 206 species belonging to 78 families and 145 genera. The most represented plant families were *Moraceae*, followed by *Arecaceae* and *Fabaceae* and, *Euphorbiaceae* and *Anacardiaceae*. When plants are grouped according to plant habit, results revealed

that trees and shrubs had the highest number of species among the group. A total of 150 individual trees consisting of 40 species were observed. *Vitex parviflora* (Tugas), *Adinandra robinsonii* (Sagimsim) and *Radermachera whitfordii* (Magasili) obtained the highest importance value in limestone site while in Tinigbasan watershed, *Artocarpus blancoi* (Antipolo), *Paraserianthes falcataria* (Falcata) and *Gmelina arborea* (Gmelina) dominated the area. In terms of important flora species, there were seven (7) vulnerable, eight (8) endangered and one (1) critically endangered species recorded.

The faunal environment within the survey area is also diverse, observed with a total of five (5) species of anurans, three (3) species of reptiles, 31 species of birds, and eight (8) species of mammals. Most of the species identified are categorized from least concern to near threatened.

E.3.2.2 Water Resources

A. Hydrology and Hydrogeology

The Agata Limestone Project is in the catchment of Payongpayong Creek and the road system towards project site, affecting the Tinagbasan Creek. The drainage basin is bound by a natural topographic and geologic divide which separate one drainage area or watershed from the other. The drainage basin supplies water to streams and their tributaries. Streams are classified based on consistency of flows, namely: perennial, intermittent and ephemeral stream.

The Municipality Tubay depend mainly on springs and creeks for their domestic water requirements. These water sources are typically located higher than the communities they serve. Concrete spring boxes and small dams are used to store the water while galvanized iron (GI), polyethylene (PE) and polyvinyl chloride (PVC) pipes connected to these structures convey the water by gravity to Level 2 and Level 3 water systems.

B. Oceanography

A localized bathymetric survey was done in the Payongpayong Port location prior to its construction in Year 2014**.** The bottom profile showed a gradual bathymetric change from the shore to the 250-meter length of the causeway. Beds of subtidal boulders or less rough textured rocks and/or large stones with growths of algae which cover the surface of the rock are a common feature of the first 20 meters offshore.

After this region is a fringing coral reef in poor to fair condition (20 to 130m away from shore with a depth range of 1.0 to 6.0m). Sandy substrates make up the remainder of the sea bottom (130 to 250 m away from the shore with a depth range of 6 to 18m). Much of its surface is covered by a very thin sheet of silt and mud. The deposited sediment is loosely packed and is highly re-suspendable with only little disturbance.

C. Water Quality

Water quality sampling and testing is performed internally by the Environment Department at 32 locations as part of the quarterly Multipartite Monitoring Team activity of the nickel project. Out of this water sampling stations, six stations are within the affected watershed of the Project. These locations include Downstream Payongpayong Creek, Tinigbasan Creek Confluence of Tributaries, Sitio

Payongpayong Water Source, Brgy. Tinigbasan Water Source, Payongpayong Coastal Area and the Tinigbasan Coastal Area.

Water quality monitoring activities include in-situ measurement of physical parameters such as pH, turbidity, and temperature. Laboratory analysis of chemical parameters include Nitrate, Phosphate, DO, Ammonia, Fluoride, surfactants, arsenic, cadmium, lead, iron, manganese, total suspended solids, oil and grease, BOD. The laboratory testing is done by accredited third party laboratories. Bacteriological testing is also done to determine fecal and total coliform levels.

Results of the surface water testing indicated general compliance with DAO 2016-08 for Class C water quality standards, except in upstream reforestation, Mantiwas Creek and in Midstream Kalinawan River, which showed high fecal coliform level above the 200 MPN/ 100 mL DAO 2016-08 standard. The baseline data collected for these stations in year 2012 already shown elevated coliform levels, which can be attributed to the human activities, natural decomposition process, and faunal manure deposits observed during the investigation conducted by the Environment Department. These stations of concern however, are not within the affected watershed of the project.

All parameters tested for drinking water sampling stations are within the prescribed standards of DAO 2016-08 and meet the AO 2010-010 “Philippine National Standard for Drinking Waters”, except for the exceedance detected for the fecal coliform in all sampling stations. The drinking water stations do not have any water treatment facility in place and is open to contamination. The community near the affected stream was informed of these findings. The concerned barangays have coordinated with the municipal government on the disinfection of the local water sources. In fact, barangay Tinigbasan have started using Reverse Osmosis facility to treat and provide clean drinking water to the community. Barangay Lawigan on the other hand, have a new water source but is not within the scope of the project.

All parameters tested for marine water showed compliance to applicable DAO 2016-08 Marine Water Quality standard.

D. Freshwater Ecology

The freshwater biological sampling within Payong-payong Creek and Tinigbasan Creek conducted in July 2020 recorded a total of 18 aquatic macroinvertebrates from 10 families. Majority of the organisms belong to *Phylum Arthropoda* which was largely dominated by the *Gerridae* family.

Water quality index (WQI) is also determined based on the presence of indicator species for sensitivity/tolerance to pollution. Comparison of WQI values between the two creeks studied indicated better WQI in Payongpayong Creek, which is based on its WQI value, can be categorized under *very clean water.* This is compared to Tinigbasan Creek which fall within the *rather clean- clean water* range.

E. Marine Ecology

The latest third-party coral monitoring survey conducted in May 2019 within the vicinity of the Payong-payong Port area and the coral relocation site in Tinigbasan Sanctuary indicated a relatively good to fair coral cover. Lateritic soil was not observed on the rocky and sandy bottom of the nearshore shallow reef, south of the pier facility. The encrusting or foliate coral *Pavona decussata* and the massive/ sub-massive *Porites spp* were the most predominant form in the reef area. Individual colonies of these coral species are still very much intact and in an apparent healthy condition with normal coloration and pigmentation.

The corals within the study area are being threatened by both natural and human-induced disturbances. Potential source of stresses and disturbances that were identified during the monitoring period included turbidity and siltation, accidental bumping of corals by tugboats and barges, infestation of crown-of-thorns starfish *Acanthaster planci* and storm damage.

The survey also looked at the reef fish communities. A total of 140 species belonging to 31 families, with were recorded at the sampling stations. The damselfishes (*Pomacentridae*) are observed as the dominant species in the coral reefs.

Visual census of macroinvertebrates while scuba diving recorded a total of 19 macroinvertebrate species/taxa that are classified under seven (7) major faunal groups. The tiny reef ascidian C*lavelina sp.* and the green ascidian/sea squirt *Didemnum sp.* were the most common and abundant macroinvertebrates found in the study area. This was followed by the blue starfish *Linckia laevigata*, and the ink-spot sea squirt/ascidian *Polycarpa aurata.*

E.3.2.3 Air Resources, Noise, and Climate

A. Meteorology and Climatology

The Project area is located within a Type II climate zone as defined by the Modified Coronas Climate Classification developed by the Philippines Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). This particular climate type is characterized by an absence of a dry season. Rainfall occurs throughout the year with the heaviest rainfall occurring during the months of December and January.

The mean annual rainfall (1981-2010) at the PAGASA-Butuan Station is 2,058 mm with the period of October to February being the wettest months. The company maintains its own rain gauges and are installed at the nickel mine area and another one at the port area in Payong-payong. The mean annual rainfall recorded at the surface mine site for the five-year period record is 204.66 mm. A slightly lower precipitation trend was observed at the Payongpayong Port area with annual mean rainfall of 139.79 mm. In both stations, January was observed as the wettest month, while April and May were the driest months.

The temperature records of the PAGASA Butuan City Station indicate a relatively warm annual average temperature of 32.2°C(max), 23.4°C(min) and an annual mean of 27.8°C. May, June and August are the hottest months, while January is the coldest.

B. Air and Noise Quality

Third party monitoring of ambient air and noise were conducted by Berkman Systems Inc. as part of the quarterly monitoring for ANLP. Included among the stations monitored are the Payong-payong area and at the Brgy. Tinigbasan community which are both covered within the identified impact area for the ALP. Results for both stations indicated that the TSP and PM-10 levels detected are in compliance to the applicable ambient air standards. Morning noise level at the station in Brgy. Tinigbasan slightly exceeded the noise standard which can be attributed to its location being near a population center.

E.3.2.3 People

A. Community Profile

The impact area where Project activities will be implemented is in Brgy. Tinigbasan, Municipality of Tubay. The neighboring community that hosts the support facilities is Brgy. of Lawigan, also within the municipal jurisdiction of Tubay. Each barangay has a population of around 1,000 individuals and each with nearly 200 households. The majority of the local inhabitants within and surrounding the Project area are of Visayan heritage. The area is also the home of the Mamanwa-Manobo indigenous peoples.

In most recent times migrants from the Visayas and Luzon Province s have settled in the area due to the economic opportunities brought about by the current mining operations.

In terms of educational attainment, only a small percentage of the population was able to complete tertiary education, around 5%-6% in both impact barangays. More than a third of the population at least attended primary schooling.

The two (2) mining impact barangay are located along the coastline. For this reason, a good number of families depend on fishing as their major source of income. Barangays Tinigbasan and Lawigan has an average production of 17.1 tonnes of fish per year. Livestock raising is also practiced. The current nickel mining operations is also one of the big employers for labor workers.

Leading causes of mortality among the impact communities vary across municipalities. In Barangays Lawigan and Tinigbasan, they are infection, pneumonia, hypertension, tuberculosis, and acute gastroenteritis. There are health care facility and health care workers catering to the health care needs of the community.

All households of the two (2) impact barangays have access to toilets and safe drinking water. Most of the water are distributed via a Level II water system of communal source for 2-3 household units. All barangays of Municipality of Tubay are adequately served with power supply, mainly provided by the Agusan del Norte Electric Cooperative (ANECO). Communication services is provided through six (6) cellular sites present in the Tubay municipality.

B. Perception Survey

The Community Relations Office commissioned a group of researchers to conduct a Project Perception Survey to assess the social acceptability of the proposed development and operation of ALP. A total of 192 residents from the two impact barangays responded to the survey conducted in February 2020.

More than half or 71% of the participants expressed positive acceptance for an extended mining operation through the Agata Limestone Project. Positive response was accounted from both of the barangays. The most direct reason given by the participants for favoring the extension is the economic opportunities from the mining industry.

Most of the survey respondents agreed to the idea that there will be an overall improvement if the mining activity will continue to operate in the area. Majority cited improvement in education through the company's educational assistance program. Other perceived benefits cited are API's contribution to the local disaster risk reduction and response management, livelihood opportunities, and health benefits.

Respondents who answered no expressed their apprehensions on the possible risks that could be aggravated by mining activities particularly on the environment, health, and geological aspect. Some also noted that they don't think the project will provide them with employment opportunities.

E.3.3 Summary of Key Impacts and Environmental Management Plan

A summary of the key impacts and management plan of API for the Construction and Development Phase, Operations Phase and Abandonment Phase of the Project is summarized **Table E-13.**

Table E-13 Summary of Impact Management Plan

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
1. Change in surface landform, topography, terrain and slope.	1. Site Preparation Clearing, and Earthwork. 2. Construction of Additional Roads. 3. Pre stripping activities at the quarry site. 4. Clearing and Grubbing 5. Ore Extraction, Loading, and Hauling	• Engineering design to prevent slope failure. • Proper benching. • Establishment of proper drainage to prevent erosion and scouring. • Reshaping and recontouring of mined out areas. • Application of Thematic landscaping in the progressive rehabilitation of improve the aesthetic view of the modified land form. • Topsoil conservation, storage, and management. • There is no overburden to strip, however, any incidental topsoil would be removed and stockpiled for future use.	• Mine Design Criteria: o Bench Height - 25m o Berm Width (Safety Catchment) - 5m o Overall Slope Angle - 60 Degree • Accomplish at least 90% of the quarterly rehabilitation target following contour planting and thematic landscaping design. • At least 60% of the Removed Topsoil will be stored for future Utilization.
	6. Construction of Crushing Plant and other Facilities.	• Limited clearing and earth movement according to the approved Mine Development Plan; phasing of activities (if possible).	• At least 90% Completion of Structure Construction Within 6 Months. • Limit disturbance to not more than 60 ha during Quarry Operations. • Plant design and specifications will be thorough prior to actual construction and commissioning. The design of the plant and other facilities will be subject to required review and approval of the regulators (DENR) prior to construction and operation.
	7. Drilling	• Contract an Accredit Third Party Contractor to Conduct Drilling Activity. • Follow the prescribed drilling specifications.	• Drilling Parameters: o Bench height 5 m o Drill depth 5.8 m o Hole diameter 89.00 mm o Burden 3.60 m o Spacing 4.20 m o Sub-drill 0.80 m o Stem height 2.70 m o Charge length 2.30 m o Ratio of HE to LE 20% to 30%

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
1. Change in surface landform, topography, terrain and slope.	8. Blasting	• Contract an Accredited Third Party to Conduct Drilling and Blasting Activity • Follow the prescribed blasting specifications. • Implementation of controlled blasting techniques such as single hole firing, trim blast, and pre-splits.	• Blasting Parameters: o Ammonium Nitrate with Fuel Oil (ANFO) o Cast Primer 250 gms o NONEL Surface Connector x 6 metres o In-hole delay, 500ms x 12 metres o Detonating Cords, 6 grams Cast Primer 250 gms o NONEL Surface Connector x 6 metres o In-hole delay, 500ms x 12 metres o Detonating Cords, 6 grams
	1. Structure Decommissioning 2. Rehabilitation of Mine Disturbed Areas	• Follow safety bench and slope parameters in post mining landform. • Follow contour planting and thematic landscaping.	• Design Parameters for Safety of Slopes: o Bench Height: 25 m o Berm Width (Safety Catchment): 5m o Overall Slope Angle: 45 degrees • Accomplish at least 90% of the quarterly rehabilitation target following contour planting design.
2. Loss of vegetation, topsoil, and exposure of soil materials	1. Site Preparation Clearing and Earthwork 2. Pre stripping activities at the quarry site. 3. Construction of Additional Roads 4. Construction of Crushing Plant and other facilities. 5. Clearing and Grubbing 6. Ore Extraction, Loading and Hauling	• Limited clearing and earth movement according to the approved Mine Development Plan; phasing of activities (if possible). • Earth balling and transplanting of viable regenerations. • Establishment of forest reserve pockets or buffer zone within the influence area where native species are preserved.	• At least 90% Completion of Structure Construction Within 6 Months. • Limit disturbance to not more than 60 ha during Quarry Operations. • Plant design and specifications will be thorough prior to actual construction and commissioning. The design of the plant and other facilities will be subject to required review and approval of the regulators (DENR) prior to construction and operation. • Recover at least 10% representatives of each species to be removed. • Establish at least 1-hectare forest reserve within the project site.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Application of high-quality seedling propagation such non mist cloning and bioremediation. • Application of soil erosion control such installation of fascines and wattling and plantation hedgerows along the slope. • Topsoil conservation, storage, and management.	• Produce at least 30% of the total seedling requirement for reforestation. • Establish 50% slope stabilization measures within the covered area. • Recover at least 80% of the topsoil cover for rehabilitation.
3. Disturbance of Flora and Fauna: Loss of terrestrial biodiversity	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site. 5. Clearing and Grubbing	• Provision of Buffer Zones. • Collection of wildlings prior to vegetation clearing for endemic plant species preservation. • Landscaping and revegetation activities. • Replace all affected vegetation with diverse vegetative species to contribute a stable and compatible ecosystem in the progressive rehabilitation program. • Regular Flora and Fauna Monitoring.	• Maintenance of buffer zone of at least 25 meters away from project periphery. • Establish at least 1-hectare forest reserve within the project site. • Develop / Enhance a forest land in adjacent buffer zone to recreate an ecological balance. • Collect at least 10% representative of each specie type per mine parcel • Establish a minimum of 1 nursery and/or satellite nursery in support of the reforestation program. • Accomplish at least 90% of the quarterly rehabilitation target following contour planting and thematic landscaping design. • Planting of at least 80% native or indigenous species. • 100% Conduct Semi-Annual Flora and Fauna Monitoring to be conducted every April (50%) and November (50%).

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
4. Disturbance of Flora and Fauna: Faunal migration due to noise	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing	• Provision of Buffer Zones. • Establishment of vegetation along roads as ecological curtain. • Planting of faunal feeding tree species to attract fast regeneration of disturbed faunal species. • Periodic conduct of air and noise monitoring. • Periodic conduct of Terrestrial Flora and Faunal Inventory.	• Maintenance of buffer zone of at least 25 meters away from project periphery. • 100% planting of trees along the road. • Planting at least 80% indigenous and bird feeding species. • 100% Conduct of Air and Noise Sampling. Air and Noise Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%) • 100% Conduct Semi-Annual Flora and Fauna Monitoring to be conducted every April (50%) and November (50%).
	6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Crushing Plant Operation Port Operations (Barging and Shipping) 9. Drilling 10. Blasting 11. Structure Decommissioning 12. Rehabilitation of Mine Disturbed Areas	• Application of noise control device in all machineries. • Implementation of the Standard Operating Procedure that include minimization of noise from operation. • Establishment of vegetation along roads as ecological curtain to minimize noise. • Planting of faunal feeding tree species to attract fast-regeneration of disturbed faunal species in declared mined out areas or disturbed areas subject for progressive rehabilitation. • Periodic conduct of air and noise monitoring.	• 100% installation of noise control device in all machineries. • Controlled Blasting will be done Once a Week • 100% planting of trees along the road. • Planting at least 80% indigenous and bird feeding species. • 100% Conduct of Air and Noise Sampling. Air and Noise Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%)

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Periodic conduct of Terrestrial Flora and Faunal Inventory.	• 100% Conduct Semi-Annual Flora and Fauna Monitoring to be conducted every April (50%) and November (50%).
5. Increased soil erosion from exposed soil surface.	1. Site Preparation Clearing, and Earthwork. 2. Pre stripping activities at the quarry site. 3. Construction of Additional Roads. 4. Clearing and Grubbing 5. Ore Extraction, Loading, and Hauling 6. Structure Decommissioning 7. Rehabilitation of Mine Disturbed Areas	• Follow Mine Design Parameters/Criteria to Maintain Safety Slope and Minimize soil erosion. • Installation of erosion control materials (i.e. coconets, gabion basket, stop logs, wattlings, and fascines) to provide slope stability. • Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	• Mine Design Criteria: o Bench Height - 25m o Berm Width (Safety Catchment) - 5m o Overall Slope Angle - 60 Degree • Maintain slope not more than 70 Degrees. • 50% coverage of slope stabilization measures within the covered area. • Quarterly Installation of erosion control measures To be conducted in March (25%), June (25%), September (25%), December (25%). • 100% Turn-over of Mined out Areas to MEPEO for Final Revegetation every end of the Quarter. Area with mineable ore will be temporarily revegetated.
6. Face/ slope instability resulting to landslides.	1. Site Preparation Clearing, and Earthwork 2. Pre stripping activities at the quarry site 3. Construction of Additional Roads	• Design slope with correct elevation and level of benches for land stability	• Maintain slope not more than 70 Degrees. • 100% Implementation of a Final Mine Rehabilitation and Decommissioning Plan (FMRDP).
7. Reduced soil fertility	1. Site Preparation Clearing, and Earthwork 2. Pre stripping activities at the quarry site 3. Construction of Additional Roads 4. Clearing and Grubbing 5. Ore Extraction, Loading, and Hauling	• Topsoil conservation, storage, and management to preserve soil fertility. • Amelioration and conditioning of soil during revegetation. • Regular soil quality testing.	• Remove Less than 1m topsoil during extraction (Only during first phase of Extraction, No more topsoil as the Quarry Progresses) • Restore at least 80% of the initial Soil Quality prior to mining. • Quarterly application soil amelioration. To be conducted in March (25%), June (25%), September (25%), December (25%). • 100% planting of leguminous or nitrogen fixing plants in mined out /disturbed areas.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Implementation of Sloping Agricultural Land Technology along steep slopes to prevent erosion such as contour planting using leguminous hedgerows and other nitrogen fixing plants to enhance the fertility of the soil like kakawate, flemengia, rensonii, arakish pentoii etc.	• Conduct 4 (100%) soil quality testing annually. To be conducted on: March (25%), June (25%), September (25%), December (25%).
8. Land contamination due to potential leaks or spills of oils and fuels from equipment use.	1. Site Preparation Clearing, and Earthwork. 2. Pre stripping activities at the quarry site. 3. Construction of Additional Roads. 4. Ore Extraction, Loading, and Hauling 5. Stockpiling 6. Structure Decommissioning	• Strict implementation of the Hazardous materials storage and handling. • Provision of secondary containment with a capacity of 110% greater than the volume of contained liquid. • Requiring of Spill Kit in heavy equipment. • Regular spill drills to train employees and contractors of proper spill management. • Implementation of Soil Remediation program (as necessary) prior to Revegetation.	• 100% Availability of Spill Kits and secondary containment. • Weekly Inspection of Contractors' Area and Heavy Equipment. Checking for compliance Envi & Safety Requirement. (Spill Kits, PPEs, Fire Extinguishers). • Routine spill drill and IEC for employees and contractors every quarter.
9. Land contamination from solid and hazardous waste generation from domestic, office, and industrial activities.	1. Site Preparation Clearing, and Earthwork. 2. Pre stripping activities at the quarry site. 3. Construction of Additional Roads 4. Construction of Crushing Plant and other Facilities 5. Ore Extraction, Loading, and Hauling 6. Crushing Plant Operation 7. Vehicle operation (transportation of goods and people)	• Implementation of Solid Waste Management Program • Good Housekeeping • Implementation of Hazardous Waste Management Program.	• 100% Establishment of a Solid Waste Facility. • 100% completion of its target for Daily collection of Garbage Establish Material Recovery Facility • No more than 10% increase Housekeeping non-conformance every internal audit • Recycling of at least 20% of the monthly generated solid waste. • 100% Establishment of a Hazardous Waste Facility

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
	8. Daily office and housing facility operations 9. Structure Decommissioning 10. Rehabilitation of Mine Disturbed Areas		
10. Tenurial/ Land Use Issues with the CBFMA holders	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Ore Extraction, Loading, and Hauling	• Execution of MOA on temporary relinquishment of overlapping areas. • Partnership with local Peoples Organization to improve the CBFMA areas outside the areas of overlap.	100% Progressive rehabilitation of target disturbed areas thru tree planting and re-vegetation at mine-out areas to achieve the post mining land-use
11. Inconsistency of the Post Mining Land Use Plan with the CLUP of the LGU/ Land Use of the CBFM	1. Rehabilitation of Mine Disturbed Areas 2. Final Turnover of Project Facilities	• Consultation with Project stakeholders during the periodic review of FMRDP re Post Mining Land Use concept	• FMRDP consultation planning every 2 years. • 100% Implementation of a Final Mine Rehabilitation and Decommissioning Plan (FMRDP) according to Post Mining Land Use agreed with the stakeholders.
12. Exposure of Decommissioned Structures (Aesthetic Value)	1. Structure Decommissioning	• Revegetation of barren areas after decommissioning of structure.	• 100% Implementation of a Final Mine Rehabilitation and Decommissioning Plan (FMRDP).
13. Water Quality Degradation: Sedimentation and siltation in local rivers,creeks, and marine water due to local erosion, dust generation from disturbed areas, and accidental ore spillage from loading to conveyor belt transport to loading facility.	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Structure Decommissioning 9. Rehabilitation of Mine Disturbed Areas	• Provision of Buffer Zones • Proper Planning and Establishment of proper drainage system around active disturbed areas for runoff management: o Road berms and interceptor canals o Peripheral drains around the mines, stockpiles, and waste dumps.	• Buffer zone of at least of >25m between the Areas of Disturbance and Rivers and Creeks. • Limit disturbance to not more than 60 ha during Quarry Operations. • 100% completion on the construction of water management structures as designed or planned in the EPEP.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Installation of erosion control materials along slopes (coconets, gabion basket, stop logs, wattlings, and fascines). • Installation of silt curtain along the near shore water to capture silt/ sediment materials discharged in the ocean. • Conduct periodic maintenance of the water management structures. • Conduct Period monitoring on the stability and efficacy of the water management structures. • Conduct of Quarterly Ambient Water Quality Monitoring, Evaluation and Analysis. • Diversion water run-off from hills away from the active mining areas and waste dumps for low quality limestones and fines raised at 10-meter lifts • Construction of water retention/ treatment facilities (silt/ sediment ponds) at catchment areas for sediment removal prior to discharge of the clear water to the local streams. • Conveyor belt facility to be equipped with catchment system for ore spillage. • Regular collection of spilled materials as part of site maintenance activities. • Regular Water Quality Monitoring.	• 50% coverage of slope stabilization measures within the covered area. • 100% Installation of silt curtain and other filtration process in water discharge points • 100% completion of regular de-silting of catchment basins (Weekly and or Every after rains)Weekly inspection of settling ponds and drainage system evaluation. • 100% Conduct of Quarterly Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%) December (25%). • 100% Conduct of Quarterly Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%) December (25%).

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
14. Water Quality Degradation: Siltation of near shore environment due ore spillage during ore loading activities.	1. Port Operations (Barging, Shipping) 2. Ore stockpiling	• Installation of silt curtain at the periphery of the port to capture silt/ ore spillage. • Provision of ore spill raft as catchment during loading. • Regular Marine Water Quality Monitoring	• 100% Provision of Ore Spill Raft, at least 1 Raft Per Barge/LCT • 100% conduct of Quarterly Marine water quality monitoring to be conducted in March (25%), June (25%), September (25%), December (25%)
15. Water Quality Degradation: Water contamination from accidental spillage of fuel and chemicals from daily operational activities.	1. Ore Extraction, Loading, and Hauling 2. Crushing Plant Operation 3. Stockpiling 4. Port Operations (Barging, Shipping) 5. Vehicle operation (transportation of goods and people)	• Chemical and Fuel Storage areas equipped with spill kits and secondary containment. • Proper handling and storage of Hazardous Wastes. • Regular spill drills to train employees and contractors of proper spill management. • Hazardous waste disposal and treatment by DENR accredited facilities.	• 100% Availability of Spill Kits. • Weekly Inspection of Fuel and Chemical Storage Building Checking for compliance Envi & Safety Requirement. (Spill Kits, PPEs, Fire Extinguishers). • Routine spill drill and IEC for employees and contractors every quarter. • Schedule disposal upon reaching 80% of the Hazardous Waste Storage Facility capacity.
16. Water Quality Degradation: Nutrient influx from contaminated domestic wastewater.	1. Port Operations (Barging, Shipping) 2. Daily office and housing facility operations.	• Regulate barges and conduct IEC on Barge and Vessel Crew Regarding Company Policies on proper wastewater management. • Construction of septic tanks in all office buildings and accommodation buildings for domestic wastewater treatment prior to discharge. • Regular Water Quality Monitoring	• Barge Inspection every month. • Routine IEC for barge personnel/ contractors every quarter. • Zero discharge of untreated domestic wastewater. • 100% Conduct of Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%).
17. Water Quality Degradation: Water run-off contamination due to contact with exposed rocks and loose sediments.	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities.	• Establishment of Buffer Zone. • Limited clearing and earth movement according to the approved Site Development Plan.	• Buffer zone of at least of >25m between the Areas of Disturbance and Rivers and Creeks. • Limit disturbance to not more than 60 ha during Quarry Operations.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
	4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling Stockpiling	• Establishment of proper drainage system around active disturbed areas for runoff management: o Road berms and interceptor canals o Peripheral drains around the mines, stockpiles, and waste dumps. • Construction of water retention/ treatment facilities (silt/ sediment ponds) at catchment areas for sediment removal and chemical degradation prior to discharge of the clear water to the local streams. • Regular Water Quality Monitoring	• Weekly Drainage System Inspection. • Installation and maintenance of 5-10 Settling ponds before final discharge. • 100% Conduct of Quarterly Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%) December (25%).
18. Water Quality Degradation: Recharge of contaminated water in shallow aquifers	Ore Extraction, Loading, and Hauling	• Establishment of drainage system (road berms, interceptor canals) around active disturbed areas for runoff management. • Regular Water Quality Monitoring • Water Conservation Measures.	• 100% Conduct of Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%).
19. Threat to Freshwater and Marine Ecology: o Freshwater Habitat and Marine Habitat degradation from poor water quality (silt deposition and discharge of poor quality run-off/discharge) o Impediment in the natural biological processes of freshwater/ marine organisms due to presence of contaminants.	1. Construction of Crushing Plant and other Facilities. 2. Pre stripping activities at the quarry site 3. Clearing and Grubbing 4. Ore Extraction, Loading, and Hauling 5. Stockpiling 6. Crushing 7. Port Operations (Barging and Shipping)	• Installation of sediment control materials (i.e silt traps, gabions, silt fence, wattlings, etc.) along waterways to prevent flow of silt and contaminants to natural water bodies. • Regular Water Quality Monitoring Installation of silt curtain along the near shore water to capture silt/ sediment materials discharged in the ocean. • Provision of drainage system and water management structure at the periphery of the disturbed area.	• Installation and maintenance of 5-10 Settling ponds before final discharge. • 100% Conduct of inspection on settling ponds on a weekly basis. • 100% Conduct of Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%). • 100% establishment of periphery canal along disturbed areas diverting all silt laden run off to the established water management structures.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Construction of water retention/ treatment facilities (silt/ sediment ponds) at catchment areas. • Regular maintenance of the drainage and water management facilities. • Provision of ore spill raft as catchment during loading. • Regulate barges and conduct IEC on Barge and Vessel Crew Regarding Company Policies on Water Resource Management. • Regular Freshwater and Marine Habitat Monitoring. • Regular Water Quality Monitoring	• 100% implementation of the target maintenance activities per quarter. • 100% operation water raft per barge. • Conduct of IEC Campaign once a week or Weekly Sea based Contractors Meeting to monitor contractors Performance and Environmental Measures. • 100% Conduct of Semi-Annual Marine Ecology Assessment conducted every July (50%), January (50%). • 100% Conduct of Freshwater Ecology Assessment conducted every year. • 100% Conduct of Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%).
20. Human health impacts from water contamination	1. Construction of Crushing Plant and other Facilities. 2. Pre stripping activities at the quarry site 3. Clearing and Grubbing 4. Construction of Crushing Plant and other Facilities. 5. Pre stripping activities at the quarry site 6. Clearing and Grubbing 7. Ore Extraction, Loading, and Hauling 8. Stockpiling 9. Crushing Port Operations (Barging and Shipping)	• Provision of drinking water to employees to prevent tapping from untreated sources. • Separate water sources for project activities and community use. • Installation of Reverse Osmosis for water supply at the Camp facilities. • IEC on the water quality monitoring results to the community.	• 100% Conduct of Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%). • Conduct of Quarterly IEC re: Water Quality Monitoring Results. • 100% Conduct of Water Quality Sampling and Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%).

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Health programs under SDMP. • Regular water quality Monitoring	• Less than 3 cases of morbidity cases related to water borne illness among employees every month. • Implementation of quarterly medical missions and other health programs through the SDMP.
21. Water supply competition	1. Construction of Crushing Plant and other Facilities. 2. Pre stripping activities at the quarry site 3. Clearing and Grubbing 4. Ore Extraction, Loading, and Hauling 5. Stockpiling 6. Crushing 7. Port Operations (Barging and Shipping) 8. Water spraying for dust suppression 9. Daily office and housing facility operations	• Water sources separate from community water source. • Conditional Water Rights is secured from NWRB • Regular Flow Rate Measurement and Monitoring • Implementation of Water Conservation Measures such as recycling of water from the settling ponds to be used for plant watering and dust suppression. • Minimization on the use of water for domestic purposes. And harvesting of rainwater.	• 100% compliance to the conditions of Water Rights Permit from NWRB. • 100% conduct of quarterly flow rate monitoring on the identified water sources. • Recycle at least 10% of used water from the domestic. • At least 90% recycling of the run-off water contained in the settling ponds.
22. Potential downstream flooding due to high flow velocities and peak discharges during rainfall events.	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing Ore Extraction, Loading, and Hauling	• Hydrology and Discharge Monitoring • Construction of drainage control facilities for stormwater management. • Installation of sediment ponds acting as water retention ponds to attenuate flow.	• Quarterly discharge monitoring. • Daily meteorology monitoring. • 100% Conduct of inspection on settling ponds on a weekly basis. • 100% completion of regular de-silting of catchment basins (Weekly and or Every after rains)
23. Reduced infiltration and water holding capacity of the affected watershed.	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing	• Limited clearing and earth movement according to the approved Mine Development Plan; phasing of activities (if possible).	• Disturbed not more than 60ha during Quarry operations.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
	6. Ore Extraction, Loading, and Hauling	• Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	• Quarterly turnover of Mined out Areas for Progressive Rehabilitation. • 100% completion of the quarterly target for area revegetation.
24. Change in current pattern and littoral drifts due to alteration of wave refraction	1. Port Operations (Barging, Shipping)	• Careful site selection of Port location considering the discharge flow of creeks. • Regular Marine Ecology Monitoring Regular Marine Water Quality Monitoring	• 100% conduct of Annual Coral and Marine Habitat monitoring • 100% conduct of Quarterly Marine Water Quality Monitoring to be conducted in March (25%), June (25%), September (25%), December (25%)
25. Erosion of shorelines	1. Port Operations (Barging, Shipping)	• Installation of gabion baskets to serve as sea wall to prevent erosion. • Covering of tarpaulin at the causeway head during high swell or bad weather condition to prevent causeway material from eroding. • Suspension of loading and docking of barges during bad weather condition.	• 100% implementation of seawall. • Weekly Causeway Inspection. • 100% covering of tarpaulin at the causeway head during bad weather condition
26. Dust Generation from Equipment Operation	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Port Operations (Barging and Shipping) 9. Structure Decommissioning Rehabilitation of Mine Disturbed Areas	• Provision of Buffer Zones from mine area to the nearest community. • Deployment of Water Trucks for Dust Suppression Regular Ambient Air Monitoring	• Buffer zone of at least of >25m around the periphery of the disturbed area. • Deployment of Water trucks for Dust Suppression. 1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily. 50 Trips Daily. 100% Conduct of Ambient Air Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%)

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
27. Dust generation from vehicle and heavy equipment movement	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Vehicle operation (transportation of goods and people) 9. Structure Decommissioning 10. Rehabilitation of Mine Disturbed Areas	• Water truck deployment • Speed limit regulation • Regular Ambient Air Monitoring	• Deployment of Water trucks for Dust Suppression. 1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily. 50 Trips Daily. • Speed limit set at 20 kph for mobile vehicles and 15 kph for dump trucks and other heavy equipment. • 100% Conduct of Ambient Air Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%)
28. Dust generation from Stockpiles	1. Stockpiling	• Covering stockpiles to prevent dust and fines from blowing • Set the stockpile Location with Natural Wind Barrier (vegetation as ecological curtain) • Regular Water Spraying at the stockpile area.	• Full cover of stockpile with tarpaulin material. • 100% Water Spraying Every Day.
29. Health Impacts from Dust Generation: o Stunted growth of plants due to dust deposition. Health Impacts from dust inhalation	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Vehicle operation (transportation of goods and people) 9. Port Operations (Barging and Shipping 10. Structure Decommissioning	• Deployment of Water Trucks for Dust Suppression • Provision of PPEs to employees directly working at the active areas. • Health programs under SDMP (i.e. free medical assistance for the community) • Regular road maintenance • Set the stockpile Location with Natural Wind Barrier	• Deployment of Water trucks for Dust Suppression. 1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily. 50 Trips Daily. • 100% Provision of Personal Protective Equipment • Implementation of quarterly medical missions and other health programs through the SDMP.

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
	11. Rehabilitation of Mine Disturbed Areas.	• Enforce appropriate speed limit to vehicular movement. • Regular Ambient Air Monitoring.	• Speed limit set at 20 kph for mobile vehicles and 15 kph for dump trucks and other heavy equipment. • 100% Conduct of Ambient Air Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%).
30. Chemical emissions from fuel combustion/ equipment use	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Vehicle operation (transportation of goods and people) 9. Port Operations (Barging and Shipping) 10. Structure Decommissioning 11. Rehabilitation of Mine Disturbed Areas.	• Efficient equipment utilization (achieving the same volume of work while maintaining lower diesel consumption for lower gas emissions.) • Require regular maintenance of vehicle and equipment. • Regular preventive maintenance. • Monitoring of fuel consumption. • Consider buffer zones at areas near communities; development of green belt/plantation in the safety zone • Progressive rehabilitation thru tree planting to sequester carbon emissions from quarry and transport operations • Regular Ambient Noise Monitoring.	• Daily Inspection of Crushing Plant and Heavy Equipment to check equipment worthiness. • Monitoring of fuel consumption. Submission of Energy consumption Report to MGB every Quarter. • Plant high-rise and thick trees around quarry areas that will serve as a buffer zone Coordinate • Tree Planting activities as part of Progressive Rehabilitation. • 100% Quarterly turn-over of Mined out Areas for Progressive Rehabilitation. • 100% Quarterly Air Quality Sampling & Monitoring: March (25%), June (25%), September (25%) December (25%).

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
31. Noise generation from crushing plant and equipment operation	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Port Operations (Barging and Shipping) 9. Structure Decommissioning 10. Rehabilitation of Mine Disturbed Areas	• Installation of noise suppression accessories to the machineries (i.e. mufflers). • Provision of PPEs to employees directly working at the active areas. • Free medical assistance for the community. • Regular road maintenance. • Use of vegetation buffer to minimize noise. • Require regular maintenance of equipment both inhouse and Contractors. • Regular plant preventive maintenance. • Regular Ambient Noise Monitoring.	• 100% Provision of Personal Protective Equipment • Daily Inspection of Crushing Plant and Heavy Equipment • 100% Conduct of Ambient Noise Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%).
32. Noise generation from drilling and blasting.	1. Drilling 2. Blasting	• Drilling machine shall be fitted with dust suppression, collection and disposal arrangement. • Deep wetting of drilling zones shall be done by water sprinkling before starting drilling. • During the drilling operations efforts shall be made to reduce dust generation by taking appropriate measures • Drilling and Blasting operation via Third-Party experts. • Implementation of controlled blasting techniques such as single hole firing, trim blast, and pre-splits. • Regular noise quality monitoring.	• Drilling will be done Once a Week • 100% Conduct of Noise Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%).

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
33. Human health impacts from air and noise pollution	1. Site Preparation Clearing, and Earthwork 2. Construction of Additional Roads 3. Construction of Crushing Plant and other Facilities. 4. Pre stripping activities at the quarry site 5. Clearing and Grubbing 6. Ore Extraction, Loading, and Hauling 7. Stockpiling 8. Vehicle operation (transportation of goods and people) 9. Port Operations (Barging and Shipping) 10. Structure Decommissioning 11. Rehabilitation of Mine Disturbed Areas. Drilling and Blasting	• Provision of Personal Protective Equipment (PPE) for employees directly working at the active sites. • Implementation of health programs under SDMP. • Regular briefing on safety hazards and safety practices at work • Regular Ambient Air and Noise Monitoring.	• 100% Provision of Personal Protective Equipment • Implementation of quarterly medical missions and other health programs through the SDMP. 100% Conduct of Air and Noise Quality Sampling (Quarterly) to be conducted in March (25%), June (25%), September (25%), December (25%).
34. Safety and Health Impacts from Blasting: o Fly Rock Generation o Generation of fines and dust is influenced by several blasting and rock parameters Release of Fumes	Blasting	• Contract an Accredited Third Party to Conduct Drilling and Blasting Activity • Implementation of controlled blasting techniques such as single hole firing, trim blast, and pre-splits. • Follow the prescribed blasting specifications. • Provision of Personal Protective Equipment (PPE) for employees directly working at the active sites. Implementation of health programs under SDMP.	• Blasting Parameters: o Ammonium Nitrate with Fuel Oil (ANFO) o Cast Primer 250 gms o NONEL Surface Connector x 6 metres o In-hole delay, 500ms x 12 metres o Detonating Cords, 6 grams Cast Primer 250 gms o NONEL Surface Connector x 6 metres o In-hole delay, 500ms x 12 metres o Detonating Cords, 6 grams • Implementation of quarterly medical missions and other health programs through the SDMP.
35. Occupational Hazards from Issues of Structural stability of the Plant	1. Crushing Plant Operation	• Crushing Plant Facility will undergo detailed stability analysis. • Structural analysis takes into consideration a number of foreseeable forces including gravitational (based on rated capacity), dynamic, wind and manual forces.	• Full compliance to the Building Code of the Philippines. • 100% Daily Toolbox Meetings before each shift. • 100% conduct of regular monitoring for signs of instability

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
		• Analysis take into consideration the machines expected operating configuration, envelope, and approved operating conditions (i.e. slope) • Provision of Personal Protective Equipment (PPE) for employees directly working at the active sites. • Safety Orientation for Employees • Regular stability monitoring	
36. Stability issues from stockpiling (i.e. Rainwater absorption and slumping)	1. Stockpiling	• Proper stockpiling. • Provision of stockpile cover when it rains. • Provision of Personal Protective Equipment (PPE) for employees directly working at the active sites.	• Stockpile slope should now be greater than 70 degrees. • 100% conduct of regular monitoring for signs of instability. • 100% Provision of Personal Protective Equipment
37. Vehicular accidents	1. Ore Extraction, Loading, and Hauling 2. Stockpiling 3. Vehicle operation (transportation of goods and people)	• Defensive Drivers' Training • Safety Orientation for Drivers	• 100% Provision of Personal Protective Equipment • 100% Daily Toolbox Meetings before each shift.
38. Work safety hazards related to demolition of structures (industrial accidents resulting to physical injuries)	1. Structure Decommissioning 2. Rehabilitation of Mine Disturbed Areas.	• Risk Assessment and Management Plan included as part of the Mine Closure Planning • Safety Orientation for Employees • Provision of Personal Protective Equipment (PPE) for employees directly working at the active sites.	• Mine closure planning and review every 2 years. • 100% Daily Toolbox Meetings before each shift. • 100% Provision of Personal Protective Equipment
39. Safety hazards related to long-term structural stability of rehabilitated areas	1. Structure Decommissioning 2. Rehabilitation of Mine Disturbed Areas.	• Conduct Geotechnical slope stability analysis prior to and after final rehabilitation	• 100% Implementation of a Final Mine Rehabilitation and Decommissioning Plan (FMRDP). • Third-party stability analysis every 2 years. • 100% conduct of regular monitoring for signs of instability

Potential Impacts	Project Phase/ Activity	Management Plan for Prevention, Mitigation and Enhancement	Target Efficiency
40. Displacement of local workers and Loss of source of income (employment, business opportunities, etc.) from Project closure	1. Rehabilitation of Mine Disturbed Areas 2. Final Turnover of Project Facilities	• Implementation of Labor Support Policies and Programs during the early stages of operation to improve the employment capacity of the workers in preparation to the job transition. • Series of capacity building programs for the community which will include organizational strengthening, capability assessment, enhancement trainings, financial management, project management, etc. • Post mining sustainable livelihood program. • Retrenchment package provided for the employees in accordance to the Labor Code. • Sustainability planning of the livelihood component of the SDMP.	• Stakeholder consultation on sustainable livelihood planning. • Regular stakeholder consultation on SDMP Program planning and implementation. • 100% Implementation of Sustainable Livelihood under the Final Mine Rehabilitation and Decommissioning Program (FMRDP).
41. Less income to LGU and National Government due to termination of taxes from the Project	1. Rehabilitation of Mine Disturbed Areas 2. Final Turnover of Project Facilities	• Sustainability planning of the projects under SDMP. • Capacity building for the locals • Post mining sustainable livelihood program.	• Regular stakeholder consultation on SDMP Program planning and implementation. • 100% Implementation of a Final Mine Rehabilitation and Decommissioning Plan (FMRDP).
42. Security Issues: o Theft of dismantled facilities/ components with residual value. o Intrusion of outsiders/ illegal claimants in the Project area	1. Structure Decommissioning 2. Rehabilitation of Mine Disturbed Areas.	• Maintenance of a Security group regularly patrolling the area • Security checkpoints to control access to the area • Community Relations Office to remain during the Mine Closure Rehabilitation Period	• Checkpoints at every entry and exit points of the MPSA. • Local coordination (LGU, IPs) through regular meetings and consultation.

Section 1- Project Description

1.1. Project Location and Area

The Mineral Production Sharing Agreement (MPSA 134-99-XIII) in which the Agata Limestone Project (ALP) is located covers a total of 4,995-hectare area. The tenement is bound by geographical coordinates 9°10’30” and 9°19’30” north latitude and 125°29’30” to 125°33’30” east longitude, encompassing the municipalities of Tubay, Jabonga, and Santiago, located within the province of Agusan del Norte in Mindanao, Philippines. The geographical coordinates of the MPSA is shown on **Table 1-1.**

The mining operations and activities for the proposed Limestone Project will be confined within the MPSA boundary. The existing mine facilities of Agata Nickel Laterite Project (ANLP) will also be used for the Limestone Quarrying operations. The map in **Figure 1-1** shows the Limestone Project area relative to the MPSA location.

Nearest commercial airports near the site are the Butuan City and Surigao City Airports, where daily flights to and from Manila and Cebu are available. Commercial sea transport to Nasipit (Butuan City) and Surigao City are also available. The mine site is approximately 47 kilometers north-northwest of Butuan City and 73 kilometers southwest of Surigao City. It is accessible by any land vehicle either from Surigao City or Butuan City via the Pan-Philippine Highway to Brgy. Bangonay intersection in Jabonga, Agusan del Norte, thence via a 4-km concrete municipal road towards the west, followed by a 6-km farm-to-market all weather road southwards to the main gate of the project camp. From this point, the limestone quarry site is connected via a 4-km mine road passing through the existing nickel project access roads.

There is an existing Environmental Compliance Certificate granted under the MPSA. This is for the ongoing Agata Nickel Laterite Project (ANLP). The original ECC was issued to MRL Gold Philippines Inc. in May 2008. Ownership of the ECC was then transferred to Minimax Mineral Exploration in November 2013; with the ECC conditions remained the same. On April 22, 2014, a Deed of Assignment was executed between Minimax and Agata Processing Inc. (API) assigning, transferring and conveying to the latter all rights, interests and obligations of the former under the approved MPSA, including the ECC. This Deed of Assignment was approved by the MGB last June 21, 2016. Finally, in July 2018, the ECC was amended for an increased production capacity and was issued under API. The amended ECC covers a total mining area of 603.06 hectares with annual production capacity of 3.5 million DMT per year. The geographical coordinates of the ANLP ECC is listed in **Table 1-2.**

The MPSA includes the Agata North Laterite and Agata South Laterite Prospect but at present, only the ANLP is being developed. The Agata South prospect, located at the southern portion of the MPSA, is a potential source for high iron laterite deposit. Exploration activities, including test pitting commenced in July as additional input for the Final Exploration Report and the 3-Year Work Program being prepared for submission to MGB. Another related mineral being explored for development within the MPSA is the Agata Magnesium Oxide Project (AMOP). In-house estimate is available for magnesium oxide resource, however, the current economics for the commodity does not warrant investment to pursue for development just yet. This possibility will be revisited in the future. The map of mineral prospects within MPSA relative to the proposed limestone project is shown on **Figure 1-2.**

The proposed ALP ECC coverage area is within the MPSA and will cover about 554.4 hectares. The geographical coordinates is listed in **Table 1-2.** This area will include the Agata Limestone Quarry, Ore Stockyards, and other facilities such as access roads, administrative office, power and water source, drainage system, motor pool, etc. The location of the ECC application area for the Agata Limestone Project, relative to the MPSA and the ANLP ECC is shown in **Figure 1-3.**

The commencement year of Agata Limestone Project is set after the completion of the Agata Nickel Laterite Project. The use of some of the mine facilities from ANLP will be continued when the ALP start operating.

Table 1-1 MPSA 134-99-XIII Corner Points Survey and Geographical Description

Corner	Latitude	Longitude	Notes
1	9° 10' 30"	125° 32' 00"	
2	9° 11' 00"	125° 32' 00"	
3	9° 11' 00"	125° 33' 00"	Parcel I
4	9° 10' 30"	125° 32' 00"	
1	9° 12' 30"	125° 31' 22.5"	
2	9° 13' 15"	125° 31' 22.5"	
3	9° 13' 15"	125° 31' 00"	
4	9° 13' 30"	125° 31' 00"	
5	9° 13' 30"	125° 30' 52.5"	
6	9° 14' 22.5"	125° 30' 52.5"	
7	9° 14' 37.5"	125° 30' 30"	Parcel II
8	9° 14' 37.5"	125° 30' 22.5"	
9	9° 15' 45"	125° 30' 22.5"	
10	9° 15' 45"	125° 30' 30"	
11	9° 16' 30"	125° 30' 30"	
12	9° 16' 45"	125° 30' 22.5"	
13	9° 18' 00"	125° 30' 22.5"	
14	9° 18' 30"	125° 30' 07.5"	
15	9° 18' 30"	125° 30' 00"	
16	9° 19' 00"	125° 30' 00"	
17	9° 19' 00"	125° 29' 45"	
18	9° 19' 30"	125° 29' 39.3"	
19	9° 19' 30"	125° 30' 00"	
20	9° 19' 00"	125° 30' 00"	
21	9° 19' 00"	125° 31' 30"	
22	9° 18' 30"	125° 31' 30"	
23	9° 18' 30"	125° 33' 30"	
24	9° 16' 00"	125° 33' 30"	
25	9° 16' 00"	125° 33' 00"	
26	9° 16' 30"	125° 33' 00"	
27	9° 16' 30"	125° 32' 30"	
28	9° 16' 30"	125° 32' 00"	Excluded
29	9° 16' 30"	125° 31' 30"	
30	9° 16' 00"	125° 31' 30"	
31	9° 16' 00"	125° 32' 00"	
32	9° 16' 30"	125° 32' 00"	
33	9° 16' 30"	125° 32' 30"	
34	9° 15' 00"	125° 32' 30"	
35	9° 15' 00"	125° 33' 00"	Parcel II
36	9° 13' 30"	125° 33' 00"	
37	9° 13' 30"	125° 32' 00"	
38	9° 13' 00"	125° 32' 00"	
39	9° 13' 00"	125° 31' 30"	
40	9° 12' 30"	125° 31' 30"	

Figure 1-1 Agata Limestone Project Location Map

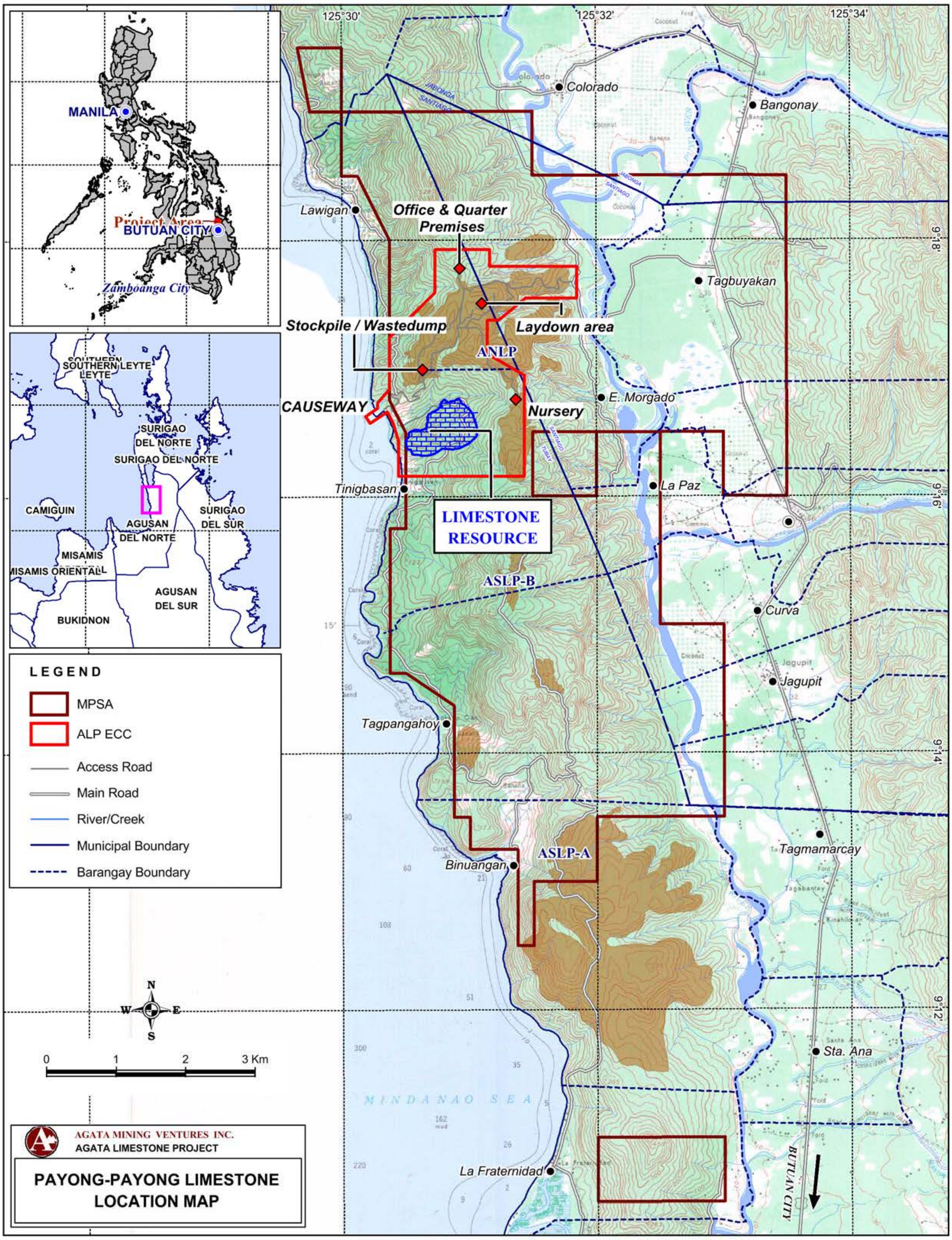


Table 1-2 Agata Nickel Laterite Project ECC Corner Points Survey and Geographical Description

Corner	Latitude	Longitude
1	125°30' 26.6544"	9°16' 09.5268"
2	125°30' 26.6976"	9°16' 25.4892"
3	125°30' 23.9400"	9°16' 34.5324"
4	125°30' 21.3300"	9°16' 39.7128"
5	125°30' 13.2408"	9°16' 34.3236"
6	125°30' 10.9548"	9°16' 37.5312"
7	125°30' 16.6536"	9°16' 41.3580"
8	125°30' 16.7688"	9°16' 43.9752"
9	125°30' 22.5000"	9°16' 50.4624"
10	125°30' 22.5000"	9°17' 14.4816"
11	125°30' 43.8948"	9°17' 35.3508"
12	125°30' 44.0388"	9°17' 55.4676"
13	125°31' 09.7788"	9°17' 55.2876"
14	125°31' 09.7248"	9°17' 47.6556"
15	125°31' 50.9412"	9°17' 47.3640"
16	125°31' 50.8332"	9°17' 32.4528"
17	125°31' 26.6520"	9°17' 32.6220"
18	125°31' 13.9728"	9°17' 22.2072"
19	125°31' 08.7096"	9°17' 22.2432"
20	125°31' 08.5980"	9°17' 06.6804"
21	125°31' 26.1480"	9°16' 56.4492"
22	125°31' 25.8960"	9°16' 09.1452"

Table 1-3 Agata Limestone Project ECC Corner Points Survey and Geographical Description

Corner	Latitude	Longitude
1	125° 30' 29.9988"	9° 16' 09.4944"
2	125° 30' 29.9988"	9° 16' 30.0000"
3	125° 30' 22.5000"	9° 16' 45.0012"
4	125° 30' 22.5000"	9° 17' 14.4816"
1	125° 30' 43.8948"	9° 17' 35.3508"
2	125° 30' 44.0388"	9° 17' 55.4676"
3	125° 31' 09.7788"	9° 17' 55.2876"
4	125° 31' 09.7248"	9° 17' 47.6556"
5	125° 31' 50.9412"	9° 17' 47.3640"
6	125° 31' 50.8332"	9° 17' 32.4528"
7	125° 31' 26.6520"	9° 17' 32.6220"
8	125° 31' 13.9728"	9° 17' 22.2072"
9	125° 31' 08.7096"	9° 17' 22.2432"
10	125° 31' 08.5980"	9° 17' 06.6804"
11	125° 31' 26.1480"	9° 16' 56.4492"
12	125° 31' 25.8960"	9° 16' 09.1452"
13	125° 30' 29.9988"	9° 16' 09.4944"
14	125° 30' 29.9988"	9° 16' 30.0000"
15	125° 30' 22.5000"	9° 16' 45.0012"
16	125° 30' 22.5000"	9° 17' 14.4816"

Figure 1-2 - Agata Tenement Map

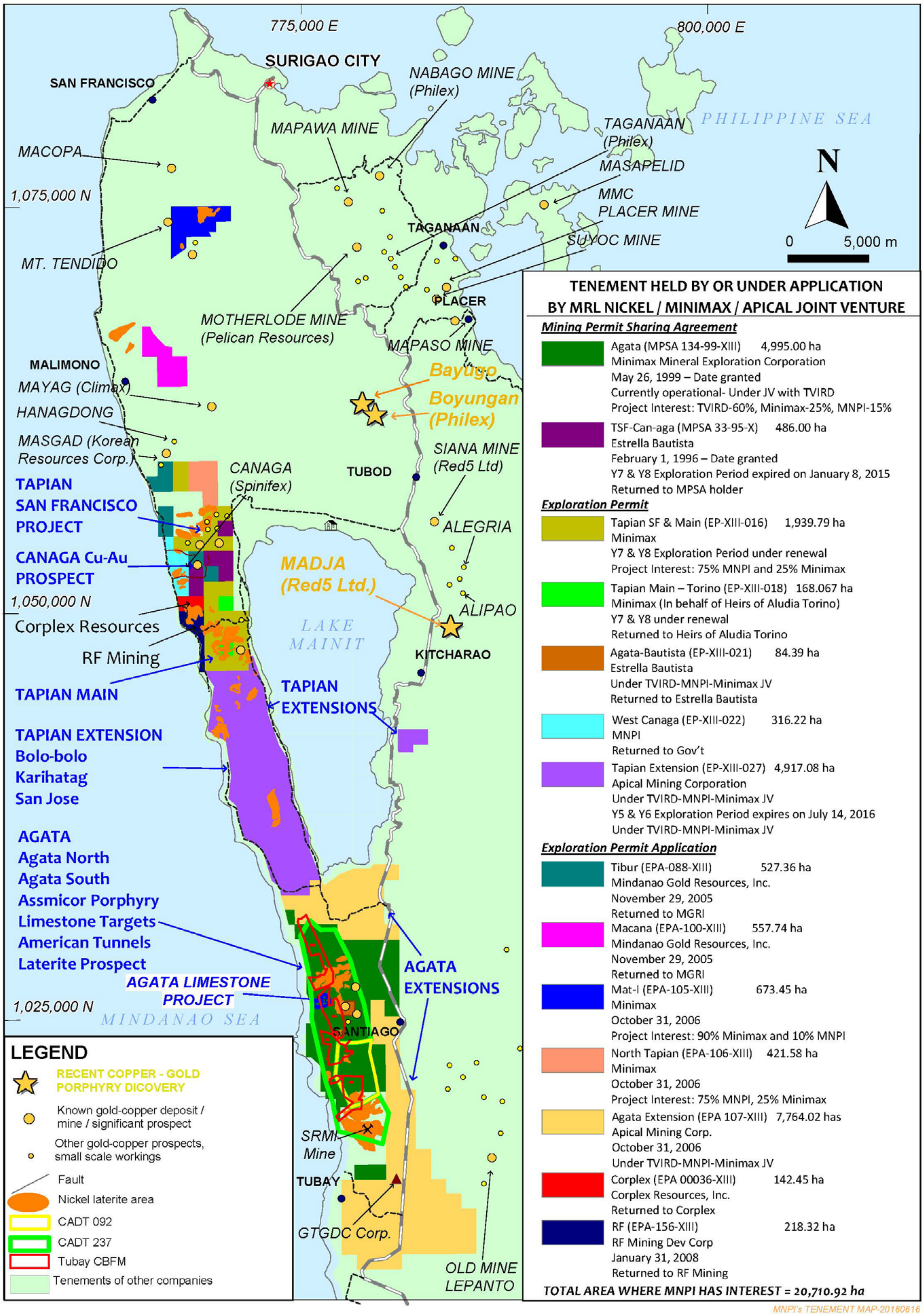
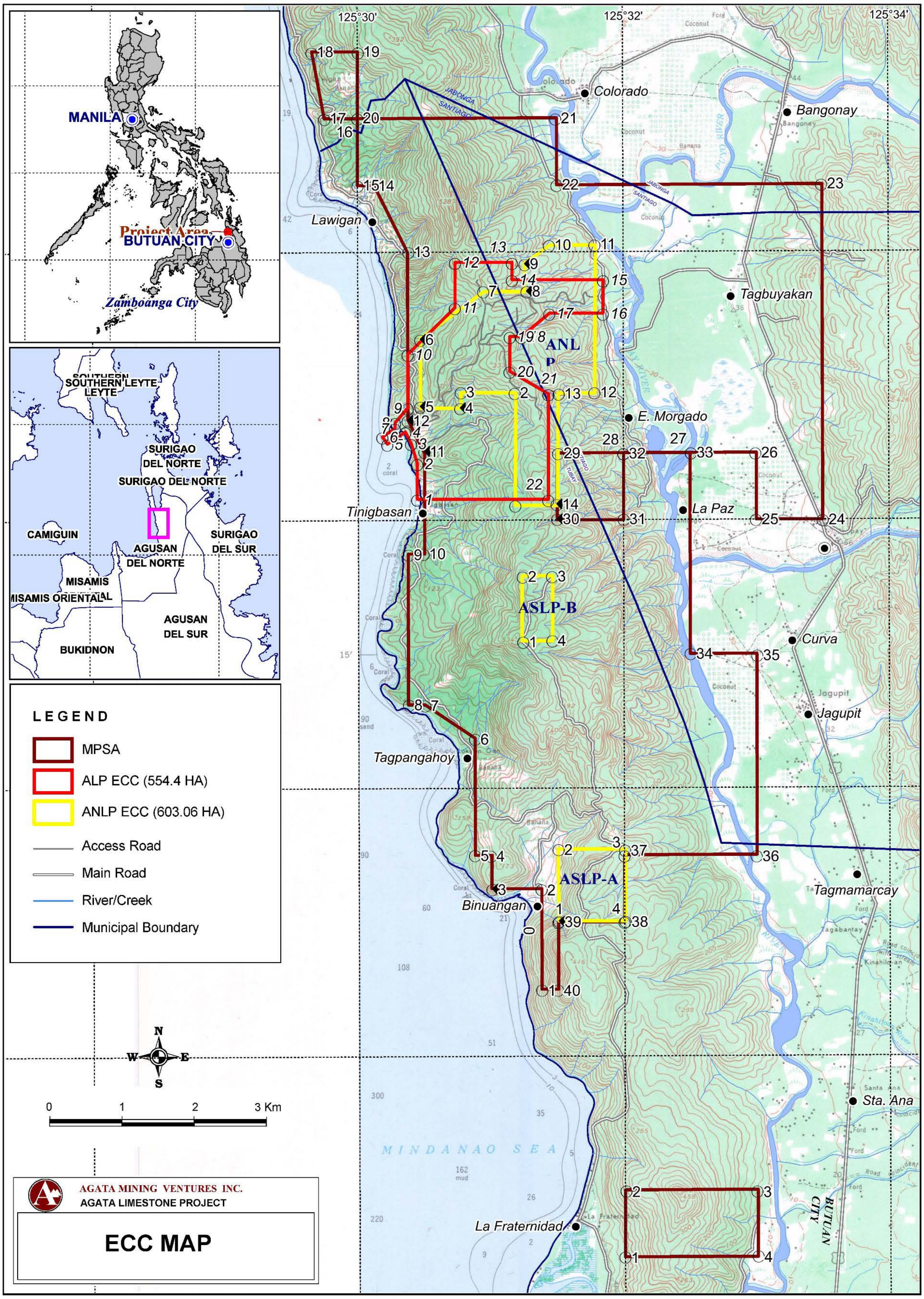


Figure 1-3 Proposed ALP ECC and ANLP ECC Location Map



1.1.1. Project Impact Areas

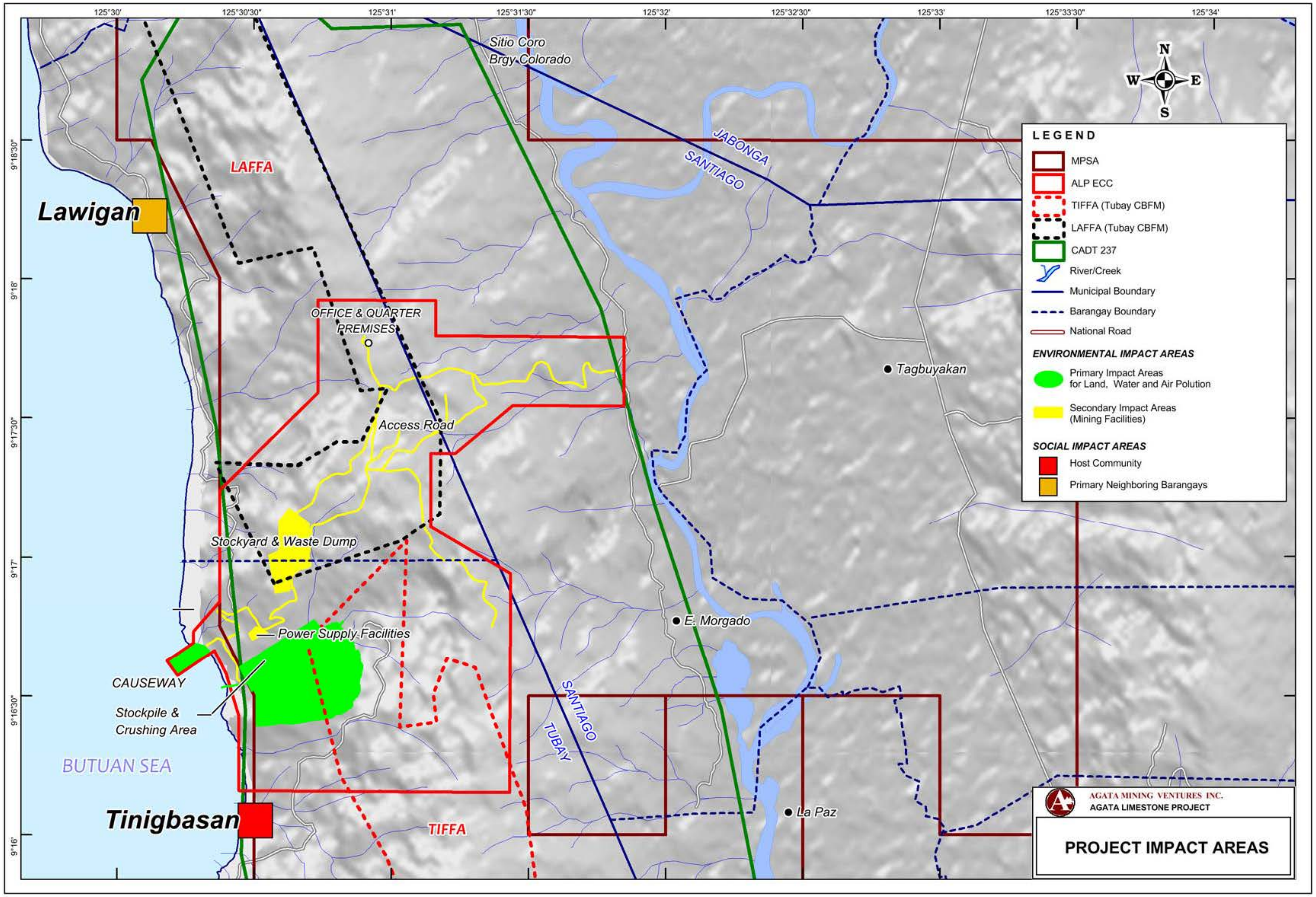
The primary impact barangays include two (2) barangays within the MPSA area, where the Agata Limestone surface mine and the mine facilities will be located. These include Brgy. Lawigan and Brgy. Tinigbasan, both within the Tubay Municipality. They will be the most susceptible to the direct and/or indirect environmental impacts relative to the air and noise quality, watershed functions including stream flows and water quality, and to disturbance of flora and fauna resources. They are also affected by the socio-cultural impacts, determined based on several qualitative factors such as livelihood, and cultural impacts from the Project.

The impact areas and how they are affected by the Project is listed in **Table 1-4**. Location of the impact areas are also shown in Error! Reference source not found..

Table 1-4 Project Impact Areas by Sector

Impacts	Affected Area
Land Resource Impacts	
Clearing of vegetation	Brgy. Tinigbasan
Sedimentation of agricultural lands	Brgy. Tinigbasan
Overlapping tenurial instruments	Brgy. Tinigbasan
Air Impacts	
Dust generation	Brgy. Tinigbasan, Brgy. Lawigan
Exhaust emission	Brgy. Tinigbasan, Brgy. Lawigan
Noise	Brgy. Tinigbasan, Brgy. Lawigan
Water Resource Impacts	
Siltation of waterways	Brgy. Tinigbasan
Diversion of streamflow	Brgy. Tinigbasan
Social Impacts	
Socio-cultural impacts to IPs	CADT 237
Socio-cultural impacts to non-IP communities	Brgy. Tinigbasan
Increase in Employment and Business Opportunities	Brgy. Tinigbasan, Brgy. Lawigan
Land Resource Impacts	
Clearing of vegetation	Brgy. Tinigbasan
Sedimentation of agricultural lands	Brgy. Tinigbasan
Overlapping tenurial instruments	Brgy. Tinigbasan
Air Impacts	Brgy. Tinigbasan, Brgy. Lawigan

Figure 1-4- Project Impact Area



Section 1- Project Description

1.2. Project Rationale

1.2.1. National and Regional/ Local Economic Development

Our country is endowed with rich mineral resources. Responsible development and extraction will benefit not only the localities where mining projects are located but will benefit the whole country as well.

The government is generating funds to replenish its treasury depleted because of the economic havoc the COVID-19 pandemic has wrought and is wreaking. The Department of Finance (DOF), Bangko Sentral ng Pilipinas (BSP), Department of Trade and Industry (DTI), and Mines and Geosciences Bureau (MGB), among others, are correct in espousing for the mineral sector because it can significantly help in our current economic malady.

The Agata Limestone Project will generate funds for government in terms of Income Taxes, Withholding Taxes on Payroll, Withholding Taxes on Foreign Stockholders' Dividends, Withholding Taxes on Profit Remittance to Principal, Withholding Taxes on Interest Income, Excise Taxes on Minerals, Customs Duties/Fees, VAT on Imported Equipment, VAT on Sale of Good or Properties, Mine Waste and Tailings Reserve Fund, Occupation Fees, Evaluation Fees of FS Report/EPEP, Mineral Processing Fee, OTP, Purchaser's License to Purchase/Transfer Explosives, Documentary Stamp Taxes, Capital Gains Tax, among others. The mining industry is recorded as top contributor to the Gross Regional Domestic Product of the CARAGA Region.

A robust responsible mining industry will also help boost investor confidence-- a very important factor in the current situation. Local and foreign investors alike, will look at the Philippines as a balanced pro-development country if it will promote responsible mining. Furthermore, a profitable mining venture will help strengthen the banking and financial institutions, who normally lends capital for mining projects.

A mining project is a huge employer in a locality and by virtue of its location, spurs development in the rural areas of the country. This gives the Government an opportunity to divert its resources to the less fortunate rural areas. For every job created in mining, the International Council on Mining and Metals (ICMM) estimates two to five more created in other sectors. The Project will provide employment opportunities to the residents of Tubay, Agusan del Norte.

As a contributor to the supply chain, Agata Limestone Project aims to initially serve the construction and steel industry, as well as the environmental and agricultural sectors, although very high purity limestone can eventually be processed for the paper and paints industry. In terms of the product, limestone applications extend to various industries including glass, paper, fertilizer, food and medical goods, as well as steel, cement and construction aggregates. Limestone is an essential material that plays a key role in our daily lives.

Global demand for steel continues to rise to meet the demands of the construction and automobile sectors. Likewise, the demand for limestone is expected to increase as it is a key raw material for steelmaking. The main consumers of the Philippine limestone lumps are the steelmakers based in Taiwan and Japan. The Limestone Project could contribute to the country's foreign exchange earnings through exports and will provide additional revenue to the government through taxes for as long as 15 years.

1.2.2. Socio-Economic Benefits

Operation of the Limestone Project is anticipated to provide socio-economic benefits to the Host and Neighboring Communities through the implementation of the Social Development and Management Program (SDMP), which include the following:

- Human Resource Development and Institutional Building
- Enterprise Development and Networking
- Assistance to Infrastructure Development and Support Services
- Access to Education and Educational Support Programs
- Access to Health Services, Health Facilities and Health Professionals
- Protection and Respect of Socio-Cultural Values
- Use of facilities/services within the mine camp such as the medical practitioners, ambulance, service vehicles for emergency situations, etc.

The projected SDMP allocation for five years is estimated at Php 39.6 million. Breakdown per program sector is shown in **Table 1-5.**

On top of the community benefits from SDMP, the IP communities will continue to benefit from the royalty payments while the Project is in operation. Royalty share from the Limestone project will sustain the improvement of the IP sector and their communities in accordance with their Community Royalty Development Plan.

Table 1-5 Projected SDMP Allocation for Years 2022-2026 (PhP)

Government Income	2022	2023	2024	2025	2026
Health, Nutrition and Sanitation Programs (18%)	1,083,341	1,143,462	1,054,828	1,008,241	1,051,383
Education Programs (18%)	1,083,341	1,143,462	1,054,828	1,008,241	1,051,383
Livelihood Programs (37%)	2,226,869	2,350,450	2,168,258	2,072,496	2,161,177
Public Infrastructure Programs- (15%)	902,784	952,885	879,023	840,201	876,153
Socio-Cultural and Religious Activities (12%)	722,227	762,308	703,218	672,161	700,922
Information Education and Communication (IEC) – (15%)	1,203,712	1,270,513	1,172,031	1,120,268	1,168,204
Development of Mining Technology Geosciences – (10%)	802,475	847,009	781,354	746,845	778,802
TOTAL	8,024,753	8,470,091	7,813,542	7,468,455	7,788,027

Source: CRO

The Mamanwa-Manobo IP sector has already acquired their Certificate of Ancestral Domain Title (CADT) Number 237 giving this sector ancestral authority over areas within the Agata MPSA including the ALP area. They have an existing Community Royalty Development Program (CRDP), which was duly approved by the NCIP Commission En Banc and is basis of the Indigenous Cultural Communities' development programs. At present funding for the CRDP is derived from the Agata Nickel Laterite Project's royalty payments, and will be continued using the royalty payments from the ALP.

The following tribal groups comprise the CADT 237 holders with their corresponding royalty shares:

- Mamanwa Tribal Management Organization – 23%
- Agata Mamanwa Tribal Organization – 23%
- Mamanwa Manobo Mapaso Tribal Sectoral Organization – 24%
- Coro Mamanwa Management Organization – 30%

Approximately PHP 45.5 million worth of royalty will be received by the IP beneficiaries for the first five (5) years of the Project, as shown on **Table 1-6**.

Table 1-6 Estimated Royalty Payments (PHP)

Cost Item	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
IP Royalty	9,213,750	9,804,350	8,977,500	8,583,750	8,977,500	45,556,850

Allocation of the royalty payments they will receive will be used for the implementation of their Community Royalty Development Plan (CRDP). Fund allocation will be 50% for CADT governance and 50% for IP community development program. The corresponding allocation per program groups is presented in **Figure 1-5** and **Figure 1-6.**

Figure 1-5 IP Allocation for Community Development Program

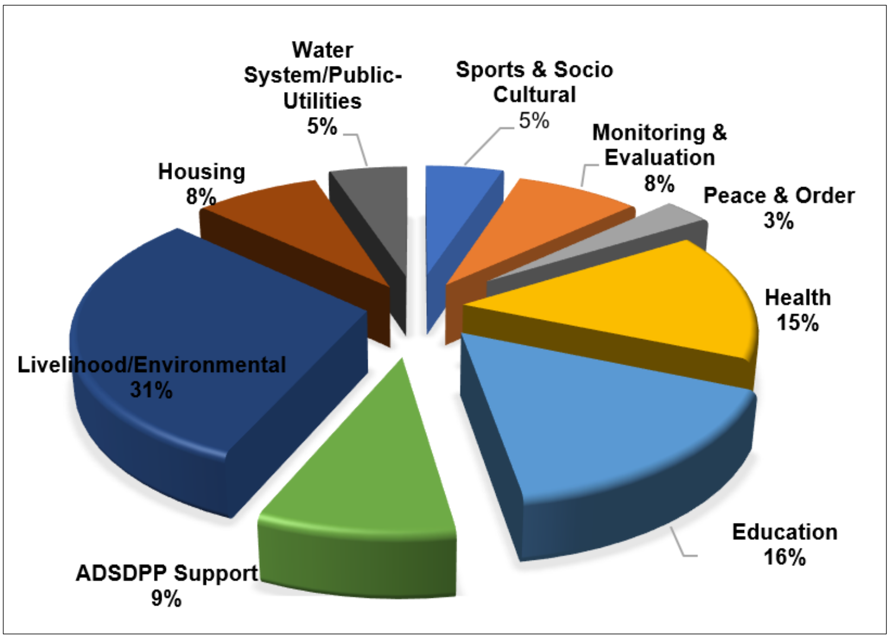
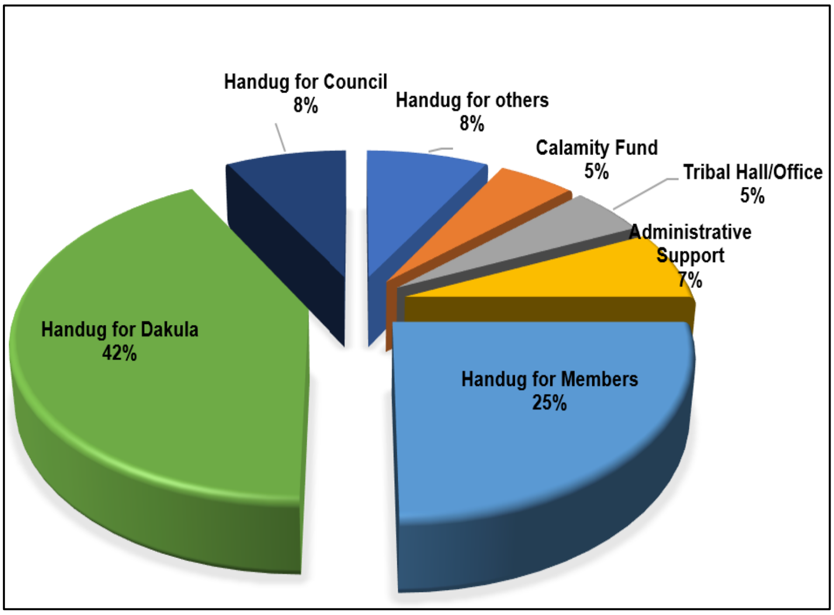


Figure 1-6 IP Royalty Allocation for Governance



Benefit of the LGU and the National Government will be in the form of taxes (i.e., business taxes, excise taxes, withholding taxes, corporate income taxes, and occupational taxes). Other income includes various permit fees and license fees.

As shown in **,** approximately Php 392 million will be collected from the Project in the form of taxes, royalty, SDMP, and fees for the first five years of project operation.

Table 1-7 Estimated Project Benefits from SDMP, Taxes, Fees, and Royalty (PHP)

Cost Item	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Volume, DMT	2,047,500	2,178,750	1,995,000	1,907,500	1,995,000	10,123,750
Revenue	921,375,000	980,437,500	897,750,000	858,375,000	897,750,000	4,555,687,500
OPEX	534,983,540	564,672,742	520,902,860	497,897,059	519,201,860	2,637,658,060
SDMP	8,024,753	8,470,091	7,813,543	7,468,456	7,788,028	39,564,871
IP Royalty	9,213,750	9,804,375	8,977,500	8,583,750	8,977,500	45,556,875
Wharfage	18,785,813	19,990,031	18,304,125	17,501,313	18,304,125	92,885,406
Excise Tax	36,855,000	39,217,500	35,910,000	34,335,000	35,910,000	182,227,500
Business Tax	6,449,625	6,863,063	6,284,250	6,008,625	6,284,250	31,889,813
TOTAL	**79,328,941**	**84,345,060**	**77,289,418**	**73,897,143**	**77,263,903**	**392,124,465**

1.3. Project Alternatives

Different project alternatives were evaluated with respect to economics, technical feasibility, social and environmental impacts and post mining sustainability. The features of each alternative, as well as the more significant opportunities and constraint, are discussed in the following subsections.

1.3.1. Siting and Resources Alternatives

There is no alternative identified for the project site location as it was determined by the setting of the deposit. The processing facility was strategically chosen to be situated near the mineralized area to minimize the hauling distance from quarry to plant facility. Moreover, the chosen site is also near the causeway, where the loading activities will be performed. This location will minimize the hauling cost.

The adjacent flat area north of the quarry is planned to be the ore stockpile area. The southern side of the quarry is for infrastructures. Areas on the east side were not considered since it is far from the causeway.

The project siting, water, and power source considerations are summarized in **Table 1-8** below.

Table 1-8 Project Siting and Resource Alternatives

Component	Alternatives	Decision Criteria
Ore Resource	Alternative 1: Nickel Laterite Deposits	• Agata North Laterite Project (ANLP) is ongoing; Nickel Laterite deposit is near depletion.
	Alternative 2: Gold and Copper Deposits	• Gold deposits within the MPSA boundary are currently deemed not economically feasible to mine. • Further exploration work is needed.
	Alternative 3: Limestone Deposit ***(selected)***	• The limestone deposit is found to be a high-grade resource of $CaCO_3$/CaO. • Project can promote continuity of employment opportunities for the community after the ANLP ends. • Project can supplement the demand for aggregates and cement industries in Mindanao and nearby regions.
Mine Site	Payongpayong, Brgy. Tinigbasan, Tubay ***(selected)***	• Location of the limestone ore deposit. • Site is considered with low flood susceptibility but with high landslide susceptibility according to the Mines and Geosciences Bureau; therefore, ground stability techniques should be utilized.
Crushing Plant Site	Alternative 1: Flat area north of deposit	• Identified location of the stockpile area. • Location far from the causeway, increasing hauling costs.
	Alternative 2: Northwest of deposit ***(selected)***	• Location is near relative to both the deposit and the causeway. • Streamlining the transport of ore from mining to product delivery.

Resource Utilization (Power)	Power Alternative 1: Local grid ***(selected, main)***	• Current ANLP project is tapping ANECO for the power source. • ALP can expand the existing infrastructures up to the crushing plant.
	Power Alternative 2: Generator sets ***(selected, secondary)***	• Generator sets will be used in case of power interruptions or as additional source of power.
Resource Utilization (Water)	Water Alternative 1: Payongpayong creek ***(selected)***	• Payongpayong Creek will be the source of freshwater for water lorries and Land Craft Transport (LCT)
	Water Alternative 2: Payton Creek ***(selected)***	• Payton Creek will be the source of water for the campsite/ domestic water requirements.

1.3.2. Technology/ Operation Processes Selection Alternatives

Quarrying, which is the widely accepted and practiced method on limestone deposit recovery for cement manufacture, will be used to extract the ore. Other mining activities involved in the limestone extraction are site clearing, drilling, blasting, loading, hauling, benching, and road and dump maintenance. Mining will be simultaneous with comminution, or size reduction. Crushing and screening will also be carried out to produce the desired sizes of limestone products. The method and technology selection criteria are summarized in **Table 1-9** below.

Table 1-9 Technology and Process Alternatives

Component	Alternatives	Decision Criteria
Mining Method	Surface Mining (Quarrying) ***(selected)***	• The geology and mineralization within the area is shallow and suggests a surface mining approach following technical and economic considerations. There is no other method considered given this type of deposit.
Blasting	Alternative 1: Electrohydraulic blasting	• This blasting method is still unproven. • Requires large amount of water and power utilization.
	Alternative 2: Conventional rock blasting ***(selected)***	• Site is not considered an area susceptible to liquefaction according to PHILVOCS. • Controlled blasting to be implemented to minimize effects of noise, vibrations and dust.
	Alternative 3: Dozer ripping (or no blasting)	• Ripping will be done when competence of the ore will not require blasting.
Comminution	Crusher Alternative 1: Jaw crusher	• Jaw crusher is a commonly used primary crusher and is best suited for high hardness rocks.
	Crusher alternative 2: Impact crusher ***(selected)***	• Impact crusher is used to minimize production of unwanted fine products. • Impact crushers have higher crushing efficiency than jaw crushers.

1.3.3. No Action Alternative

The no action alternative assumes that the Agata Limestone Project will not pursue after the Agata Nickel Laterite Project is concluded. The benefits and consequences of not continuing with the Limestone Project are summarized in **Table 1-10.**

Table 1-10 Summary of Benefits and Consequences from the No Action Alternative

Aspect	Benefits	Consequences
Environment	• Land surface clearing and excavation associated with the surface mining method will be avoided. • Potential air quality impacts from equipment usage, such as dust emission and diesel emission will be avoided. • Potential impacts to water quality and aquatic environment from siltation due to mining activity will be avoided.	• The opportunity to expand the Agro-cum-Tourism Project as part of the post mining land use plan within the Payong-payong area will be lost. • The environmental stewardship will be limited to the rehabilitation areas of ANLP.
Health and Safety	• Potential health and safety hazards from the mining activities will be eliminated.	• Opportunity for more and/ or expanded health and sanitation programs to be implemented from continued SDMP for the impact communities will be lost.
Socio-economic	• Influx of people resulting from economic boom will be avoided. • Potential cultural/ lifestyle changes from economic development will be avoided.	• Opportunity loss for the ff benefits of Project Expansion: • Social development programs for the improvement of Health, Education, Livelihood, and Infrastructure due to continued SDMP for the impact communities. • More skills training and livelihood assistance programs as part of the continued SDMP implementation. • Continuity of household income due to direct employment from mining and creation of downstream industries (business opportunities) and livelihood programs provided by the Company. • Continuity of development projects for the IP community.
National/ Local Economy	• Value of the commodity in the area could potentially increase in the future.	• Development of mineral resources, as part of the MPSA agreement with the Government will not be maximized. • The support to the government's drive to boost the domestic production of cement and construction aggregates for the various infrastructure projects nationwide will not be realized. • Potential income loss for the LGU and National Government from the payment of direct taxes (excise tax, withholding tax and occupational taxes)

Table 1-10 Summary of Benefits and Consequences from the No Action Alternative (continued)

Aspect	Benefits	Consequences
National/ Local Economy	• Value of the commodity in the area could potentially increase in the future.	• Potential income loss for the LGU from the indirect tax payments from increased economic activities (i.e. higher purchasing power of consumers as a result of direct employment in mining and creation of downstream industries (businesses, livelihood, etc.). • Opportunity of receiving IP royalty payment due to increased Company revenue will be lost.

1.4. Project Components

The components will be within a 554.4-hectare area, including the actual quarry area, processing plant, stockyards, and support facilities. Major project activities include drilling, blasting, excavation, hauling, stockpiling, crushing, and ship loading. The support facilities are existing structures of the ANLP, including the offices, accommodations, mess hall, clinic, warehouse, motor pool, contractor's laydown areas, fuel depot and storage, environmental structures, and causeway (port facilities) that will be used to supplement the limestone operation.

1.4.1. General Layout of Facilities

Approximately 554.4 hectares or about 11.10% of the 4,995 hectares MPSA will be the component area. This, however, may be slightly changed as the mining operation progresses. A large part of the ANLP ECC shall also be part of the components of the ALP mainly because the main haul roads of the ANLP project will be transformed as secondary access roads for the ALP. These roads will be used for transport of supplies and materials. The settling ponds and other environmental structures to address these secondary impact areas requires to cover a large area to be deemed effective. At certain periods during the operations phase, some mined out areas shall be subjected to progressive rehabilitation activities. The component area distribution is summarized in **Table 1-11**. A site development map showing the mining facilities, routes, boundaries, and buffer zones are shown in **Figure 1-7.**

Facilities will be laid out strategically to streamline the flow of the limestone products from the quarry to the clients. The ALP route map shown on **Figure 1-8**. demonstrates the flow of transport of raw material. From quarry, the defragmented limestone will pass through Road 1 and will be transported to the crushing plant. From the crushing plant, the materials will pass through primary and secondary vibrating screens and will be segregated into covered stockpiles of limestone products that are ready for delivery to clients. The stockpiled materials will be transported via 1.5 km covered conveyor belt along Road 1 directly loaded to LCT/barges as final material at the port and will be unloaded to mother vessels for clients outside the region. Crushed limestone materials may also be hauled to clients within the region via Roads 2, 3, and 4, exiting at the Mangga Main Gate. Roads 2 and 3 may also be used for transport of waste and materials for temporary storage at COS2.

Table 1-11 Project component for Agata Limestone Operations

Component	Area (ha)	% MPSA area
Payong-Payong Limestone Quarry Area	66.94	1.3%
Causeway	5	0.1%
Overburden Waste Storage Area / MOS- Marginal Ore Stockpile	184.15	3.7%
Stockyard and Screening Plant	20.35	0.4%
Crushing plant & Stockpile area	21.93	0.4%
COS1 & COS2	11.93	0.2%
Environment Structures-Nursery	4.65	0.1%
Explosive Magazine Area	0.79	0.0%
Office and Housing Facilities	43.06	0.9%
Power Supply Facility	3.11	0.1%
Motor pool	95.21	1.9%
Roads	53.46	1.1%
Environment Structures (MRF, Hazardous Facility, Settling ponds)	43.81	0.9%
Total Area	**554.4**	11.1%

Figure 1-7 Site Development Map

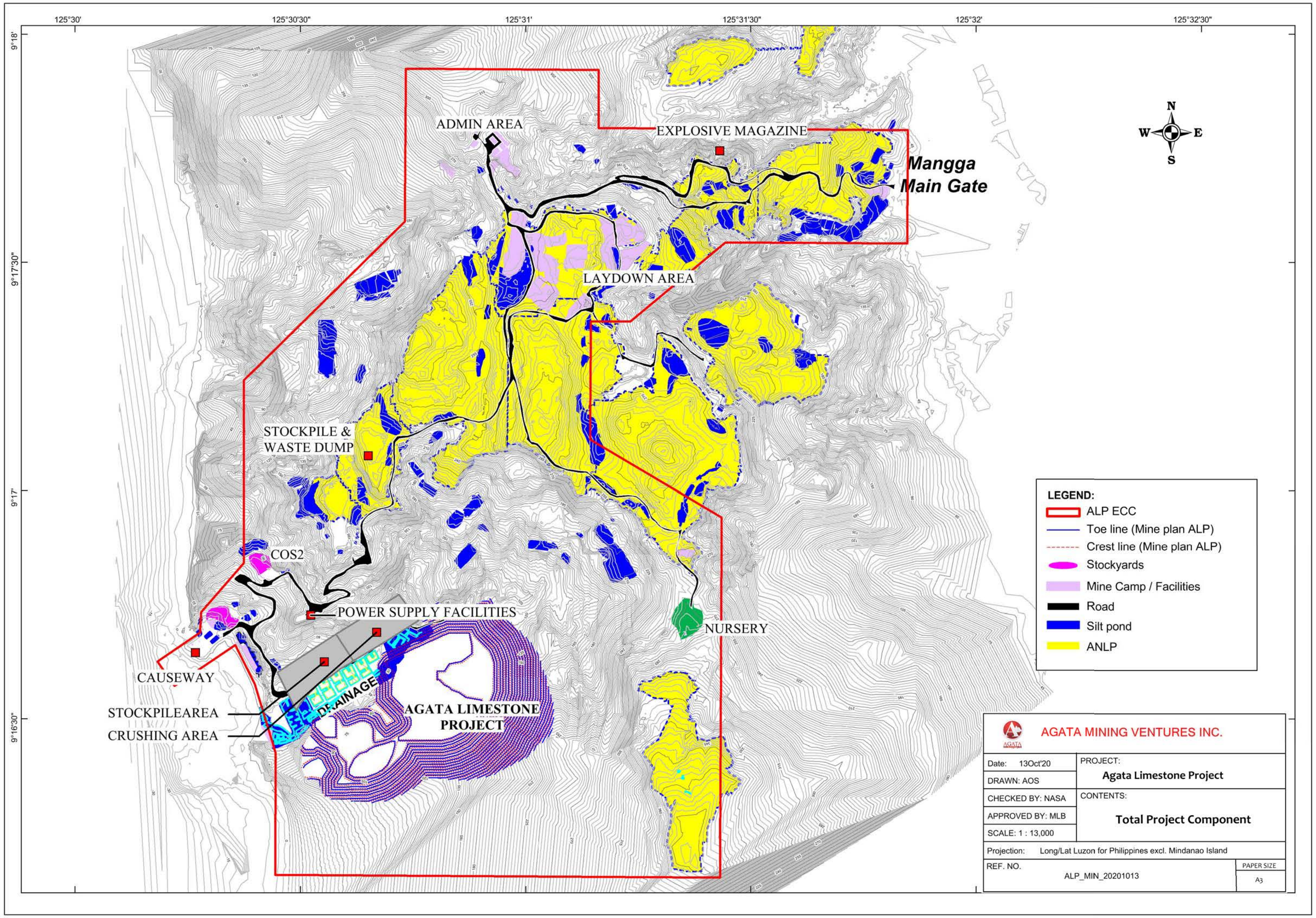
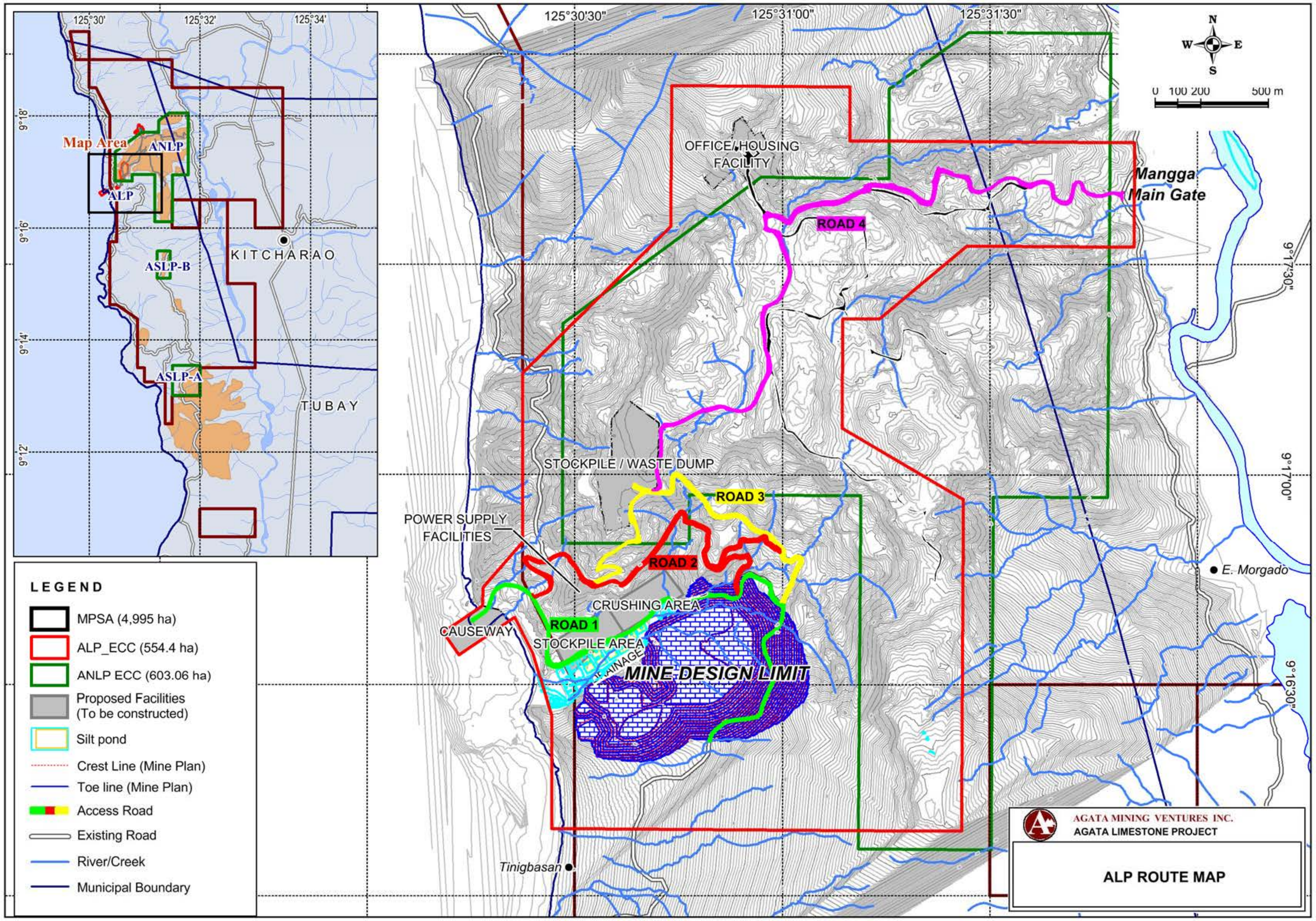


Figure 1-8 Route Map



1.4.2. Major Project Components

The description of the identified major components of the Project is discussed in the following subsections. The technical description of each is provided in **Table 1-12.**

Table 1-12 Coordinates of the Mining Project Facilities (Major Project Components)

Component	Description	Area (ha)	Location	Corner	Latitude	Longitude
Delineated Limestone Resource Quarry Area (with buffer zones)	Delineated Limestone Resource Area for future development	66.94 ha	Payong-Payong Limestone	1	9° 16' 17.7276"	125° 30' 32.7672"
				2	9° 16' 25.4892"	125° 30' 26.6976"
				3	9° 16' 45.1848"	125° 30' 46.3644"
				4	9° 16' 46.9956"	125° 30' 57.3876"
				5	9° 16' 30.8388"	125° 31' 6.4776"
				6	9° 16' 20.9928"	125° 30' 57.0168"
Causeway	Site for Ore Loading to Shipping Vessel; incudes the 0.77 ha causeway	5 ha.	Sitio Payong-payong Shore	1	9° 16' 40.224"	125° 30' 19.8648"
				2	9° 16' 37.0776"	125° 30' 16.3584"
				3	9° 16' 39.1764"	125° 30' 14.2344"
				4	9° 16' 42.4272"	125° 30' 17.2584"
Overburden Waste Storage Area / MOS-Marginal Ore Stockpile	Dump site for waste materials located on mined out areas from the ANLP	184.15 ha	Agata North Storage ore material	1	9° 16' 52.0464"	125° 30' 34.4844"
				2	9° 17' 0.5244"	125° 30' 32.9796"
				3	9° 17' 1.464"	125° 30' 35.3556"
				4	9° 17' 7.7712"	125° 30' 35.2692"
				5	9° 17' 10.6584"	125° 30' 37.6416"
				6	9° 17' 7.2708"	125° 30' 42.1992"
				7	9° 16' 58.1952"	125° 30' 41.9004"
				8	9° 16' 57.5652"	125° 30' 39.6972"
				9	9° 16' 55.8732"	125° 30' 37.9404"
				10	9° 16' 52.6944"	125° 30' 37.8972"
Screening Plant	Screening and sizing facilities with temporary stockpile area for input and output materials	20.35 ha	Sitio Payong-payong	1	9° 16' 34.5324"	125° 30' 23.94"
				2	9° 16' 39.7128"	125° 30' 21.33"
				3	9° 16' 39.27"	125° 30' 20.4768"
				4	9° 16' 40.7064"	125° 30' 19.1232"
				5	9° 16' 41.358"	125° 30' 16.6536"
				6	9° 16' 43.9752"	125° 30' 16.7688"
				7	9° 16' 45.4692"	125° 30' 22.5"
				8	9° 16' 45.0012"	125° 30' 22.5"
				9	9° 16' 36.1164"	125° 30' 26.9424"
Crushing Plant	Crushing facilities with temporary stockpile area for input and output materials	21.93 ha	Sitio Payong-payong	1	9° 16' 31.0476"	125° 30' 29.4768"
				2	9° 16' 36.1128"	125° 30' 26.9424"
				3	9° 16' 42.5424"	125° 30' 36.918"
				4	9° 16' 39.1044"	125° 30' 39.0996"
				5	9° 16' 34.8708"	125° 30' 32.7888"
COS1 and COS2	Crushed ore stockyard; storage area for limetone products that are ready for shipment	11.93 ha	Sitio Payongpayong	1	9° 17' 33.3744"	125° 30' 55.746"
				2	9° 17' 37.2372"	125° 30' 57.9528"
				3	9° 17' 33.8712"	125° 31' 5.088"
				4	9° 17' 37.158"	125° 31' 12.4212"
Environment Structures-Nursery	Nursery - Area to grow and propagate plants for rehabilitation works	4.65 ha	Agata North	1	9° 16' 40.764"	125° 31' 20.1864"
				2	9° 16' 43.0428"	125° 31' 19.056"
				3	9° 16' 45.8148"	125° 31' 21"
				4	9° 16' 45.8616"	125° 31' 22.3392"
				5	9° 16' 43.1004"	125° 31' 24.0384"
				6	9° 16' 40.1232"	125° 31' 21.8856"

1.4.2.1. Payongpayong Limestone Quarry Area

The limestone deposit located at the Payongpayong ridge will be mined by quarrying method. Mining activities will include drilling, blasting, excavation, loading to hauling equipment, hauling, road maintenance, and drainage management.

The mine design is based on the principle of maximizing recovery of reserves and minimizing movement of waste. For this purpose, final berms are designed with different widths ranging from five (5) to thirty (30) meters. The quarry design criteria are based on similar limestone quarry/mining operations. The mine design criteria are shown in **Table 1-13.**

Table 1-13 Project component for Agata Limestone Operations

Parameter	Value
Bench Height	at least 5 meters
Working Berm Width	5 -30 meters
Batter Angle	60 degrees
Slope Angle	24 - 45 degrees
Ramp Width	10 meters

Mining activities will progress from the topmost elevation to the bottom of the mine (0 msl). Grade control samples will be obtained from production blast hole drilling. Blast hole sample assays will be the guide whether the material in the area is suitable for processing, blending, stockpiled as marginal ore, or labeled as waste material. Areas suitable for processing will be properly delineated in the field using ribbons, flags, stakes and/or ropes.

Every working bench shall be levelled using heavy equipment before it is defragmented by blasting. Drilling and Blasting shall be done by a licensed drilling and blasting contractor and supervised by licensed mining engineers and blast foreman. Whenever appropriate, dozer ripping shall be undertaken instead of blasting. Service Contractors shall be engaged to provide the equipment and operators for quarrying and mining operations. **Table 1-14** lists the mine equipment complement for the Limestone Project.

Table 1-14 Mine Equipment List

Equipment Type	Model
Dozer	CAT D8R
Drill	FD HCR900 (76/89 mm)
Hydraulic excavator	Komatsu PC850-8R1
Wheel loader	CAT 950 GC
10/12W Truck	Isuzu CYH, Howo, Chenglong
Offroad dump truck	Komatsu HD405-8
Grader	GD705-5
Rock breaker	
Compactor	10 tons
Water truck	10,000 liter capacity

1.4.2.2. Causeway

The existing causeway already has an approved Environmental Compliance Certificate (ECC-R13-1306-0084) issued by EMB-13 in July 2013**.** It is located at Sitio Payong-payong, Brgy. Tinigbasan, Tubay, Agusan del Norte approximately 1.5 km from the limestone quarry area. The ownership of the existing ANLP facilities such as pier yard, port office, roads, drainage system, and stockyard in Payong-payong will be transferred to the ALP once ANLP ceases operations.

1.4.2.3. Overburden Waste and Marginal Ore Stockpile Area

There will be no tailings storage facility necessary because there is no tailings produced by the operations. However, a proper overburden waste and marginal ore stockpile area will be built, complete with sedimentation control facilities. The technical specifications of the waste and ore stockpiles is summarized on **Table 1-15.**

Table 1-15 Waste/MOS stockyard design specifications

Element	Description	Value
Dump Lift Height	Dump lift heights for every berm	15m
Dump Access Width	Dump ramp width	10m
Dump Lift Face Angle	Dump slope angle at repose	35 degrees
Dump Ramp Grade	Dump ramp gradient	10%

1.4.2.4. Crushing and Screening Plant

A crushing and screening plant will be processing the mined limestone to the desired final product. Mined limestone from the site will be loaded into dump trucks or articulated trucks and hauled to the crushing facility. The crusher will be located near the mine site for shorter hauling and easy transport of big limestone rocks. The screening and stockpile facility will be located between the crushing plant and the port. Limestone products will be conveyed to the port via a 1.0 km conveyor belt. The required process plant machineries and equipment are listed in **Table 1-16.**

Table 1-16 Crushing Plant Equipment List

Equipment Type	Size	Design Duty	Unit
CRUSHING CIRCUIT			
Vibrating Grizzly			1
Dump Ore Bin			1
Primary Feeder			1
Horizontal Shaft Impactor	51" x 59"	Max. feed size 24", 360 t/h max capacity	1
Sacrificial Conveyor	13.14		1
Transport Conveyor			1
Primary Vibrating Screen	5' x 14'	Triple deck (80 mm, 40 mm and 20 mm	1
Transport Conveyor 1			2
Transport Conveyor 2			2
Transport Conveyor 3			2
Transport Conveyor 4			2
Secondary Vibrating Screen	4' x 10'	Double deck (10 mm and 5 mm aperture)	1
Transport Conveyor 1			1
Transport Conveyor 2			1

Transport Conveyor 3			1
WATER SERVICES			
Service Water Tank	100 m^3		1
Service Water Pump 1			1
Service Water Pump 2			1
Fire Water Tank	100 m^3		1
Fire Water Pump 1			1
Fire Water Pump 2			1
ELECTRICAL SERVICES			
Generator set	1 MW		2
PRODUCT HANDLING			
Covered conveyor belt	1.0 km		1

1.4.2.5. Crushed Ore Stockpiles (COS)

COS, or crushed ore stockpile, may be stored in a stockyard area prior to shipment to ensure continuity of ship loading in case of unforeseen delays in production. COS 1and COS 2 will have the same specifications as the Waste Dump/MOS stockpile area.

1.4.3. Mine Support Facilities

Most of the mine support facilities are already existing at the ANLP. Additional facilities may include power and water supply, fuel depot, additional access roads, explosive magazine, fabrication shop, and warehouse. **Table 1-17** shows the identified support facilities, along with the technical description of their location. Additional services to be provided by Service Contractors are drilling and blasting, suppliers of explosives, plant maintenance, and conveyor maintenance.

Table 1-17 Limestone Project Support Facilities

Component	Description	Area (ha)	Location	Corner	Latitude	Longitude
Explosive Magazine	Facility for explosive magazine	0.87 ha	Agata North Magazine	1	9° 17' 45.4596"	125° 31' 25.0788"
				2	9° 17' 45.5136"	125° 31' 26.6628"
				3	9° 17' 44.1744"	125° 31' 26.5908"
				4	9° 17' 44.0916"	125° 31' 25.2156"
Power Supply Facility	Serves as power source to the crushing plant	3.11 ha	Sitio Payongpayong	1	9° 16' 41.7756"	125° 30' 29.4876"
				2	9° 16' 43.5288"	125° 30' 28.7028"
				3	9° 16' 45.2064"	125° 30' 30.4524"
				4	9° 16' 43.752"	125° 30' 33.1704"
Roads	Includes main road from Mangga gate to the other auxiliary facilities needed for the ALP	53.46 ha	Main road	1		
Motor pool/ laydown area	Area for equipment and truck maintenance of mining contractors.	95.21 ha	Motor pool and laydown area	1	9° 17' 33.3744"	125° 30' 55.746"
				2	9° 17' 37.2372"	125° 30' 57.9528"
				3	9° 17' 33.8712"	125° 31' 5.088"
				4	9° 17' 37.158"	125° 31' 12.4212"
				5	9° 17' 33.594"	125° 31' 17.6484"
				6	9° 17' 18.4884"	125° 31' 4.584"
				7	9° 17' 25.4184"	125°31'12"

Environment Structures	Settling ponds - The silt pond will serve as catchment of eroded soils prior to discharge	48.81 ha	Agata North	1		
Office and Housing Facilities	Includes base camp facilities, assay lab, MRF, hazardous waste facilities and admin office.	43.06 ha	Agata North Sitio Payong-payong	1	9° 17' 37.7196"	125° 30' 52.0236"
				2	9° 17' 43.1412"	125° 30' 47.214"
				3	9° 17' 52.0872"	125° 30' 54.3204"
				4	9° 17' 43.476"	125° 31' 1.7868"

1.4.3.1. Explosive Magazine

The explosive magazine is a container used as temporary storage of explosive material such as dynamites, ANFO (Ammonium Nitrate Fuel Oil) and blasting accessories. The explosive magazine building will be constructed in conformance to the standards set by the government. It will have a double-layer fence constructed along the perimeter of the area and will be secured 24-hours a day as measures of security. Proper safety signages and warning signs will also be installed.

1.4.3.2. Power Requirement and Source

Power supply for the Project shall be provided by the Agusan del Norte Electric Cooperative (ANECO). This is the same power supplying the power requirements of the direct and indirectly affected barangays.

The projected daily power consumption for the ALP is approximately 13,600 kWh. Diesel powered generator sets will be on standby power and will be used to augment the daily power supply requirement. A summary of the Project power requirements is in **Table 1-18,** while **Table 1-19** Error! Reference source not found. shows the additional power needed for the plant which shall be augmented by diesel-powered generator sets.

Table 1-18 Power Requirements During ALP Operation

Facility	Power Requirements	Source
Campsite	1,517 Kwh per day	Generator Sets and Supply Distribution from ANECO
Office complex	2782 Kwh per day	
Motor pool	759 Kwh per day	
Total	5,058 Kwh per day	

Note: API, 2016

Table 1-19 Additional Power requirement for ALP Crushing and Screening Operation

Facility	Power Requirements	Source
Vibrating feeder	300 Kwh per day	2 Generator Sets (1MW each) and additional 6-7 MW Supply Distribution from ANECO
Primary Impact Crusher	5,200 Kwh per day	
Secondary Impactor	2,600 Kwh per day	
Primary Vibrating Screen	300 Kwh per day	
Total	8,510 Kwh per day	

1.4.3.3. Road Network

Road network is classified into two (2) major parts—the production haul roads and the support facilities access roads. Production will use the Quarry-Plant-Causeway roads. Access roads allow logistics of supplies and access to the support facilities such as the camp, motor pool, and the environmental facilities. Construction and maintenance of all roads shall be in line with the mine, environmental and safety parameters.

1.4.3.4. Motorpool

The motor pool /mechanical shop is existing and currently used for the nickel operations. It is equipped with secondary containment to contain accidental discharge of hazardous liquids. There are also oil and water separators to prevent oil contamination in the wastewater.

Used oil storage tanks are also present in the area as temporary storage for used oil until they are removed from the site by an accredited used oil transporter. These pollution control structures are constructed in accordance with the hazardous waste management guidelines. Regular inspection/ audit is conducted by the Pollution Control Officer to monitor compliance to the pollution control protocols.

1.4.3.5. Environment Structures- Siltation/ Sedimentation Ponds

There are existing settling ponds covering a total area of 41.99 hectares within the ANLP. These facilities will be needing minimal maintenance since the ANLP area will already be under final rehabilitation. About 87% of the ANLP settling ponds will be retained as part of the mitigating measures to address siltation at the secondary impact areas of the ALP. The ponds that will remain active during ALP are those located on the mid-western part of the MPSA where the ALP is situated. A new series of settling ponds will also be constructed at the western part of the quarry area, in addition to the ANLP settling ponds, addressing potential siltation issues at the ALP secondary impact areas. Their sizes and location is discussed in detail in **Section 1.4.5.**

The settling ponds are designed incorporating the engineering parameters, capacities, and purpose. The ponds are mitigating measures to contain the silt and reduce the speed of the water flow, and for the deposition of silt. Pollution control components are the interceptor canals, silt traps, settling ponds, drainage canals, and sumps. As the extraction capacity expands, additional settling ponds will be constructed to sufficiently manage drainage requirements.

1.4.3.6. Housing Facility, Administration Offices, and Other Buildings

The existing accommodation facility has three (3) buildings - the Managerial, Superintendent, and Supervisor building. This facility houses selected managers and senior level employees. The housing complex also features the basketball court and fitness gym for fitness and recreational activities and the mess hall serving food for accommodated employees.


Photo 1-1 Agata Accommodation Facility

The existing Admin building is housing the Mines, General Services, Information Technology, Security, HRAD, TMEPEO, COMREL, Finance and Site Management Departments. It also features a meeting room and a landscaped garden for the employees.

Photo 1-2 Agata Administration Office

The existing Assay Laboratory is situated near the Administration building. The Assay laboratory consists of the Sample Preparation building and the Chemical Analysis building. The Chemical Analysis building houses the X-ray Fluorescence Spectrometer and the Atomic Absorption Spectrometer and various laboratory equipment and paraphernalia. This will continued be used for the limestone operation for quality control analyses.

Photo 1-3 Assay Laboratory

Another support structure is the Fuel Depot. Fuel is currently supplied by three suppliers namely Flying V, Petron, and Sea Birds Fuel. These fuel suppliers have their own storage tanks and dispensing units located at the fuel depot. A total of six (6) cylindrical diesel fuel storage tanks with a combined capacity of 96,000 liters are located at the fuel depot. All tanks are provided with safety control devices such as leak alarm monitors and flow regulators to prevent leaks. The fuel tanks are fitted with secondary containment to contain accidental releases. The operation of this facility will be continued during the limestone project operation.

1.4.4. Water Supply

Multiple creeks and springs around the Project site will supply the water requirements of the Project Domestic water (7%) is used for bathing, cleaning, and cooking while industrial water (93%) is used for equipment washing, nursery operation, and dust suppression. The water sources listed below will be for the following uses:

a. Coboy Creek– Dust suppression
b. Mantiawas Creek – Domestic water supply for housing and office buildings
c. Payong-Payong Creek – Dust suppression; Crushing plant water supply
d. Solana Creek – Crushing plant water supply
e. Paiton Creek– Domestic water supply for Administration Building
f. Agroland Spring - Maintenance at Nursery, MRF, and domestic water supply at security outposts

Compared to the ANLP operations the industrial water consumption for the limestone operation will increase because the limestone operation will employ wet crushing to minimize dust generation. An additional of 200,000 liters per month of water will be needed for the crushing operation. Increased equipment traffic will also require deployment of more water trucks for dust suppression. Domestic water use on the other hand, is expected to remain the same.

1.4.5. Wastewater Management

1.4.5.1. Sedimentation and Siltation Ponds

There will be no need for a tailings storage facility for the Project. Expected wastewater discharges will be in the form of sediments in stormwater runoff only. Environmental infrastructure is integral to the mine plans and will be part of the mining operation standard protocols. The following activities will be undertaken relative to drainage management.

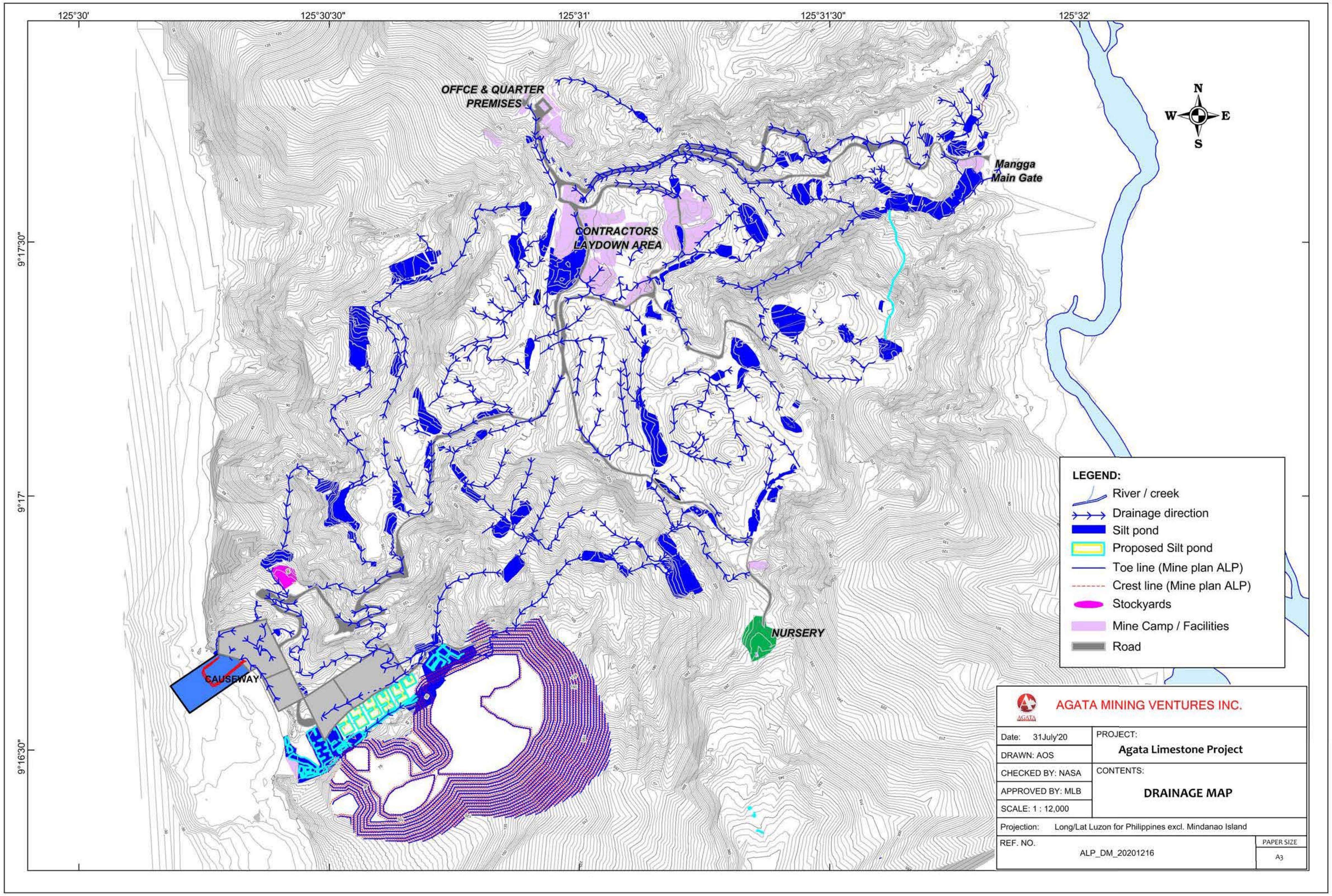
- Development of proper benching and gradient to address the water drainage and minimize erosion;
- Construction of peripheral and perimeter drainage around the mine area, stockyards, and waste dumps to divert water run-off towards the series of catchment ponds
- Development of silt ponds for filtering sediment prior to discharge.
- Construction of silt traps will at various locations along the drains to capture sediments before discharging to designated siltation ponds.
- Installation of geotextile and break-water boulders on the discharge-end of sedimentation ponds for catchment, filtering and control of water velocity prior to the discharge
- Constant desilting activity of the silt ponds must be scheduled to maintain the capacity of the ponds.

Currently, the sediment ponds at the causeway area has a total capacity of 130,782 cu.m. The ponds can sustain 2.81 days of continuous rain, based on the maximum recorded single day rainfall of 233 mm. Additional ponds will be installed for the limestone operation, as part of the mitigating measures. A total of 330,300 cu.m of ponds capacity will be constructed for the limestone project. This capacity can hold a total of 4.53 days of continuous rain based on the max recorded. Shown in **Table 1-20** below is the computation of current capacities of sediment catchment ponds and of the proposed catchment ponds planned for ALP. The mapped drainage flow, as well as the sediment pond location, is presented on **Figure 1-9.**

Table 1-20 Current and Proposed Siltation Ponds on Limestone Area

Per Area	Current Pond Capacities											Proposed Capacity
	MA9	MA8	MA7	MA6	MA5	MA4	MA3	MA2	MA1	Pier	Admin	Limestone
Highest peak rainfall per day (mm)	233	233	233	233	233	233	233	233	233	233	233	233
Disturbed Area (ha)	16.54	9.71	18.93	42.42	27.41	22.28	36.31	15.97	5.56	33.03	7.041	33.33
Coefficient	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Water Discharge per day (cu.m)	23,123	13,575	26,464	59,303	28,319	31,147	50,761	22,326	7,773	46,176	9,843	46,176
% silt collected monthly	1.37	2.3	1.19	0.54	0.83	1.02	0.63	1.41	3.95	0.69	3.15	0.69
Combined silt and water	23,443	13,895	26,784	59,623	38,639	31,467	51,081	22,646	8,093	46,496	10,163	46,496
Volume of Ponds (cu.m)	109,335	228,181	50,415	259,230	6,728	58,380	177,539	71,298	29,506	130,782	2,873	210,782
No. of days continuous rain	4.66	16.42	1.88	4.35	0.16	1.86	3.48	3.15	3.65	2.81	0.28	4.53

Figure 1-9- Drainage Map and Location of Sediment Ponds



1.4.5.2. Domestic Wastewater Treatment

The existing administration building, and staff houses already have established sewage treatment facility. The treatment system for septic tank is by syphoning through an accredited third-party treater of DENR. Other domestic wastes such as waste coming from grease traps are being collected and store in the hazardous waste facility, disposal is thru the accredited treater of DENR. Tap water that is commonly used for bathing, washing and for other domestic uses is chlorinated. The wastewater is directed to the septic tank. The limestone project will have less manpower (226) than the existing nickel project (>350). It is expected that the existing sewerage system will meet the requirement of this new Project.

1.4.6. Communication Facilities

1.4.6.1. Cellular Network

A cell site of Smart and Globe Company has been established at Jabonga and Santiago municipality of Agusan del Norte. The signal reaches the entrance area, admin office, motor pool and causeway area of Agata site.

1.4.6.2. Postal Communication

The Municipal Postal Office handles all the mail services throughout the municipality through the Philippines Postal Corporation. There are no private companies operating in the Municipality which handle mail or cargo delivery services.

1.4.6.3. Television and Internet Network

There are a lot of cable networks operating within the Municipality, with unlimited channels depending on the desire of the client. The company is availing of the G-Sat cable network. Internet provider KOMSPEC is owned and operated by a private corporation located in Butuan City.

1.4.6.4. Radio Communication

There is an existing radio communication on site. Two (2) radio repeaters are erected at strategic locations. There is an open channel where all can communicate and another four (4) channels for for specific uses. The radio channel assignment are as follows:

Channel 1- Used a general channel.
Channel 2- ENVI, General Services and Community Relation Departments.
Channel 3- To be used for personal matter.
Channel 4- Survey Department.
Channel 5- Mines, Safety and Health, Material Management and Assay Department.

A radio repeater is a combination of a radio receiver and a radio transmitter that receives a signal and retransmits it so that two-way radio signals can cover longer distances or can reach blind-spots.

1.4.7. Safety Devices/Emergency Facilities

Safety control procedures of ALP will adapt the applicable practices from the ANLP operations (e.g. mine, port, and shipping activities). New protocols to be added will be related to blasting and crushing operations. Some examples of the control emergency procedures are as follows:

a. Sirens within the industrial premises serves as prior notice and alert the occupants to any danger or hazard. Sirens when sounded gives the occupant enough time to escape from the danger zone. Sirens are also used whenever there are blasting operations.

b. Extensometer devices measure changes in length or ground displacements the device can detect abnormal or critical ground movements that will trigger alarms to warn of imminent danger of ground or slope failures.

c. Fire alarms, fire extinguisher, and fire trucks are equipment for fire mitigating measures. Fire alarm tools are installed on facilities like offices, staff house, and fuel depot. They are devices that detect and warn people through visual, audio, and other means if a smoke, fire, carbon monoxide or other emergencies are present in an area. Fire extinguishers are active fire protection devices used to extinguish or control small fires, often in emergency situations only. A Fire truck is used on an out-of-control fire such as one which has reached the ceiling, engulfed buildings, or bush fires. The crushing and screening plant will also be installed with fire detection systems and provided with fire mitigating equipment.

d. Emergency shutdown valves are primarily associated with activities like the crushing and screening plant wherein the entire operation can be stopped at the push of a button. A safety shutoff valve is an actuated valve designed to stop the flow of a hazard upon the detection of a dangerous event. This prevents the progression of the danger that may harm people, equipment, or the environment.

1.4.8 Pollution Control and Waste Management Facility

1.4.8.1. Pollution Control Strategies

Potential air pollution sources on site include the equipment exhaust and dust generation from mining activities. Dust generated by quarrying, crushing and screening, and hauling activities will be mitigated through regular deployment of water trucks for spraying. Priority areas for dust control will include the hauling roads. A more frequent schedule is established during dry season. Regular road grading and surfacing will also be done at haul roads. Dust from the crushing plant will be addressed by ensuring that the plant is running in optimum, with negative pressure, with its bins and storage are properly designed. Final products will be housed in a covered stockyard.

Regular preventive maintenance of the mining fleet mitigates the issue on harmful diesel emissions. Maintenance activity will be the responsibility of the contractors. Compliance of the equipment providers to this requirement will be checked through regular inspection by the Safety Department.

Noise impacts will be relatively less critical primarily due to the rural nature of the project site and distances of the quarrying and crushing plant site from the community. Crushing and sizing equipment will have noise reduction built into them.

Potential source of water pollution from operation is siltation. Pollution control components to mitigate this will comprise of interceptor canals, silt traps, settling ponds, drainage, canals and sumps. These water management facilities will allow the sediment materials in water run-off will to settle prior to discharge into draining water bodies. Covering of the stockpiles with laminated canvass is another measure to be implemented to prevent loose soils from being carried by surface run-off which contribute to siltation.

All motor pools will be equipped with oil-water separator for the generated wastewater from equipment washing and maintenance. Construction of used oil storage area in the contractor motor pools will be required to temporary contain the used oil materials, prior to its delivery to the main used oil storage facility. These pollution control structures will be constructed in accordance with the hazardous waste management guidelines. Regular inspection will be conducted by the Pollution Control Officer to monitor compliance to the pollution control protocols.

1.4.8.2. Solid Waste Management

The Solid Waste Management Program is in place and involves daily waste segregation, collection, and characterization of the domestic waste generated at the mine site and camp facilities.

Photo 1-4 Solid Waste Management Facility

Recyclable wastes are temporarily stored in the Materials Recovery Facility (MRF) while waiting to be transported or disposed or sold to local scrap buyers. Compostable wastes are used as substrate for the vermiculture process to produce organic fertilizer for the nursery and reforestation projects. A contained waste chamber is also available at site for residual wastes, such as plastic sachets, cigarette butts, pathological waste, and napkins.

1.4.8.3. Hazardous Waste Management

Hazardous wastes that will be likely to be generated from operations include used oil materials, clinic wastes, lead batteries, ink cartridges, paints, contaminated containers, and used fluorescent bulbs. All these hazardous wastes shall be deposited at the existing Hazardous Waste Facility.

Hazardous wastes generation, if not managed, have corresponding environmental and health impacts. For environmental impacts, there will be potential contamination of environmental media, such as soil, surface water, and groundwater, in case of accidental release to the environment. Personnel exposed to hazardous materials management is also at risk of the adverse health effects from improper handling.

Potential impacts of hazardous wastes will be minimized through strict implementation of the standard operating procedures specified in RA 6969. A hazardous waste storage facility is currently used for the nickel operations. Its use and operation will be continued for the limestone project. The storage area is provided with secondary containment and sumps to prevent any uncontrolled release of hazardous materials. Used oil materials will be contained in properly labeled steel drums and will be stacked in wooden pallets inside the Used Oil Storage area. Clinic wastes will be are disposed in the existing septic vault.

Photo 1-5 Hazardous Waste Storage Facility

1.5. Process/Technology

1.5.1. Mining Method

General flow of operations will follow the traditional phases of mining—exploration, development, production and decommissioning stage. There will be overlaps between development and production to minimize the extent of disturbed areas at a time. Progressive rehabilitation and safety measures will be incorporated in all mining stages.

Quarrying will be done using conventional methods of drilling, ripping, blasting, loading and hauling. The order of extraction will start at the highest elevation. As excavation levels reach lower elevation, the extent of disturbed area increases proportionally with the bench designs to promote ground stability.

Mining recovery is assumed to be high with values ranging from 95% - 100%. Dilution is projected to be minimal since the nature of the deposit is inherently homogeneous and the mining process is well established and is widely used. All oversize will be recovered and will undergo rock breaking. Waste to ore ratio is estimated to be 36%.

1.5.1.1. Mine Planning and Grade Control

Technical services like mine planning, grade control and geodetic survey will be incorporated within the activity plans to provide the necessary direction and guidance to the operations. Equipment and service contractors will be carrying out the plans, under the guidance by the in-house personnel.

In-house technical personnel will plan and supervise the mining operations. Medium- and long-term plans will be generated by the planning engineers using reliable mining software tools like *Geovia Surpac, Geovia* GEMS and *Geovia Minesched.*

A system of grade control protocols and procedures will be implemented to ensure the materials are properly classified as either ore or waste prior to actual mining. This will also provide advance information for the mining engineers to adjust mine plans in a timely manner to meet the production objectives.

Grade control will be done in two stages. First is using drill hole cuttings prior to blasting and the second is from crushed material transferred via conveyor belts. Materials will be classified based on drill hole cutting assay prior to crushing. Blasted materials shall be hauled according to quality by dump trucks from the mine area to a crusher pad at the crushing facility. Materials will be transferred to the feeder hopper for crushing via a wheel loader.

1.5.1.2. Overburden Stripping

Overburden is the earth and rock materials overlying the ore deposit. These materials will be stripped to expose the ore body, making it accessible for extraction. Stripping the overburden involves clearing and grubbing and removal of materials that are below cutoff grade.

Clearing and grubbing will involve the use of dozers and/or excavators to remove the ground vegetation to expose the overburden earth materials or ore. Chainsaw may be used to cut trees. The topsoil and organic materials that will be generated by the clearing and grubbing operations will be recovered and will be stored in separate storage areas. Topsoil will be preserved for future use during the progressive rehabilitation program and final mine closure reclamation activities.

Waste materials are mostly composed of calcareous materials or metamorphosed schists. These exposed rock materials that are below cutoff grade will be defragmented thru blasting before loading, hauling and dumping into the marginal ore stockpile or waste dump.

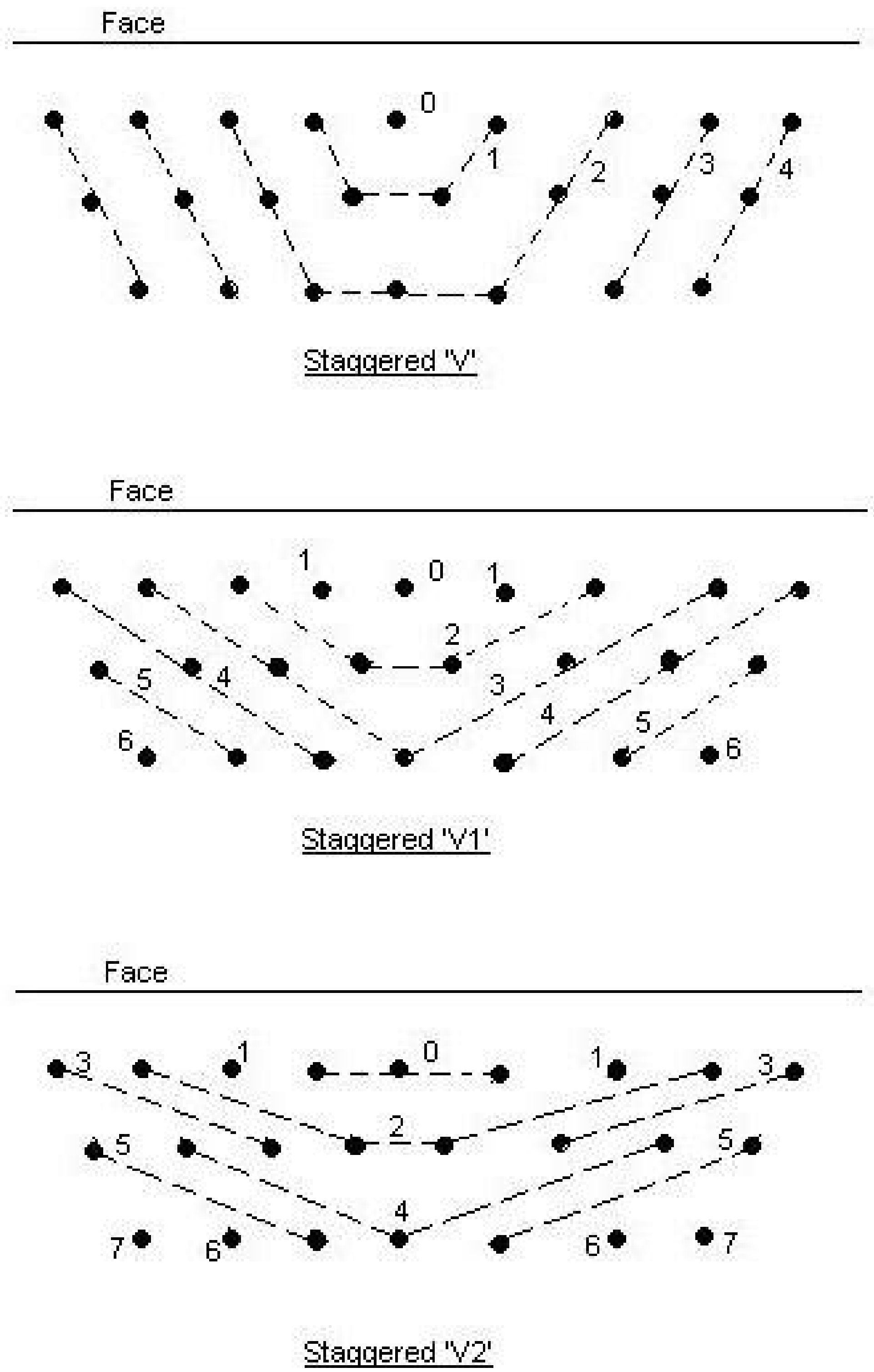
1.5.1.3. Blasting

Blasting will be done to defragment the limestone materials before feeding to the crusher plant. Blasting will be done by a licensed drilling and blasting contractor and will be monitored and supervised by in-house mining engineer/blast foreman. The **Table 1-21** Drill and Blast Design Parameters below shows the drill and blast design parameters and the typical explosives and blasting accessories used in quarry blasting. The blasting design will utilize the staggered V pattern to maximize breakage of ore and less crushing, as illustrated in **Figure 1-10.** When materials can be ripped by dozers or excavators, blasting will not be used.

Table 1-21 Drill and Blast Design Parameters

Parameter	Value
Bench height	5 m
Drill depth	5.8 m
Hole diameter	89.00 mm
Burden	3.60 m
Spacing	4.20 m
Subdrill	0.80 m
Stem height	2.70 m
Charge length	2.30 m
Ratio of HE to LE	20% to 30%

Figure 1-10 Typical staggered V blast pattern and firing sequence



The list of blasting accessories that will be needed are as follows:

- Ammonium Nitrate with Fuel Oil (ANFO)
- Cast Primer 250 gms
- NONEL Surface Connector x 6 metres
- In-hole delay, 500ms x 12 metres
- Detonating Cords, 6 grams

The limestone quarry area will be facing away the nearest community. In addition, controlled blasting will be applied to further mitigate the potential impacts. Some of the possible strategies that will be adopted are as follows:

- Single hole firing
- Accepted Vibration and Airblast Limits
- Optimized schedule of blasting
- Blast mats
- Use of good stemming materials
- Geological structure mapping
- Seed wave analysis
- Trim blasts and pre-splits
- Wind direction models and forecasts

1.5.1.4. Loading, Hauling and Dumping

Quarrying operations will be undertaken by a qualified contractor. A separate hydraulic excavator will be used each to excavate the ore and waste material from the quarry. Blasted rocks will be loaded to dump trucks and delivered to the crushing plant or to the run-of-mine pad.

Limestone crushing plant feed can either be delivered directly from the quarry or hauled from the ROM stockpile. Direct dumping will be a priority to optimize equipment operation. However, buffer feed stocks will be necessary as a standard procedure to address any delays such as in case of equipment breakdown. Allowances will be made for ancillary and support equipment fleet to operate in the quarry to maintain benches, roads, drainage, dumps and stockpiles.

1.5.2. Ore Processing Method

Comminution through crushing and screening will be employed. Mined limestone from the quarry will be hauled to the crusher pad using off road dump trucks. There will be two primary crushers and one secondary crushing-screening modules in operation. Only the 600mm ore top size limestone rocks will be fed by wheel loaders to the vibrating grizzly. Oversize materials will go directly to the primary impact crushers, while undersized limestone will be transported to the secondary crusher and screening facility.

Primary screening will be through a triple-deck vibrating screen follows wherein rocks greater than 80 mm will be sent to the secondary impact crusher. Coarse fractions passing the 80 mm screen, but larger than 40 mm will be conveyed to the medium lumps stockpile. Limestone particles finer than 40 mm will pass through the middle screen. The fractions between 40 mm and 20 mm will be transported to a separate stockpile for medium-small lumps.

All lumps finer than 20 mm will be forwarded to a double-deck vibrating screen with top screen aperture is 10 mm. Particles passing the 20 mm screen, but are coarser than 10 mm, will be forwarded to another stockpile for small limestone lumps.

Fine limestone particles passing 10 mm and 5 mm screens will be collected into a separate stockpile. A 10% dust loss for fine limestone will be considered in the design. The projected material balance of the crushing and screening processing plant is presented in **Table 1-22.**

Table 1-22 Material Balance (tons per hour)

	Primary Screen			Secondary Screen	
Material	Top 80mm	Mid 40mm	Bottom 20mm	Top 10mm	Bottom 5mm
Feed, t/h	882				
OS, t/h	242				
US, t/h	640				

A typical crushing and screening plant layouts showing the essential components of the processing plant are shown in **Figure 1-11, Figure 1-12** and **Figure 1-13.** Crushed limestone segregated into different size fractions will be the final plant products. No chemical alteration of the limestone will be involved. **Table 1-23** shows the products and its potential markets.

Table 1-23 Projected Daily Production (tons/day)

Product	Size	Potential Market
Medium Lumps	80 – 40 mm	International Iron and Steel Producers
Medium – Small Lumps	40 – 20 mm	International Steel Producers/Local Aggregates Industry
Small Lumps	20 – 10 mm	Local Cement Producers/Aggregates/Powerplants/Mining
Fines	< 10 mm	Powerplants/agriculture industry

1.5.3. Ore Shipping

The sorted and sized stockpiled ore materials will be delivered by dump trucks to ship-sided Land Craft Transport (LCT) feeder vessels at the existing causeway from the Agata Laterite Project. Barging and stevedoring services will be tapped from a service contractor.

Figure 1-11 Crushing and Screening Plant Flowsheet

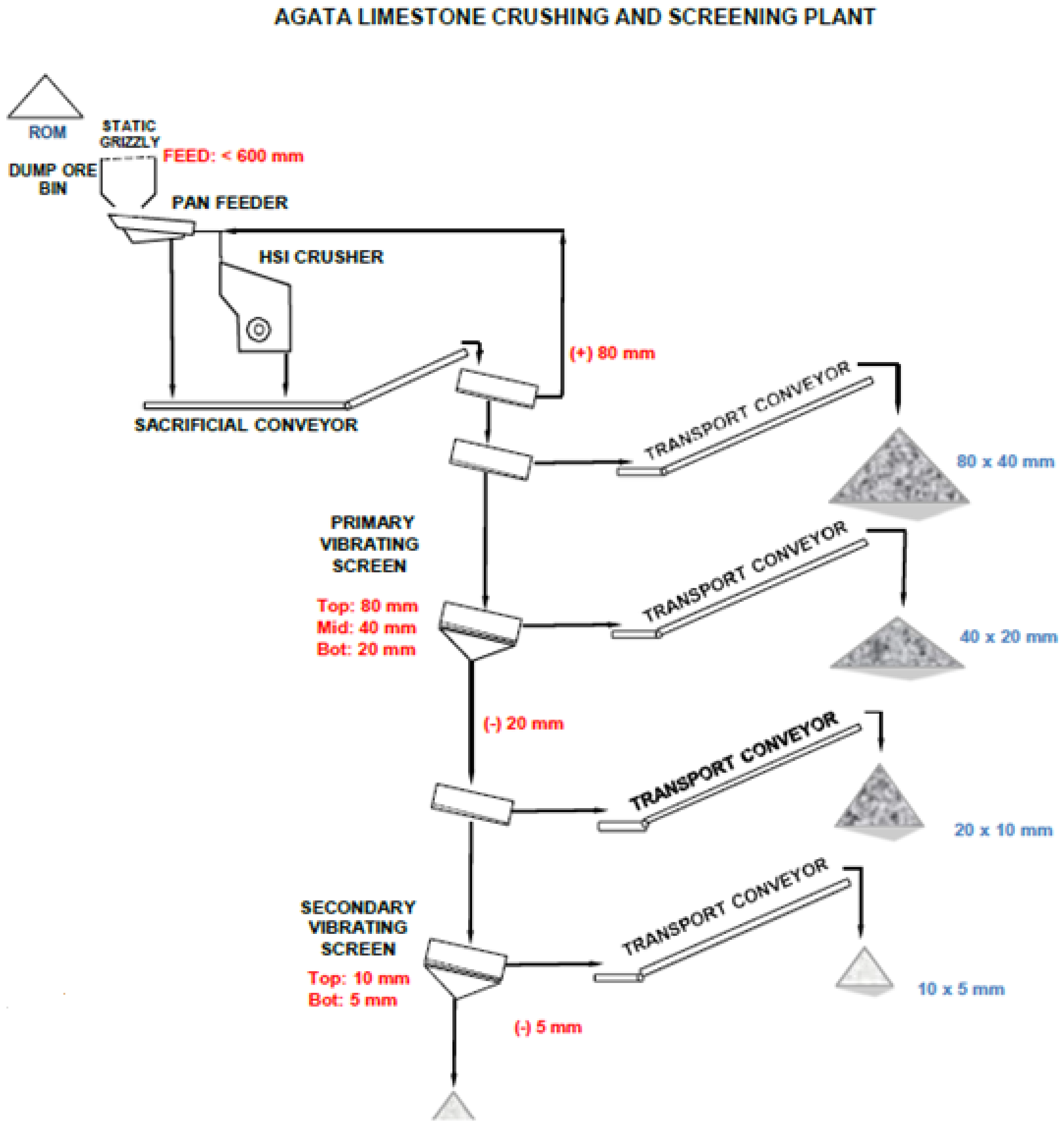


Figure 1-12 Limestone crushing plant: A – Impact crusher; C1-2 – Conveyors

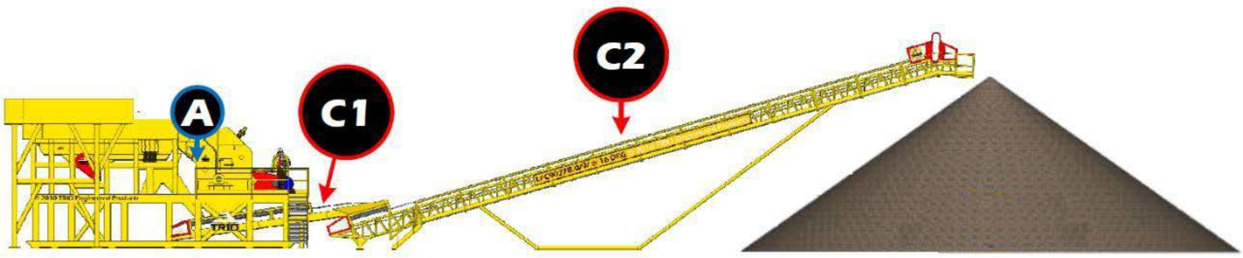
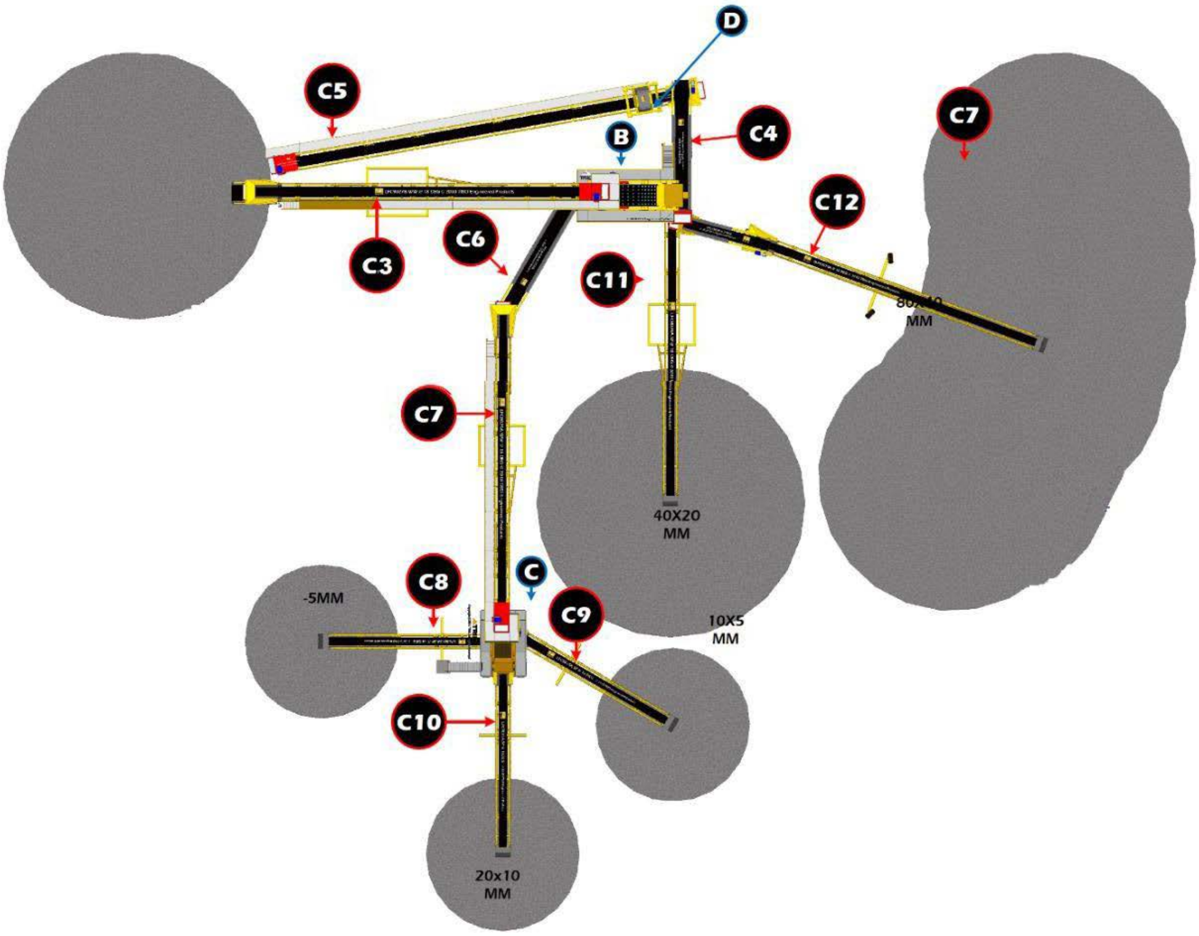


Figure 1-13 Typical screening plant lay-out: B – Primary screen; C – Secondary screen; C3-12 – Conveyors



1.5.4. Maintenance of Mine Facilities

1.5.4.1. Fleet Maintenance

The company will be using the equipment fleet of Service Contractors. The Service Contractors shall be liable for the maintenance of all their equipment that will be used in the project. Equipment may include those heavy and ancillary equipment used in mining, hauling, auxiliary works, blasting, and vessel-loading. The Company, on the other hand, oversees maintenance of its service vehicles, power and generator sets, assay laboratory, and infrastructures.

1.5.4.2 Mine Maintenance

Limestone may display karstic characteristics, hence, levelling of pinnacles prior to production stage proper will be necessary. Drilling and blasting of snake holes may be needed to develop the top benches. Road development will be complemented using dozer, excavator, grader, and compactor. Road base course/surfacing will be simultaneously sheeted with rocks of proper size. Vibratory compactor will be used to level/shape the road to 90% compaction or higher. Whenever possible, roads will be crowned to prevent water ponding, and will be super elevated to drain water towards the toe line. Drilling and blasting will be intermittently applied where applicable to fast track road development.

Where applicable, the waste materials will also be used as a surfacing material for the maintenance or construction of haul roads. Water lorries will also be utilized to minimize fugitive dusts. Perimeter canals and settling ponds will be installed within and around the active areas to control siltation. The causeway pier head will be rehabilitated or repaired once a year after the rainy season.

1.5.4.3. Plant and Camp Maintenance

The limestone crushing operation will be continuous all year-round, with a monthly scheduled preventive maintenance period. Camp maintenance will be performed jointly by the Administration and General Services Departments.

Pollution control facilities include oil and water separator at the existing motor pools and used oil storage area. They were be constructed in accordance with the hazardous waste management guidelines. Regular inspection/ audit will be continuously conducted by the Pollution Control Officer to monitor compliance to the pollution control protocols.

1.6. Project Size

1.6.1. Ore Resource

The Agata limestone was first explored and drilled by MRL in 2011. However, the drilling data were not sufficient to produce a measured resource estimate. API started drilling on 4th quarter of 2014 until 3rd quarter of 2015 and pursued the limestone project by drilling seventeen (17) more drill holes to determine and define the orebody for limestone project as measured.

Based on the consolidated drilling data, the estimated Mineral Resource of the Agata Limestone is at 35.6 million DMT of 55.11% CaO at a cut-off grade of 45% CaO. The resource estimate per grade group is shown in **Table 1-24.**

Table 1-24 Mineral Resource Estimate for Agata Limestone Project (July 2015)

Resource	Grade group CaO%	Volume	Density	Tonnage	CaCo3 %	CaO%	SiO2 %	Fe2O3%
INDICATED	45-50	306,250	2.8	857,500	85.95	48.27	6.82	1.71
	50-51	171,875	2.8	481,250	88.84	50.57	4.61	1.25
	50-52	168,750	2.8	472,500	90.44	51.58	3.88	0.95
	50-53	328,125	2.8	918,750	93.28	52.55	3.04	0.84
	50-54	656,250	2.8	1,837,500	94.74	53.59	2.13	0.6
	50-55	1,256,250	2.8	3,517,500	93.91	54.55	1.37	0.35
	50-56	7,775,000	2.8	21,769,999	98.43	55.61	0.28	0.07
	50-57	2,065,625	2.8	5,783,750	99.61	56.14	0.22	0.04
	TOTAL	**12,728,124**	**2.8**	**35,638,748**	**97.31**	**55.11**	**0.8**	**0.21**

The Mineral Resource estimate for the Project has been classified as Measured. Due to the limited area covered by the topographic survey, the extent for orebody modeling is also constrained to define resources. The drill spacing is at 100 m as such to define the resource orebody of Agata Limestone Project.

1.6.2. Ore Reserve

The complete drill hole datasets were imported to GEMS drill hole workspace to facilitate orebody modeling and estimation. The reserve estimation area was constrained within the limits of influence of the drill holes. Grade interpolation was carried out using Inverse Distance Weighted to the power of 2 (IDW2) for CaO and CaCO3, using GEMS (ver. 6.3) modeling software. The solid wireframe used to constrain the sample points were derived based on the geological interpretation done by the Exploration Geologists assigned to the ALP.

The Mineral Resource Report indicates that the block model for the resource is sufficient and consistent to define the estimates. Statistical validation also shows that the model can be upgraded into a reserve category by applying certain mining parameters. **Figure 1-14** and **Figure 1-15** indicate a valid single domain for the limestone unit.

Figure 1-14 Histogram of CaO

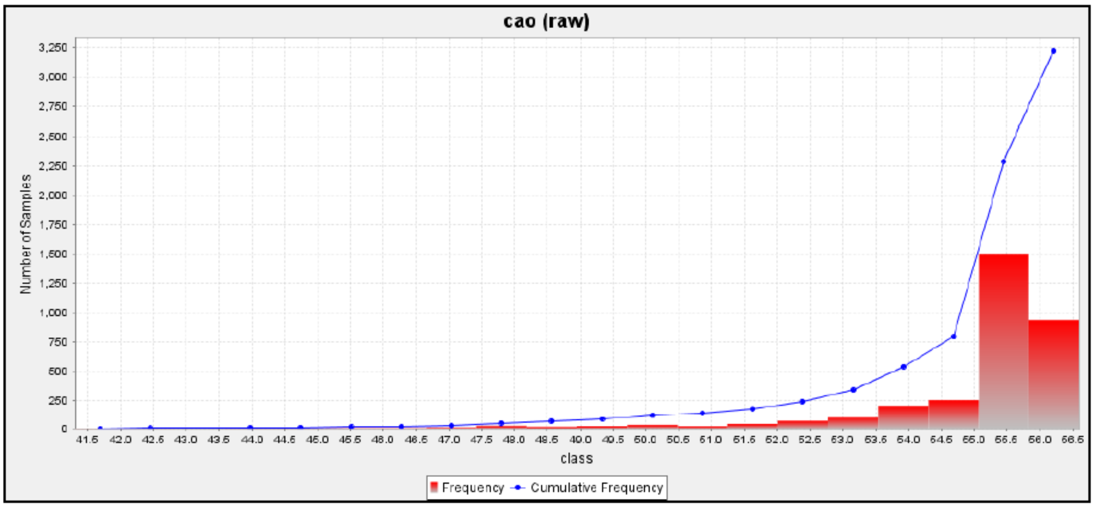
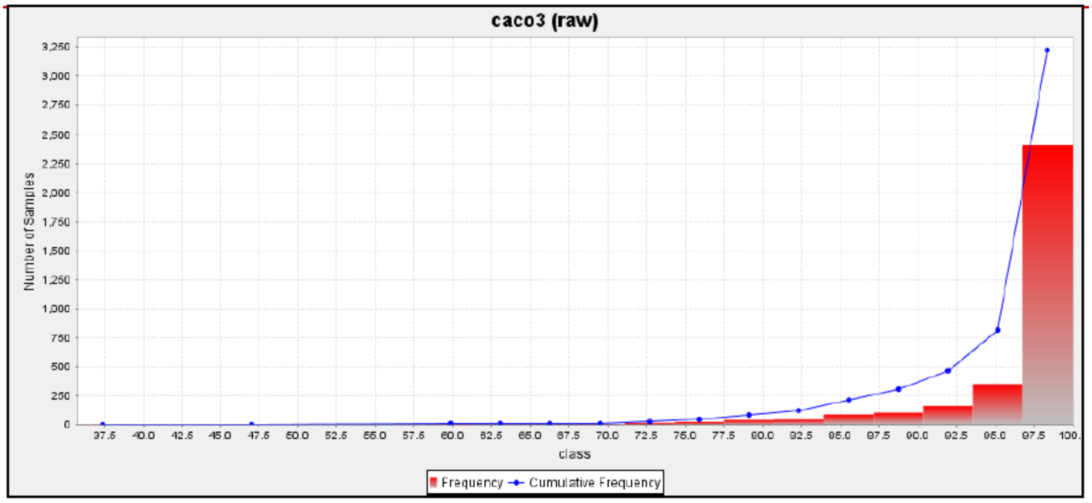


Figure 1-15 Histogram of CaO



Resource shall be considered as reserves if the ore can be economically extracted. Pit optimization was done using Whittle software. The optimization software is used to define the most profitable pit shell (or nested pit shells) based from a given set of economic parameters. The economic parameters generally include product prices, process recoveries, and operating costs. Normally when optimization is done, a range of metal prices or revenue factors are used to develop a series of nested shells to understand how the mine will expand or shrink with increasing or decreasing metal value.

The resulting pit shells from the optimization activity will serve as guide in creating a mining plan or pit design (final pit limit). The cut-off grade applied in the ore reserve estimation is 45% CaO and yields an average grade of 55.11% CaO. **Table 1-25** shows the classification of limestone based on calcium oxide quality.

Table 1-25 Ore Classification/Category Used

Category	%CaO
High grade	>54.0
Medium grade	52.5-54.0
Low grade	47.4-52.5

The estimated Ore Reserve is classified as Proven Ore Reserve. It is estimated at 30.3 million tons at 55.19% CaO (**Table 1-26**) at 45%CaO cutoff grade. The categorization indicates the bulk of the reserve falling under the high-grade classification. This is sufficient to satisfy the limestone plant requirement.

Table 1-26 Mineral Reserve Estimate for Agata Limestone Project.

Resource	Grade group CaO%	Volume	CaO%	SiO2%	Al2O3%	MgO%	Fe2O3%
PROBA-BLE	0	30.5	54.81	2.75	0.324	1.34	0.19
	42	30.3	55.19	0.75	0.328	1.34	0.19
	44	30.3	55.19	0.75	0.328	1.34	0.19
	46.5	30.2	55.22	0.72	0.324	1.34	0.18
	48	30	55.26	0.69	0.317	1.34	0.17

1.6.3. Mining Schedule

A quarry design was generated based on the results of the optimization using the mine block model. Level plans were derived from the mine model which were eventually used as cuts when merged with the original topography. The slope of the quarry bench was designed at 60_0. The overall slope ranges from 24_0 to 45_0. The pit design was limited between 0MSL and +245MSL elevations.

Year 0 involves development of haulage roads at the quarry area that will connect to existing haul/access roads of the ANLP. Production will commence on Year 1 after the haulage and access roads from the quarry are connected to the process plant yard. Production of limestone shall start in the same year. **Table 1-28** below shows the annual production schedule including waste movement.

1.6.4. Plant Capacity and Production Schedule

For the whole duration of the limestone operation there will be only one processing line producing crushed limestone. Any changes in the production capacity during operations will be dictated mainly by the demand conditions in the market.

The plant operations are assumed to be active for fifteen (15) years. Daily production as shown in **Table 1-27** will yield an approximate average annual production rate of two (2) million tons per annum. Production may slightly exceed 2 million tons to exact bench designs by the end of every year.

Table 1-27 Daily Production (tons/day)

Products	t/d
Crushed medium lumps (-80 +40 mm)	2,930
Crushed med. Small lumps (-40 +20 mm)	1,414
Crushed small lumps (-20 +10 mm)	951
Fines for sintering (-20+10 mm)	463
Minus 5mm Fines	321
Total	**6,079**

The crushing and screening operations will be on a 12-hour per day schedule with 30-working day per month allocation.

1.6.5. Total Project Area

The total project area is 554.4 hectares. It is composed of the quarry site, crushing plant, causeway, stockyards, waste and topsoil dumps, and the support facilities such as field offices, access roads, and environmental facilities.

Figure 1-16 Quarry Area for Limestone Project

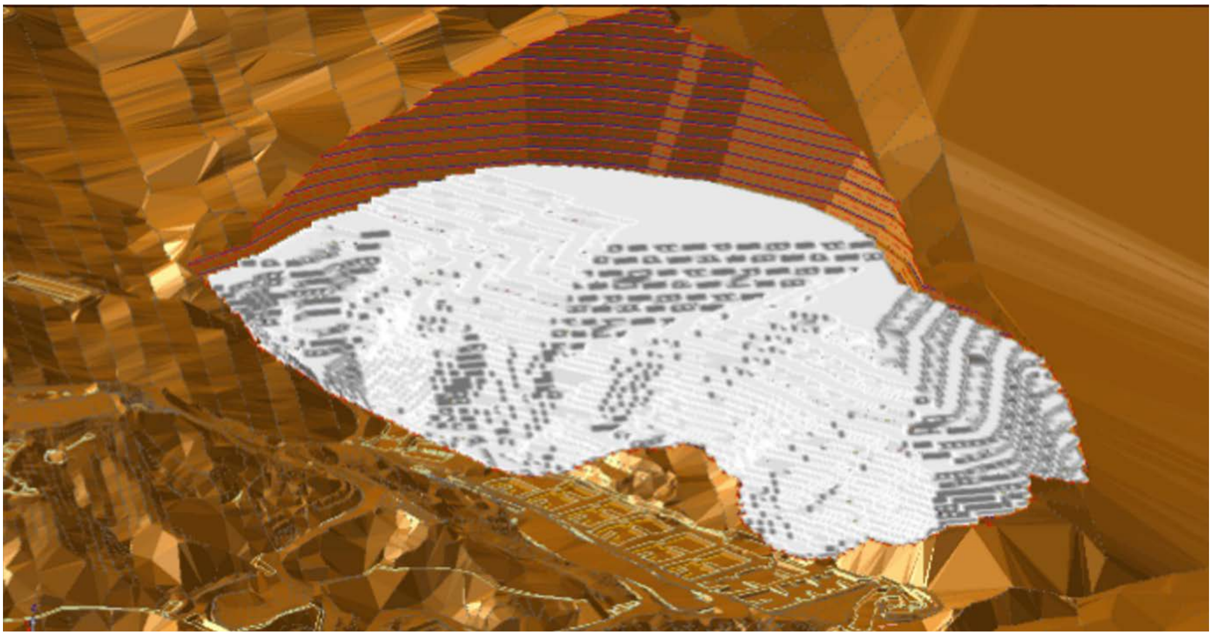
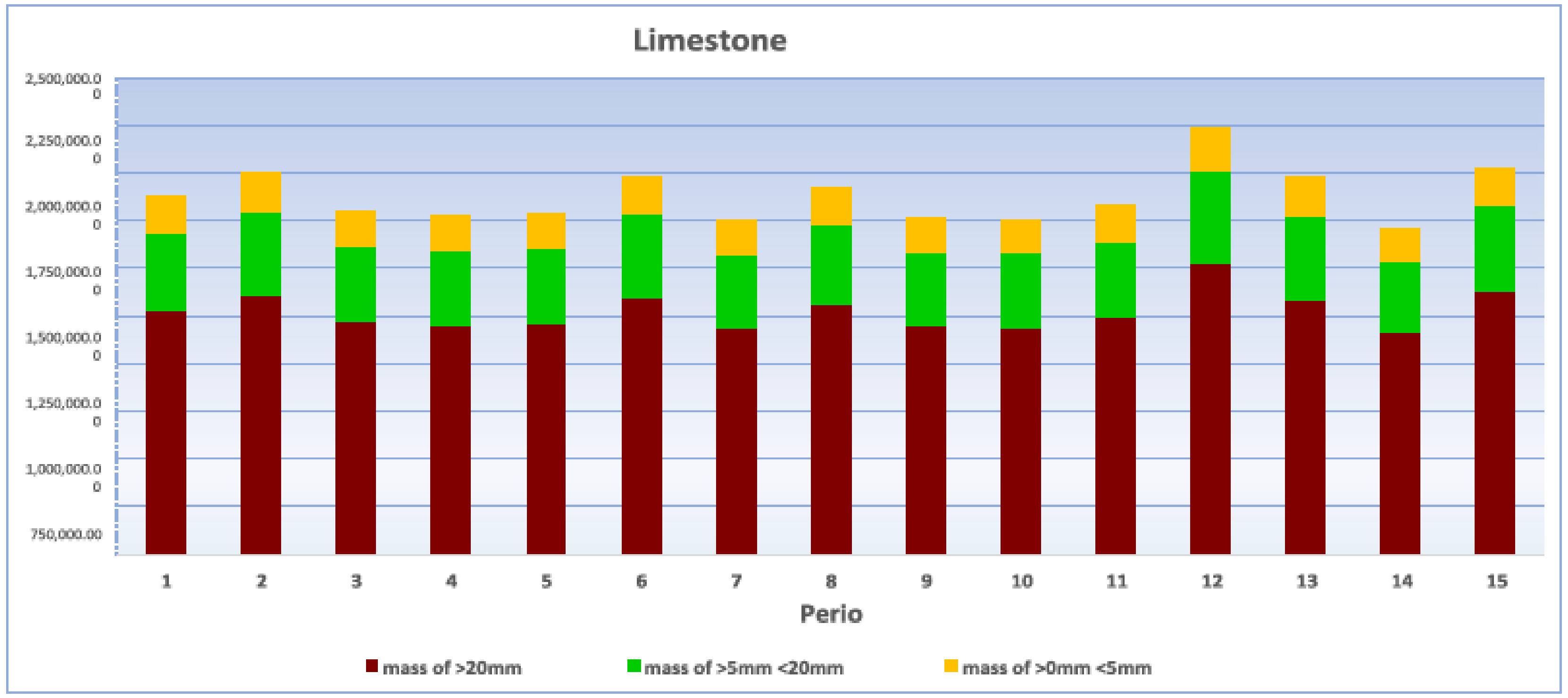


Table 1-28 Annual Materials Movement Schedule

Ore Materials	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Volume, m3	731,250	778,125	712,500	681,250	712,500	762,500	646,875	787,500	656,250	768,750	662,500	700,000	768,750	665,625	790,625	10,825,000
Tonnes, DMT	2,047,500	2,178,750	1,995,000	1,907,500	1,995,000	2,135,000	1,811,250	2,205,000	1,837,500	2,152,500	1,855,000	1,960,000	2,152,500	1,863,750	2,213,750	30,310,000
Waste Materials																
Volume, m3	418,750	184,375	293,750	131,250	125,000	193,750	212,500	271,875	196,875	343,750	256,250	321,875	418,750	275,000	221,875	3,865,625
Tonnes, DMT	1,172,500	516,250	822,500	367,500	350,000	542,500	595,000	761,250	551,250	962,500	717,500	901,250	1,172,500	770,000	621,250	10,823,750
Total Materials Movement																
Volume, m3	1,150,000	962,500	1,006,250	812,500	837,500	956,250	859,375	1,059,375	853,125	1,112,500	918,750	1,021,875	1,187,500	940,625	1,012,500	14,690,625
Tonnes, DMT	3,220,000	2,695,000	2,817,500	2,275,000	2,345,000	2,677,500	2,406,250	2,966,250	2,388,750	3,115,000	2,572,500	2,861,250	3,325,000	2,633,750	2,835,000	41,133,750

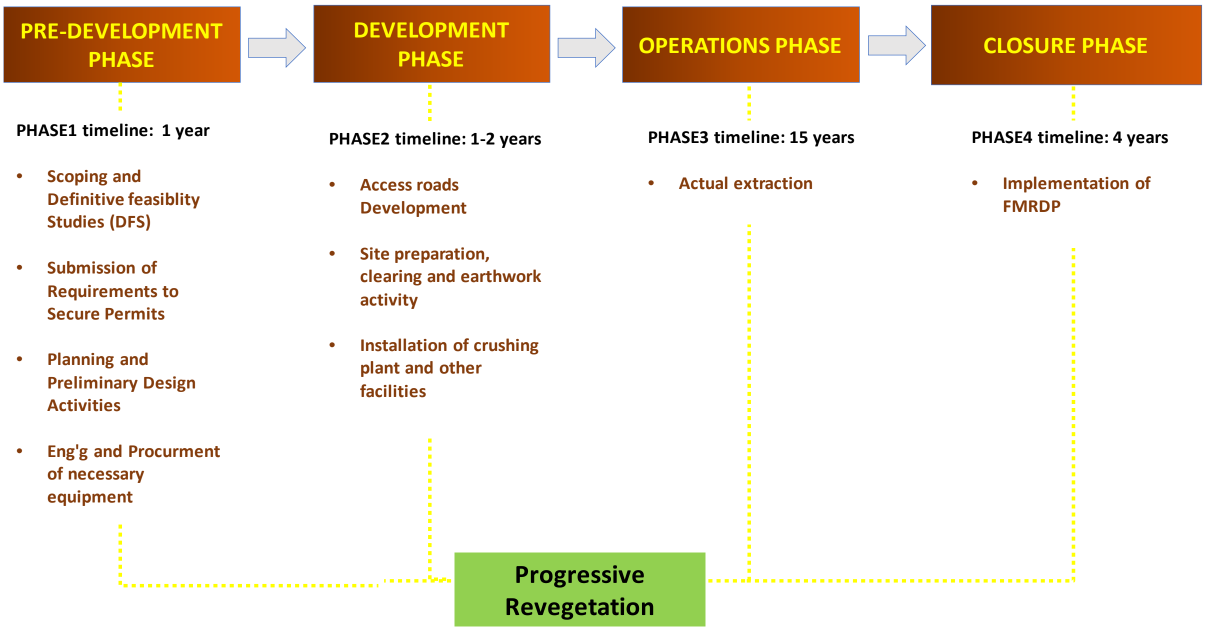
Figure 1-17 Annual Limestone Production



1.7 Description of Project Phases and Activities

The Agata Limestone Project are divided into four major phases namely: (1) Pre-development; (2) Development; (3) Operation; and (4) Decommissioning and Rehabilitation or the Mine Closure Phase. The major activities involved in every phase of the project are described in the following subsections. Each stage includes activities that have potential identifiable impacts to the environment. Management, mitigation or adaptation options to address the impacts relevant to the Project are discussed in the succeeding sections. Specific activities entailed in each project phase is shown on the general process flow in **Figure 1-18** below.

Figure 1-18 Project Process Flow



1.7.1 Pre-Development Phase

The Agata Limestone Project is currently in the Pre-Development Phase. Activities associated with this phase can be traced back to late 2014, when an initial resource evaluation indicated that the Project maybe economically viable. This phase included the following activities or milestones:

a. Scoping and Definitive Feasibility Studies (DFS)

The Scoping and DFS were conducted to establish the Project's social, technical, environmental and financial aspects, and relate these to the overall benefit of the Project. The scoping study is the first level of study performed primarily to determine whether the expense of a feasibility study is warranted.

b. Submission of Requirements to Secure Mine Development and Operating Permits

The Company must first secure the necessary endorsements and permits from the concerned government agencies and local government units before proceeding to mine-development activities. The process normally involves submission of reports and studies to concerned agencies, particularly the Mines and Geosciences Bureau (MGB) and Environmental Management Bureau (EMB) of the

Department of Environment and Natural Resources. Currently, the process of securing the necessary permits and licenses is underway and is conducted by the ALP technical team composed of Mining Engineers, Geologist, Forester, tenement officer and pollution control officer.

c. Planning and Preliminary Design Activities

Planning and preliminary design of the Project has been ongoing since Year 2018. At this stage, the planning and design are focused on identifying the most appropriate design and operation schemes that will lead to a sustainable mining project. General mine facility layout, mine production schedule, quarry design, bench plan, drainage management system, road network, and emergency preparedness plan and program are started to be developed during the planning phase undertaken by the ALP Mine Planning Engineers and Safety Engineers.

d. Engineering and Procurement of Necessary Equipment

The equipment to be used during the operation phase of the ALP will be provided by service contractors. This is to give investment opportunities to the local business players and contribute to the economy of the municipality. Except for the crushing plant and blasting contractors, all other heavy equipment service providers are readily available onsite and currently working as part of the Agata Nickel Laterite Project fleet. Negotiation of terms and conditions and signing of contracts will be conducted prior to the development phase.

1.7.2. Construction and Development Phase

The ALP operations will mostly be utilizing the existing mine support facilities of the Agata Nickel Laterite Project. The installation of the crushing plant will be the only major activity during the construction phase. Once the Project has acquired all the required permits, clearances, and financial approvals, the construction phase will begin. Procurement of materials as well as bidding for contractors will be initiated during the pre-development phase. This is expected to be completed in less than a year.

The following activities will be done during the construction and development phase:

a. Access Roads Development

The same road networks of the nickel operations will be initially used to initially access the limestone project facilities. As the limestone quarrying progresses, new roads will be constructed based on the mine design. Clearing and grubbing of vegetation during the road development will follow the SOP, that is, to secure the Notice to Proceed (NTP). It is also part of compliance to the existing Integrated Management System (IMS) of the company.

b. Site Preparation, Clearing and Earthwork Activity

Project facilities, including the administration office and staff housing area, are already available onsite. The limestone quarry will be the major area to undergo the vegetation clearing activities. The topsoil recovered will be segregated and stored for future use in reclamation and rehabilitation. The lumber retrieved from the felling activities will be used for DENR approved community projects.

The ore stockpile area and overburden waste dumps will be located on the existing mined out portions of the ANLP. Road construction, grading, and compacting these mined out areas are also among the primary activities during the development phase.

c. Installation of Crushing Plant and other facilities

New facilities that will be installed for the limestone operations include the crushing plant, the explosive magazine storage building, and the water management system (i.e. drainage canals and settling ponds). The use of other ancillary facilities such as the Fuel Depot, Hazardous Waste Management Facility, Material Recovery Facility (MRF), Nursery, Laydown areas for contractor's heavy equipment will be continued from the nickel to the limestone operations.

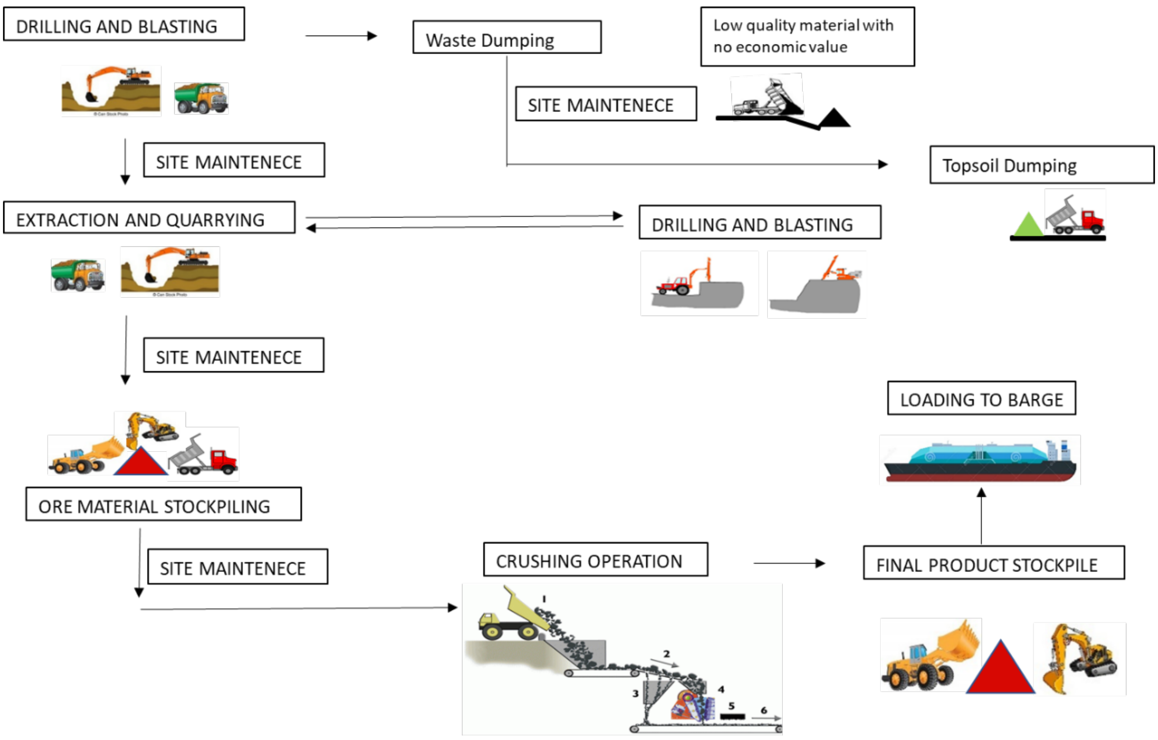
1.7.3. Operations Phase

Quarrying will proceed according to the approved mine plan. With the development of the access roads, the installation of the crushing plant and the construction of mine support facilities, the following mine production activities can commence:

- Mining Operations (Actual Quarrying of Limestone/ Excavation and loading)
- Crushing and Sizing Operations (Crushing and Sorting of Products)
- Blasting Activities (Implementation of Safety Protocols and Standards during Blasting)
- Product Delivery (Loading of Products to Barges)
- Site Maintenance (Road maintenance, dust suppression and water spraying)

The order of specific mining operations activities is shown in the process flow shown on **Figure 1-19.**

Figure 1-19 Process Flow of Mining Operations



It is also expected that the social, environmental, safety, and other mine operation protocols will follow the Integrated Management System subscribed by the company. This include the following areas, among others:

- Environmental Management and Monitoring
- Social Development and Management Program
- Safety and Health Program
- Security Program
- Progressive Rehabilitation Program
- Climate Change Impact Monitoring
- Engineering Mitigation Program

Production is expected to last fifteen (15) years.

1.7.4 Closure Phase

Details of the Closure Phase shall be covered by the revisions to be made in the Final Mine Rehabilitation and Decommissioning Plan (FMRDP) for the ANLP approved by MGB. With the planned quarrying operation for the Limestone Project, the company will re-evaluate the approved FMRDP of the ANLP and submit an amendment of the program to MGB. This version will include details on the revised rehabilitation schedule, including identification of which facilities/ disturbed areas will be subject for final decommissioned, rehabilitation, or will be retained for use in the Limestone Project. Mine closure planning will involve the active participation of the Community Technical Working Group (CTWG), represented by the different sectors within the impact communities.

The overall objective of the rehabilitation and closure plan is to rehabilitate the Project area in a manner that will promote a sustainable environment for the community. Key action items in this process includes the following:

- Implementation of a responsible and environmentally sound decommissioning process.
- Restoration of the floral and faunal biodiversity of the disturbed areas.
- Ensure the sustainability of community programs implemented during the mine operation.
- Promote a self-reliant and sustaining community after the closure of the mining Project.
- Establish the final land use of the Project area such that long term adverse environmental impacts are prevented or eliminated.

In general, the final land use goal for the disturbed areas will be an agroforestry ecosystem with an Agricultural Training Hub. It is envisioned that the Project area will host the CARAGA Sustainable Agricultural Resource and Learning Center through the collective efforts of the Company, LGU, the CBFMA-PO's and the DENR. This is in accordance with the vision of the host Municipalities to become the center of Agri-Tourism and Responsible Mining Industry in the Province.

A ten (10)-year closure program is initially established to meet the objectives of the FMRDP. The first two years are considered as the active phase of rehabilitation and decommissioning period. This will be followed by another two (2) years of the passive phase. This phase consists primarily of monitoring, care and maintenance, and validation of the viability and long-term sustainability of the rehabilitation program. Internal monitoring and third-party monitoring programs will be continued for another six-year long-term maintenance period. The goal is to secure a Certificate of Relinquishment of the Project area by the Year 2030.

The initial FMRDP document for the ANLP identified a budget of Php 270 million for closure, reclamation and monitoring activities during the 10-year closure period. This is deposited over a seven-year period, which began in Year 2016. A review of the FMRDP is underway. Among the items for review include potential changes in final land use as determined by the impact community, closure costs, implementation schedule and the FMRD Fund deposit schedule.

The overall project timeline is presented in **Table 1-29.**

1.8 Manpower

1.8.1. Personnel Requirements and Hiring Scheme

1.8.1.1. Pre-Development Phase

During the pre-construction phase, the existing technical personnel of the Agata Nickel Laterite Project (ANLP) will conduct the required activities such as scoping and definitive feasibility studies, submission to regulatory agencies to secure the necessary permits, mine planning and preliminary design activities, and the procurement of necessary equipment. Hiring of third-party experts for the technical aspects of the permitting and planning will be done, as necessary.

1.8.1.2. Construction and Development Phase

During the construction and development phase, most of the personnel will be employed through the third-party contractor who will be engaged to install the crushing plant. Workforce from the local community will still be prioritized but will be subject to qualification screening. Key positions needed include a limestone quarry engineer and construction foremen who will supervise the overall quarry development, plant installation and other ancillary facility construction.

1.8.1.3. Operations Phase

The Project will directly employ a total of 226 personnel during the actual operation. A summary of the peak manpower demand, according to employment categories and department requirements, is shown in **Table 1-30.** The limestone operation will be, in as much as possible, utilizing the existing workforce from the nickel operation. The need for additional manpower will depend on the level of mining activity, which is contingent to weather condition. Same as the hiring practice in any mining operation, workforce from the local community provided they meet the employment qualifications. Other indirect project personnel who will be part of the operation are the service contractors for equipment operation.

Employees from outside the CARAGA region will work under a roster of 5-week continuous workdays, followed by one-week rest days. This schedule will be subject to occasional changes depending on the working conditions at the project site. Accommodation facility will be provided for selected management and technical staff. Meanwhile, employees from the local community will work daily for 8-hours in 6 days per week and will be provided with shuttle at designated pick up points to the mine site.

Staff and labor costs shall be based on existing rates in Caraga~~.~~ Labor and Administrative costs are included in the Service Contractors cost for the use of their equipment. The Service Contractors will be providing the salary of its drivers, operators, and staff but still subject to existing labor costs in Caraga.

The proposed ALP will continue to employ most of the existing workforce available from the ANLP. Residents from the host communities will be given priority for employment provided they meet the qualifications.

The qualifications of key personnel are the following:

1.General Manager – must be a licensed Filipino Mining Engineer with significant experience in mining and/or processing operations. He/she will be the over-all manager of all aspects of the project.

2. Administrative Manager – must be experienced in Human Resource works and relevant experience in managing administrative functions.

3. Accounting Manager – must be a licensed CPA with experience in general accounting on mining projects or related industry. He or she must have proven integrity. He or she must have proven integrity.

4.Tenement Manager – must be knowledgeable in the compliance requirements to LGU, MGB, DENR, and other agencies with jurisdiction over mining activities. He/she should have at least three (3) years relevant experience as a Tenement Officer.

5.MEPEO – must be a licensed forester or mining engineer with at least five-year work experience in implementing environmental management program for mining operation.

6.Mine Engineering Superintendent – must be a licensed Mining Engineer with at least 5-year work experience in mine planning and engineering works.

7.Grade Control Superintendent – must be a licensed Geologist or Mining Engineer with significant work experience in Grade Control in a mining operation.

8.Port and Quarry Manager – must be a licensed Mining Engineer, with at least 10-year combined experience quarrying, mining and port operations.

9.Plant Manager – preferably a licensed engineer (MetE, EM, ME, CE, IE), with at least 10-year combined experience in handling crushing and processing plant.

10.SHES Manager – preferably a licensed Mining Engineer, with relevant experience in Mine Safety.

11.Marketing Manager – must have a wide experience in marketing mining commodity and knowledgeable in the current trends and pricing of the limestone products.

Table 1-29 Project Schedule

Project Phases	Project Timeline
1. Pre-Development Phase	1 Year
a. Scoping and Definitive Feasibility Studies (DFS)	
b. Submission of Requirements to Secure Permits	
c. Planning and Preliminary Design Activities	
d. Engineering and Procurement of Necessary Equipment	
2. Development Phase	1-2 Years
a. Access Roads Development	
b. Site Preparation, Clearing and Earthwork Activity	
c. Installation of Crushing Plant and other facilities	
3. Operations Phase	15 Years
a. Actual Extraction Period	
4. Closure Phase	4 Years
a. Implementation of the FMRDP	

Table 1-30- Project Personnel Distribution (Operations Phase)

	Allocated cost	No.
Site Mgt.	General Manager	1
	Technical Assistant	1
	Subtotal	2
Human Resource and Administration	Admin Manager	1
	HR Supervisor	2
	Timekeeper	1
	Encoder	4
	Driver	4
	Cook	2
	Dishwasher	2
	Laundry helper	4
	Utility	4
	Warehouse supervisor	1
	Purchaser	1
	Helper	2
	Subtotal	28
Accounting	Accounting Manager	1
	Accountant	2
	Cashier	1
	Accounting Clerk	4
	Subtotal	8
Tenements & Permits	Tenement Manager	1
	MEPEO	1
	Compliance Officer	2
	Liaison Officer	2
	DCC	1
	Clerk	3
	Subtotal	10
Camp Facility Management	Camp facility Manager	1
	Electrician	2
	Helper	4
	Plant Equipment mechanic	2
	PMS mechanic	2
	Heavy equipment mechanic	2
	Lube men	2
	Fuel Tender	2
	Civil Engineer	1
	Carpenter	2
	Welder	1
	Labor	4
	Subtotal	25
Planning & Engg	Mine Engineering Supt	1
	Cost Control Engineer	1
	Encoder	4
	Mine Planning Engineer	2
	CAD Operator	2
	Geodetic Engineer	1
	Survey Aide	8
	Subtotal	19

	Allocated cost	No.
Grade Control	Grade Control Geologist	2
	Mapper	2
	Grade Control Foremen	2
	Sampler	8
	Subtotal	14
Quarry and Port Operations	Port and Quarry Manager	1
	Mine Supervisor	2
	Mine Foremen	2
	Drilling Supervisor	2
	Drill Foremen	2
	Checker	4
	Spotter	8
	Drilling crew	8
	Port Supervisor	2
	Barging crew	8
	Subtotal	39
Plant Management	Plant Manager	1
	Laboratory Supervisor	2
	Laboratory Foremen	2
	Laboratory Aide	8
	Plant Supervisors	2
	Foreman	2
	Pay loader operator	4
	Crusher operator	4
	Crusher helper	4
	Screening operators	4
	Utilitymen	4
	Sub-total	37
SHES Department	SHES Manager	1
	Safety Engineer	2
	Safety Inspector	4
	Doctor	2
	Nurse	2
	PCO	1
	Forester	3
	Nursery Aide	8
	CRO Supervisor	3
	CRO Aide	8
	Subtotal	34
Shipping and Marketing	Marketing Manager	1
	Marketing Officer	1
	Market research analyst	2
	Communications Officer	1
	Shipping Agent	1
	Logistics Officer	2
	Clerk	2
	Subtotal	10
	Grand Total	**226**

1.8.1.4. Final Rehabilitation and Decommissioning Phase

Manpower will be reduced gradually during the Mine Closure Phase. Four (4) key departments, including the Environment, Administration, Security, and Community Relations, will be retained to implement the Final Mine Rehabilitation and Decommissioning Plan (FMRDP). As the rehabilitation goes from active to passive phases, the retained manpower, mostly from the local community, will be prepared for the eventual turn-over and management of the rehabilitation area during the long-term care and maintenance of the rehabilitation area.

The overall manpower requirement for the life of the project is summarized in **Table 1-31.**

Table 1-31 Summary of Manpower per Operation Phase

Department	Pre-Dev	Dev't	Operation	Final Rehab
Site Management		2	2	
Mine Planning and Engineering	4	7	19	
Quarry and Port Operations		10	39	
Grade Control			14	
Plant and Laboratory			37	
Shipping and Marketing			10	
Tenements and Permits	3	3	9	
Safety and Health		3	11	
MEPEO			13	20
Community Relations Office		2	11	2
Accounting		2	8	
Human Resources & Administration		9	28	15
Camp Facility Management		5	25	
TOTAL	**7**	**41**	**226**	**37**

1.9. Project Cost

1.9.1. Capital Expenditures

The estimated capital cost for the Project is Php 425.48 million (USD 8.51 million). This includes quarry development, crushing and screening plant construction, development of auxiliary facilities, acquisition of permits and other statutory requirements, and contingency. A summary of the costs by activity items are shown in **Table 1-32.**

Table 1-32 Summary of Capital Expenditures

CAPEX ITEM		Million Php	Million USD
Limestone Quarry			
1	Quarry Development	8.75	0.18
Crushing and Screening Plant			
1	Crushing and Screening	137.48	2.75
2	Power (Genset)	110.00	2.20
3	Conveyor system from stockyard to existing causeway (1.5km)	14.03	0.28
4	Equipment Installation Cost	39.23	0.78
5	Engineering, construction, supervision, project management and plant commissioning	11.77	0.24
	Plant Subtotal	312.50	6.25

Table 1-32 Summary of Capital Expenditures (continued)

CAPEX ITEM		Million Php	Million USD
Auxiliaries			
1	Covered stockyard, fuel tanks, water tanks, lighting, perimeter fencing, sewage, field office, bodega, control room, maintenance shed, guardhouse, bunkhouse	20.00	0.40
2	Causeway (Concrete and improve existing)	10.00	0.20
3	Waste dump and sedimentation control facilities	25.00	0.50
4	Access road construction, plantsite preparation, grading, surfacing	0.30	0.01
5	Maintenance Tools and Equipment	0.25	0.01
6	Plant Site Rental and Right of way	5.00	0.10
7	Govt permits, quarry license, ECC and LGU Endorsement	5.00	0.10
	Auxiliaries Subtotal	65.55	1.31
CAPEX Subtotal		386.80	7.74
Contingency, 10%		38.68	0.77
CAPEX TOTAL		**425.48**	**8.51**

1.9.2. Operating Expenditures

Operating Expenditure (OPEX) covers all relevant cost items in the production of limestone lumps and fines. OPEX came from in-house estimates, local suppliers and from mining operations here and abroad. Below are assumed criteria in deriving the OPEX. The summary of the operating expenditures is shown in **Table 1-33.**

1. Forex is USD 1 equivalent to Php 50
2. The power rate is USD 0.16 per kWh
3. Diesel fuel is USD 0.64 per liter

Table 1-33 Summary of Operating Expenditures

	OPEX ITEM	Php/t	USD/t
Mining Cost			
1	Drilling	8.25	0.15
2	Blasting	11.75	0.22
3	GC Sampling/ Assaying	2.25	0.03
4	Loading, Hauling, Dumping	80.75	1.60
5	Bench, Road, Drainage maintenance	35.75	0.70
6	Barging and Stevedoring	69.25	1.37
	Mining Cost Subtotal	208.00	4.16
Crushing and Screening Cost			
1	Supervision and labor	2.50	0.05
2	Lease/rental, front end loader with operator and maintenance	10.00	0.21
3	Electric power	35.74	0.74
4	Allowance for maintenance spare parts	0.10	0.00
	Plant Subtotal	48.34	1.01
Product Handling Cost			
1	Electric power	6.60	0.14
2	Allowance for maintenance spare parts	0.01	0.00
	Product Handling Subtotal	6.61	0.14
OPEX TOTAL		**262.95**	**5.26**

Section 2– Environmental Baseline Conditions for Critical Environmental Parameters, Impact Assessment and Mitigation

2.0 Introduction

This section presents the baseline environmental conditions of the Agata Limestone Project. The focus is on Land, Water, Air and People aspects. Environmental and social baseline data presented in this report are referenced primarily from the latest monitoring data of the Agata Nickel Laterite Project since ALP will be located within the same area. Supplemental data gathering, either inhouse or through third party consultants, were also conducted as necessary to provide updated information on the environmental setting prior to the commencement of the limestone project.

Secondary documents were also collected from different government agencies including the National and Local Government Units as well as the Barangay offices. Laboratory testing for soil, water and air sampling were performed by local laboratories accredited by the Department of Environment and Natural Resources (DENR). The perception of the local stakeholders regarding the Project operations was accomplished through Focus Group discussions and Key Informant interviews. The social and community investigations focused on socioeconomics, public health, infrastructure and demographics.

2.1 Land Use

2.1.1 Land Use Classification

The project is in the coastal Municipality of Tubay, Agusan del Norte with a total land area of 13,800 hectares and constitutes 5.06% of Agusan del Norte's total area. The urban area covers 2.97% of the total area while rural areas cover the dominant 97.03%. The municipality has 13 barangays, with the top 3 being Barangay Tagmamarkay (19.78%), Doña Telesfora 11.41% and Sta Ana (20.5%). The primary impact area is in Barangay Tinigbasan while the secondary impact area includes Barangay Lawigan.

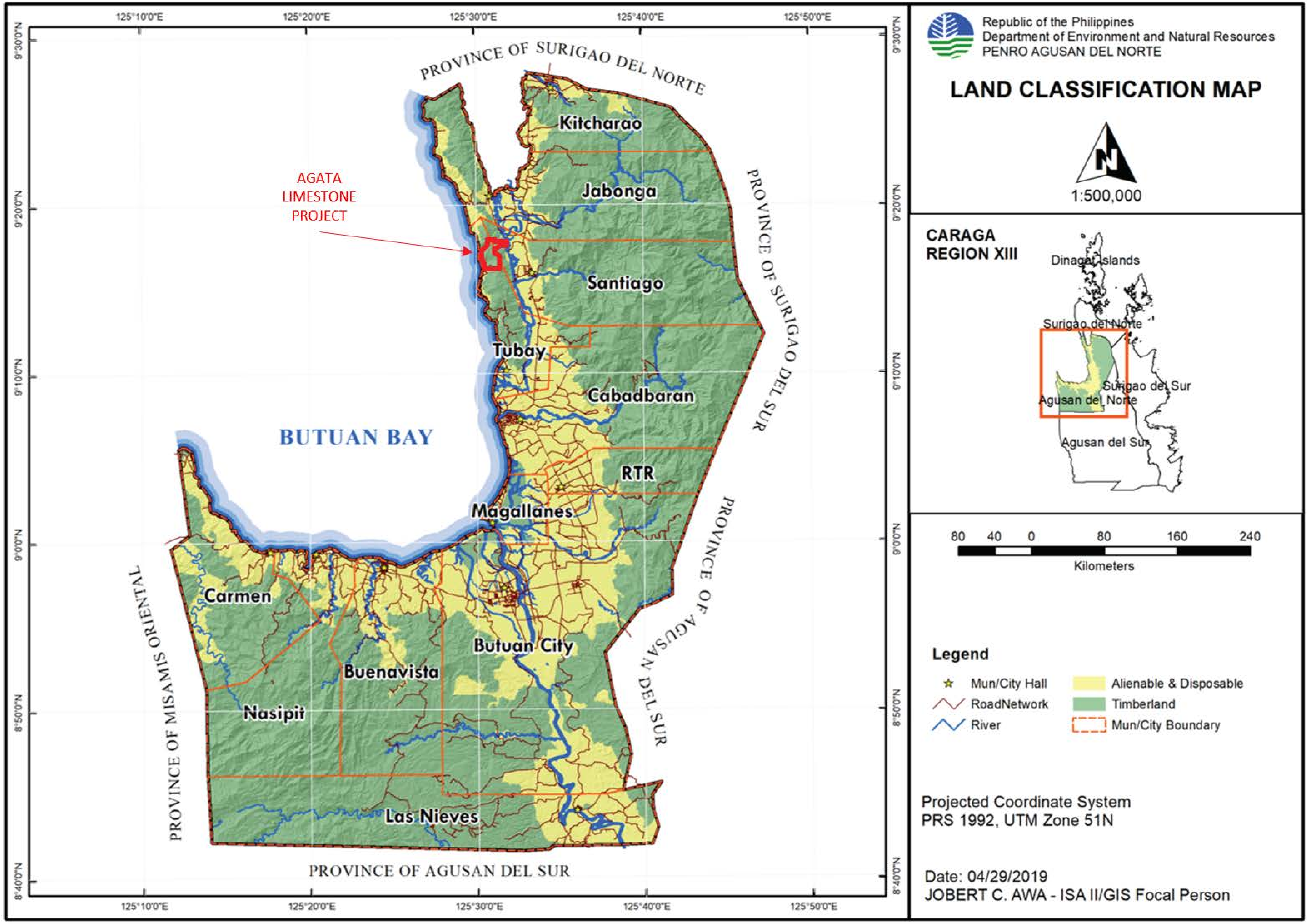
The Municipality of Tubay has a forest/timber area of 7,518.03 hectares or 54.57% while alienable and disposable area is 6,281.97 hectares or 45.43%. Total built-up area is 148.5 hectares comprising 2.36% of the total alienable and disposal lands. A total of 7, 212.04 hectares or 52.26% of land are classified as forest area while the area devoted for agricultural use in the municipality is 4,847 hectares or 35.12%, mineral land is 598.50 hectares or 4.34%, body of water is 522.96 hectares or 3.79%, open grass land is 471 hectares or 3.41 and the built-up area covers only 148.5 hectares or 1.08%

The Agata Limestone Project area is generally characterized by three ecosystem types; forest over ultramafic rocks, tropical lowland evergreen rain forest and plantations. The ultramafic forest is the primary vegetation type with only a few tall and large trees. The tropical lowland evergreen forest is found in patches throughout the Project area and may be remnants of the vegetation that previously existed. The forest patches are generally found along the ridges and the streams/valleys within the Project area.

2.1.1.1 Impact with Compatibility with Existing Land Use

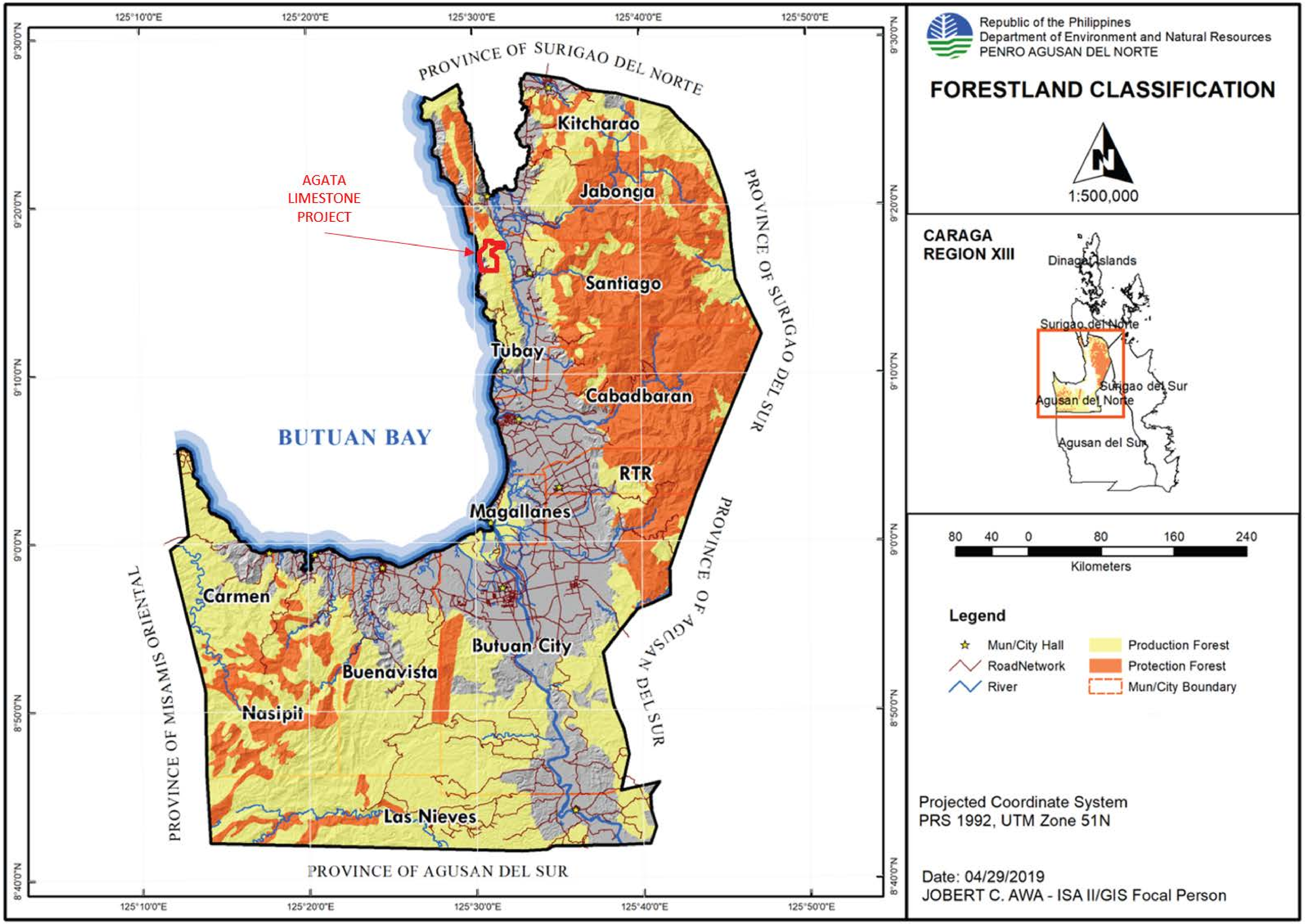
Based on the 2019 Land Classification Map shown in **Figure 2-1** obtained from PENRO Agusan del Norte and the Forest Land Classification Map from the community shown in **Figure 2-2**, the location of the Agata Limestone Project is classified as a Timber Land-Production Forest. This type is defined as areas of forest lands that can be made available for timber and agroforestry production, range lands for grazing, and other forest lands special uses. In terms of the land and forest cover, the largest portion of the Project area is agricultural land planted with either annual or perennial crops.

Figure 2-1 Land Classification Map



Source: DENR, PENRO Agusan del Norte (2019

Figure 2-2 Forestland Classification



Source: DENR, PENRO Agusan del Norte (2019)

There will be no change in the current land use, as the area where the additional volume of resource will be extracted is within the bounds of the existing MPSA area. Nevertheless, cutting and utilization of timber resources in the area during site preparation, clearing and earthwork activity shall be properly coordinated with the Department of Environment and Natural Resources. Lumber recovered from the clearing activities will be used for DENR approved community projects. Topsoil within these areas at the quarry site will be segregated and stored for future use in rehabilitation activities. Stockyards and Waste Dumps will be located at existing mined out portions of the ANLP, road construction, grading and compacting are the primary activities in the development phase.

2.1.1.2. Impact with Compatibility as Environmentally Critical Area

Based on the Revised Procedural Manual for DAO 2003-30: Implementing Rules and Regulations of PD 1586, Establishing the Philippine EIS System, twelve categories were used as bases in the identification of Environmentally Critical Areas (ECA) wherein the project area was evaluated.

Upon careful assessment and data gathering, it is determined that the Agata Limestone Project is considered an Environmentally Critical Area (ECA) based on the following: potential of occurrence of natural calamities such as typhoons, and seismic events. Although the area has low flood susceptibility, it is also identified as high landslide susceptibility based on the geohazard map obtained from the Mines and Geosciences Bureau as shown in **Figure 2-3** below.

Moreover, Indigenous Peoples (IP) group of Mamanwas and Manobos who are residents of the area were issued by an Ancestral Domain Title CADT 237 by NCIP last December 2018 with the help of the company. The presence of these Indigenous Peoples (IP) group further supports the ECA determination of the Project. The ECA assessment which indicates how the Project meets the criteria for an ECA determination in six of the evaluation categories is summarized in **Table 2-1**.

The proponent will implement mitigating measures to address land management, including topsoil management, and visual amenity.

Table 2-1 Project Area Assessment as an Environmentally Critical Area

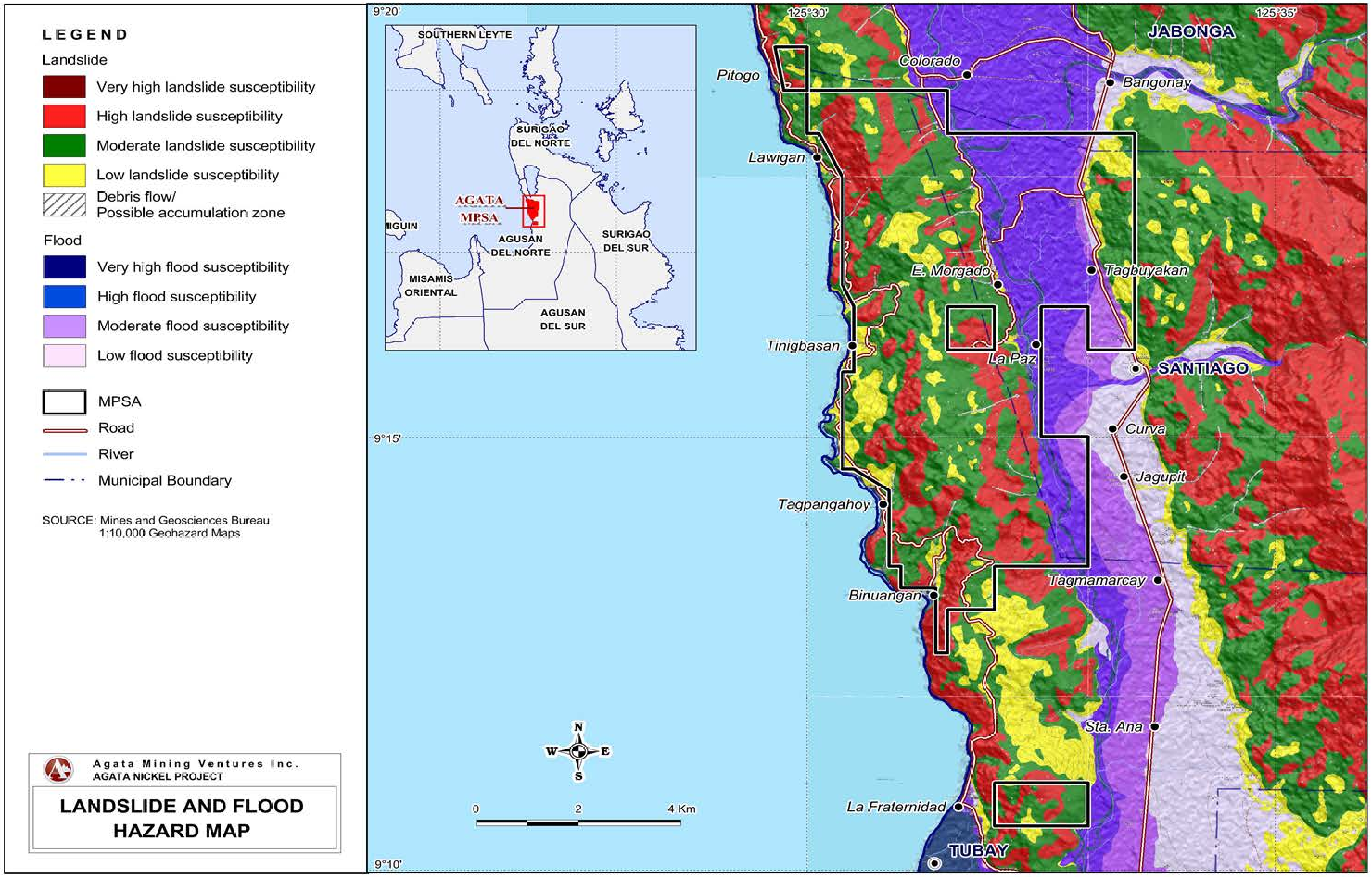
ECA Categories	Project Falls within Environmentally Critical Area Description ?			Source of Information
	Yes	No	Uncertain	
Area declared by Law as National Parks, Watershed Reserves, Wildlife Preserves and Sanctuaries.		✓		Not listed as a National Protected Area *Source: Forest Management Bureau*
Areas Set Aside as Aesthetic, Potential Tourist Spots.			✓	No Designation by Government Agencies, but portion of the project site is proposed to be a tourism site after mine life as indicated in the abandonment plan.
Areas which Constitute the Habitat for any Endangered or Threatened Species of Indigenous Philippine Wildlife (Flora and Fauna).		✓		Flora and Fauna Assessment conducted by Green Envionment Consultancy on July 16-19,2020.
Area of Unique Historic, Archaeological, Geological or Scientific Interests.			✓	None.
Areas which are Traditionally Occupied by Cultural Communities or Tribes.	✓			IP Community of Mamanwa-Manobo residing within the host communities *Source: Field Based Investigation by NCIP*

Table 2-1 Project Area Assessment as an Environmentally Critical Area

ECA Categories	Project Falls within Environmentally Critical Area Description ?			Source of Information
	Yes	No	Uncertain	
Geologic Hazard Areas	✓			Geohazard Map, Landslide S *Source: MGB XIII*
Flood-prone Areas		✓		Flood Susceptibility Map *Source: MGB XIII*
Areas Frequently Visited or Hard Hit by Typhoons	✓			Rainfall and Climate Data *Source: PAGASA*
Areas Prone to Volcanic Activities and Earthquakes	✓			Located within a Seismically Active Region. Historical Earthquakes; Active Fault Map. *Source: Phivolcs*
Areas with Critical Slopes	✓			Landslide Susceptibility Map *Source: MGB XIII*
Areas Classified as Prime Agricultural Lands		✓		The area is generally covered with
Recharge Areas of Aquifers		✓		None.
Water bodies tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities.		✓		No water bodies tapped for domestic purposes.
Mangrove Areas		✓		No mangrove areas
Coral Reefs	✓			Coral Sanctuary Located in Brgy Lawigan and Brgy. Tinigbasan in Tubay.

Source: ECA Categories based on DAO 2003-30, Annex 2-1a.

Figure 2-3 Landslide Susceptibility Map and Flood Susceptibility Zones of the Project Area



Source: Mines and Geosciences Bureau

2.1.1.3. Impact in Existing Land tenure Issues

Tenurial instruments identified within the Tubay area are shown in **Figure 2-4** and include MPSA on mining projects, CBFMA and CADT based in the 2019 Tenurial Instruments Map from PENRO, Agusan del Norte.

Prior to the Project operation of the Agata Nickel Laterite Project (ANLP) a Memorandum of Agreement (MOA) was executed between the Company and the CBFMA holders, signifying temporary relinquishment of the overlapping areas to the Project operation. Compensation and assistance are provided to the Peoples Organizations for the continuous improvement of those CBFMA areas that remain unaffected by the mining operations. Moreover, reforestation activities of the aforementioned project were developed as Community-Based Forest Management Agreements (CBFMA) entered by DENR, and the local Peoples Organizations (PO); Tinigbasan Farmers and Fisherfolks Association (TIFFA) and Lawigan Farmers and Fisherfolks Association (LAFFA). Based from the Agata Nickel Laterite Project tenement map, approximately 490 hectares is covered by the agreement of which 70% of the area is for reforestation projects while the remaining 30% is allocated for Agroforestry. While under the Agata Limestone Project, approximately 50% of the resource area covered by the agreement with TIFFA to include the same reforestation and agroforestry projects.

The relinquished parcel will be returned to the CBFMA holders after the Project rehabilitation period is complete and the proponent will continue to comply with the conditions set forth in the MOA during the Project's expanded operations. Copies of the Memorandum of Agreements are included in the **Appendices.**

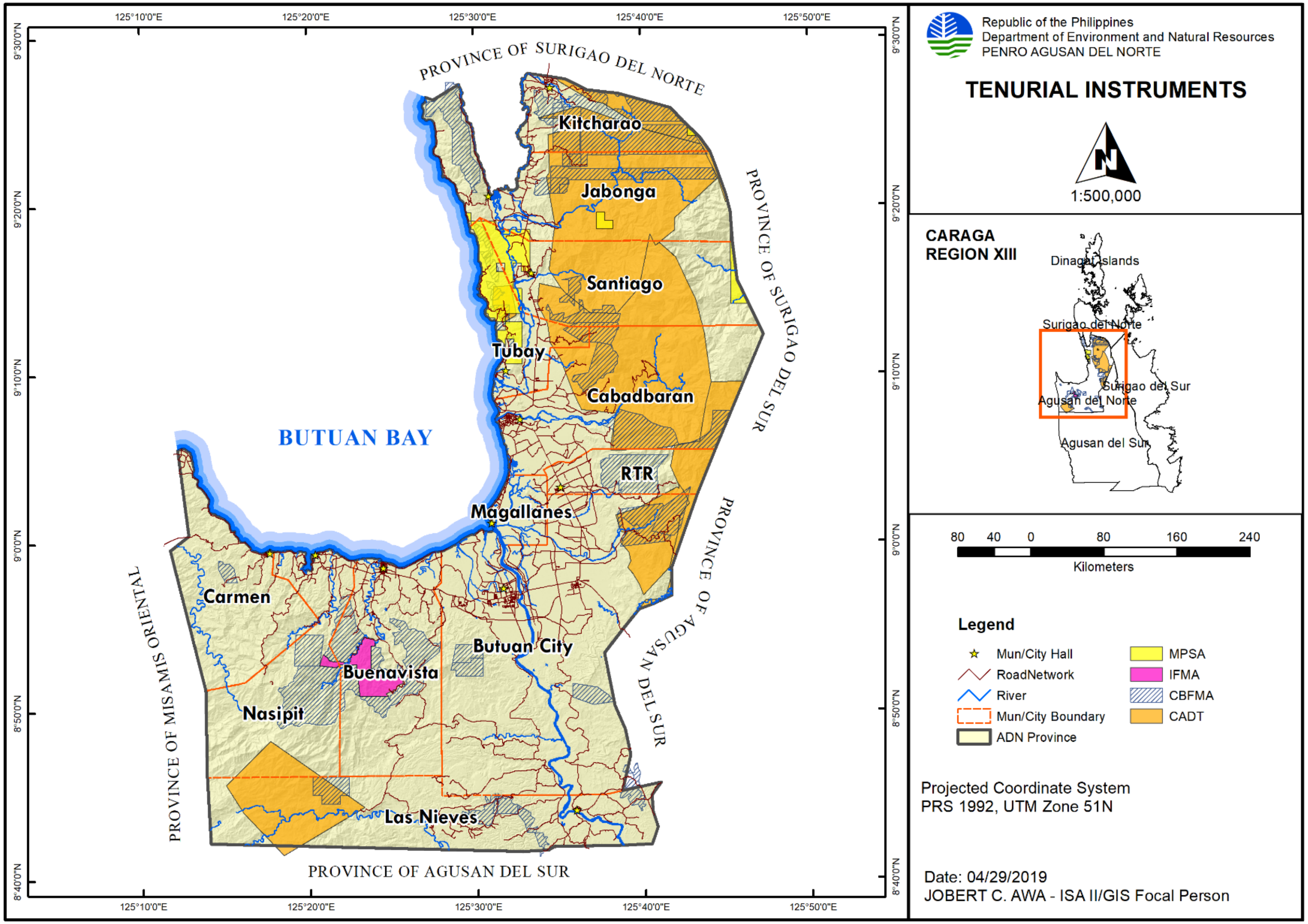
2.1.1.4. Impairment of Visual Aesthetics

The closest community settlements and dwellings to the project area are located within 1.3km - 1.9km north of the northern-most point of the proposed Agata Limestone Project. During preparation of the area for quarrying, earthmoving machinery and equipment would be visible and there is potential for dust proliferation along access roads and near operation sites.

Long-term visual impacts of the proposed mine would be addressed by progressive rehabilitation and establishment of buffer zones on the selected areas primarily along roads within the Project. Since the road network, port and other existing facilities from the Agata Nickel Laterite Project will be utilized for the Agata Limestone Project, areas with established vegetative buffer zones, enhancement planting will be conducted to improve air quality and minimize dust and improve visual aesthetics of the area.

To minimize disturbance, mining activities, including site clearing and excavation, is limited to those areas identified in the Mine Design for efficient resource extraction. Rehabilitation will be undertaken in areas that will be allotted as buffer zones or not open to mining. These denuded areas will be subjected to progressive rehabilitation or temporary rehabilitation following DAO 2018-19. The undertaking of reforestation programs aims to improve the visual aesthetics within the Project area. Extensive tree plantation and rehabilitation activities will be added to buffer zones to provide effective sight screens. This shall include access roads and open areas around the limestone mining operation which will be planted with fast growing trees to enhance the visual aesthetics and will serve as vegetation screens to mitigate or offset the visual impacts of the operations.

Figure 2-4 Tenurial Instruments Map



Source: DENR, PENRO Agusan del Norte (2019)

2.1.1.5. Devaluation of Land Value from Improper Waste Management

Under the Agata Nickel Laterite Project operation, approximately 81 kg per day of solid waste materials was collected. These consist of a combination of recyclable, biodegradable/compostable, and residual wastes. The composition of solid waste generated in Year 2019 is summarized in **Table 2-2**.

Table 2-2 Project Operations Solid Waste Generation

Domestic Waste Materials	Composition	Actual Volume
Total Biodegradable Waste (kg)	57%	16,893.57 kg
Total Residual Waste (kg)	5%	1,574.85 kg
Total Recyclable (kg)	37%	11,200.47 kg
Total Special Waste (kg)	1%	202.7 kg
TOTAL		29,871.59 kg

Source: ANLP Solid Waste Management, 2019

In compliance with RA 9003, an existing Solid Waste Management Program (SWMP) is already established and implemented in the ANLP operations. The implemented SWMP covers handling activities of generated solid wastes from collection up to disposal. Waste receptacles are provided site-wide, labelled following a unique, company-established labelling protocol so that wastes are segregated down to its specific material type.

The existing Materials Recovery Facility shall be utilized for the solid waste management activities of the Project. All waste generators on-site will be required to follow the “No Segregation, No Collection Policy”. Collection and segregation of wastes will be conducted daily and according to waste characterization: biodegradable wastes, recyclables, residuals, and hazardous/special wastes.

Collected waste are then utilized in different ways. Biodegradable wastes such as food wastes, paper and cartons will be used in compost generation in the vermicomposting facility for various nursery application, while other organic wastes such as collected yard wastes (wood, leaves, bamboo bollards) will be converted into biochar and charcoal briquettes. Recyclable wastes such as plastic materials, plastic/glass bottles, rubber wastes will be shredded for cement filling which is only used for minor concreting activities or disposed-off to accredited buyers/junkshops.

The same management scheme will be adopted and continued for the Agata Limestone Project. The expanded operation is not expected to result in a significant increase in domestic waste since the existing manpower and facilities will be used. It is however, anticipated that there will be a significant change in waste generation during the site clearing activities when the additional facilities for the ALP is developed. The vegetation waste and cuttings resulting from this activity will be used as feed stock for the Vermiculture facility and for progressive rehabilitation of previously disturbed areas.

2.1.2. Management and Monitoring Plan Relevant to Land Use

A summary of the management and monitoring plans relative to the potential impacts arising from land use impacts is provided in **Table 2-3.**

Table 2-3 Summary of Management Plan- Impacts to Land Use

Key Environmental Impact	Management Plan	Monitoring Plan
Impact with Compatibility with Existing Land Use	Limited disturbance to planned development.	Adherence to ECC conditions and Annual EPEP commitments.
Impact with Compatibility as Environmentally Critical Area	Topsoil segregation and storage.	Solid Waste Monitoring
Impact in Existing Land tenure Issues	Establishment of buffer zones.	MMT Quarterly Monitoring
Impairment of Visual Aesthetics	Enhancement planting and landscaping	
Devaluation of Land Value	Progressive rehabilitation activities.	
	Implementation of Solid Waste Management Program	

2.2. Geology and Geomorphology

2.2.1. Topography, Slope, and Elevation

The Municipality of Tubay, and the Province of Agusan Del Norte in general, is composed of flat and rolling lands. According to the Forest Land Use Plan (FLUP) of Tubay, areas with slope of 18% and above comprise 55.38% of the municipality's land area, including the western mountain ranges wherein the Project site is located.

The Project area is situated in a low lying and gently sloped topography. Elevations do not top 300 msl at northern part, while the southern part reaches 0 msl. The area has slopes of either gently sloping to undulating or rolling, to moderately steep. Given these topographical features, the area is not susceptible to landslides.

The topographic map, slope map, and elevation map of the Project site is shown on **Figure 2-5, Figure 2-6,** and **Figure 2-7**, respectively.

Figure 2-5- Topographic Map of the ALP Project Area

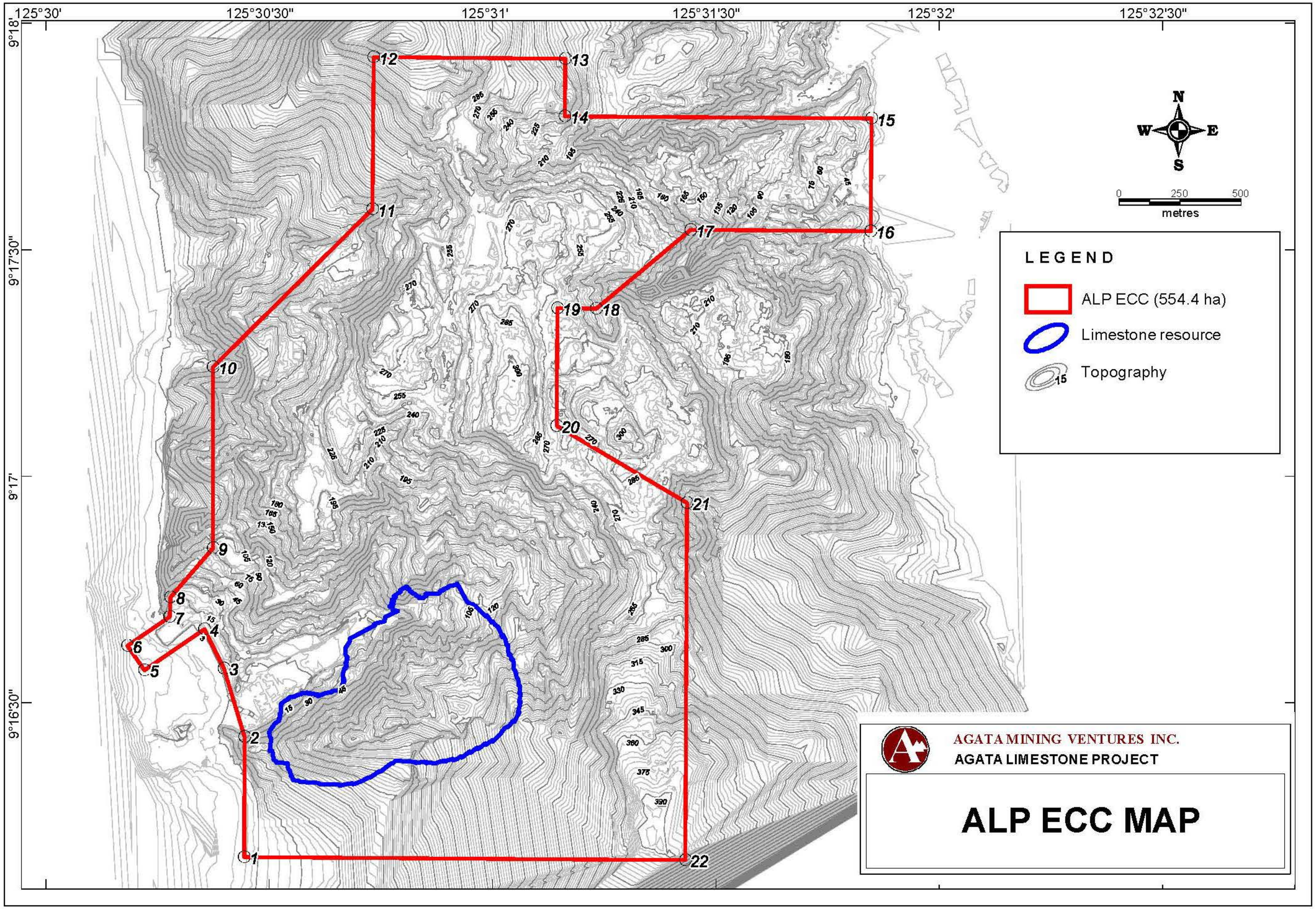


Figure 2-6- Slope Map of the Project Area (Regional View)

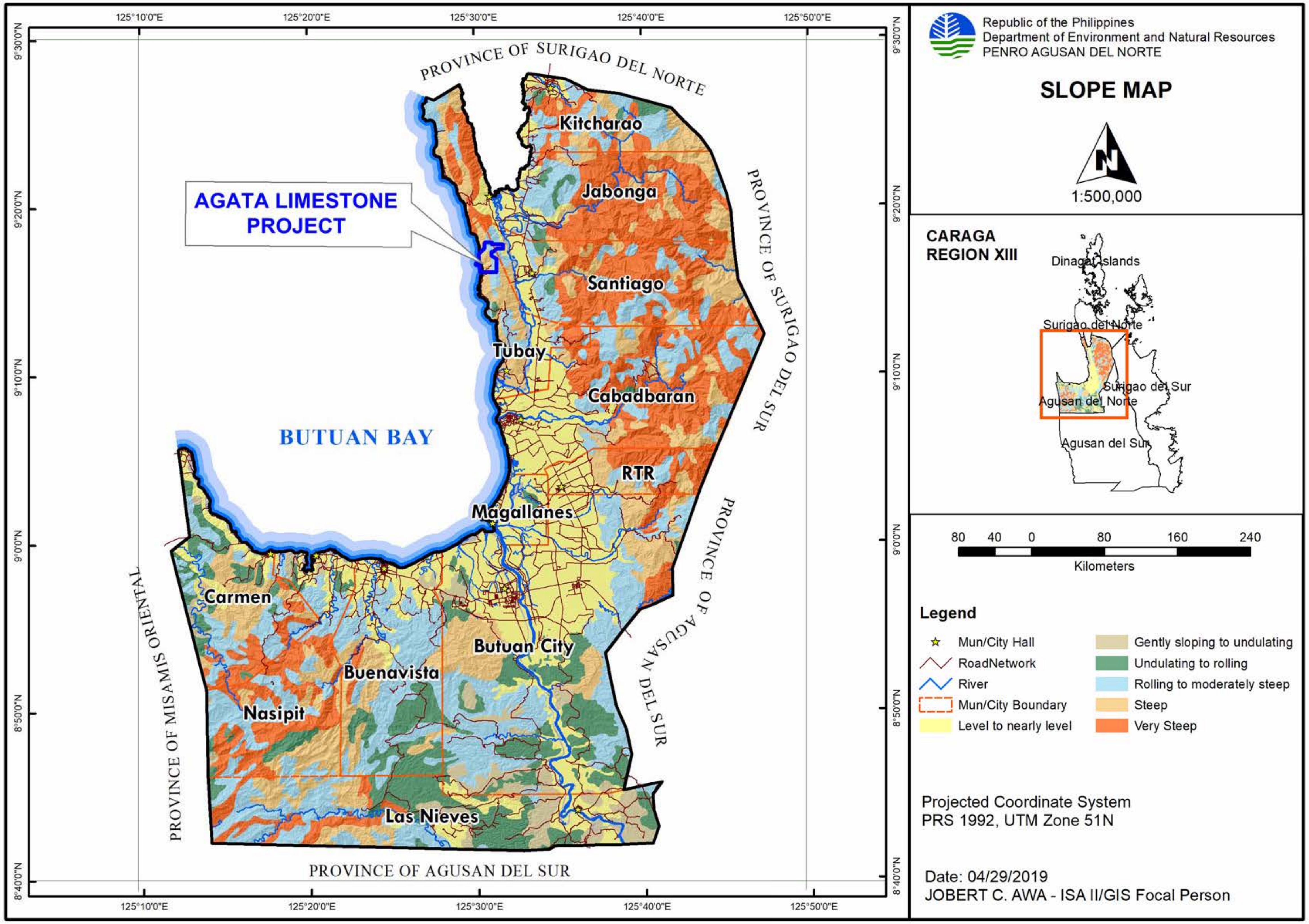


Figure 2-6- Slope Map of the Project Area (Local Map)

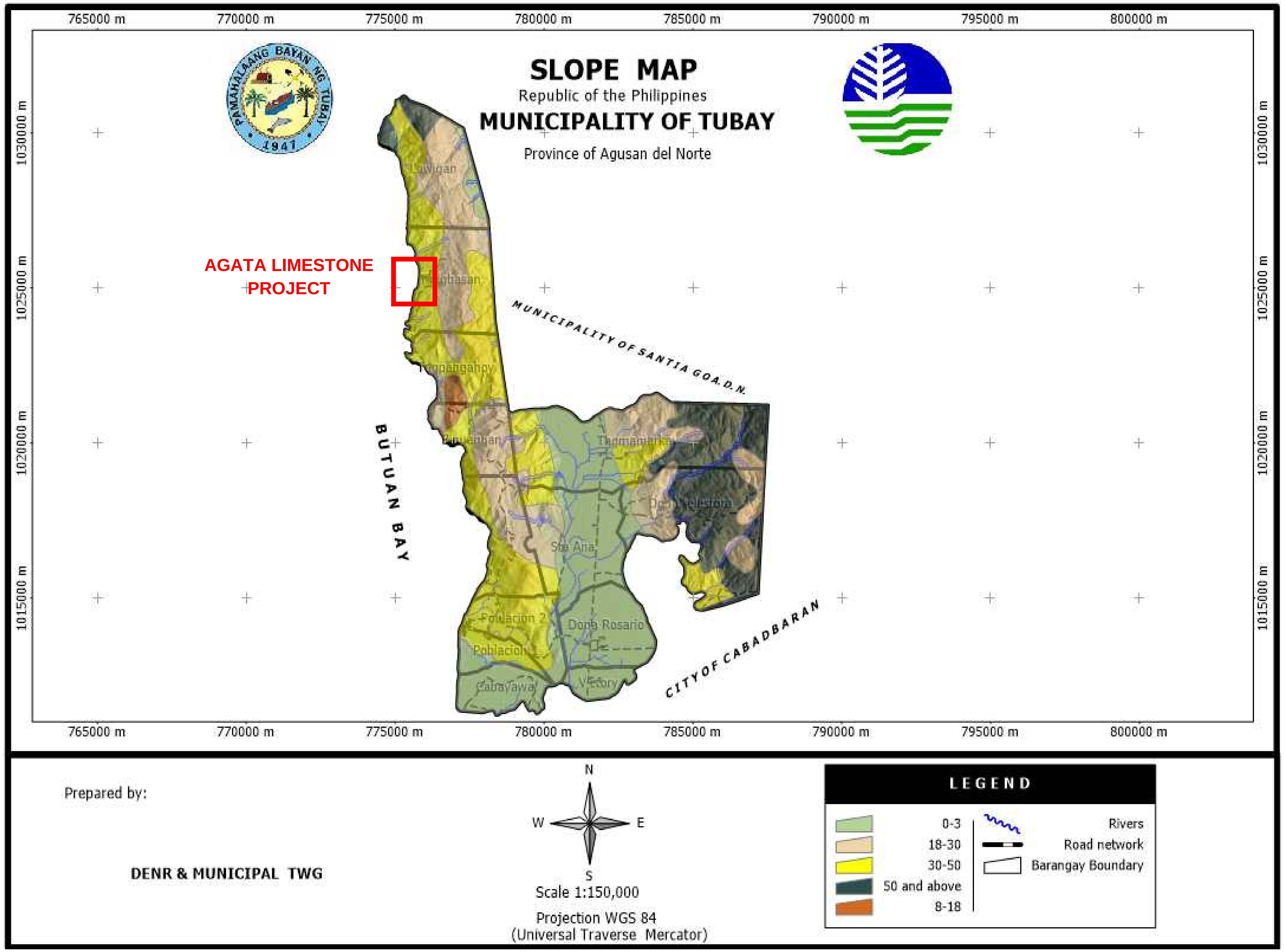
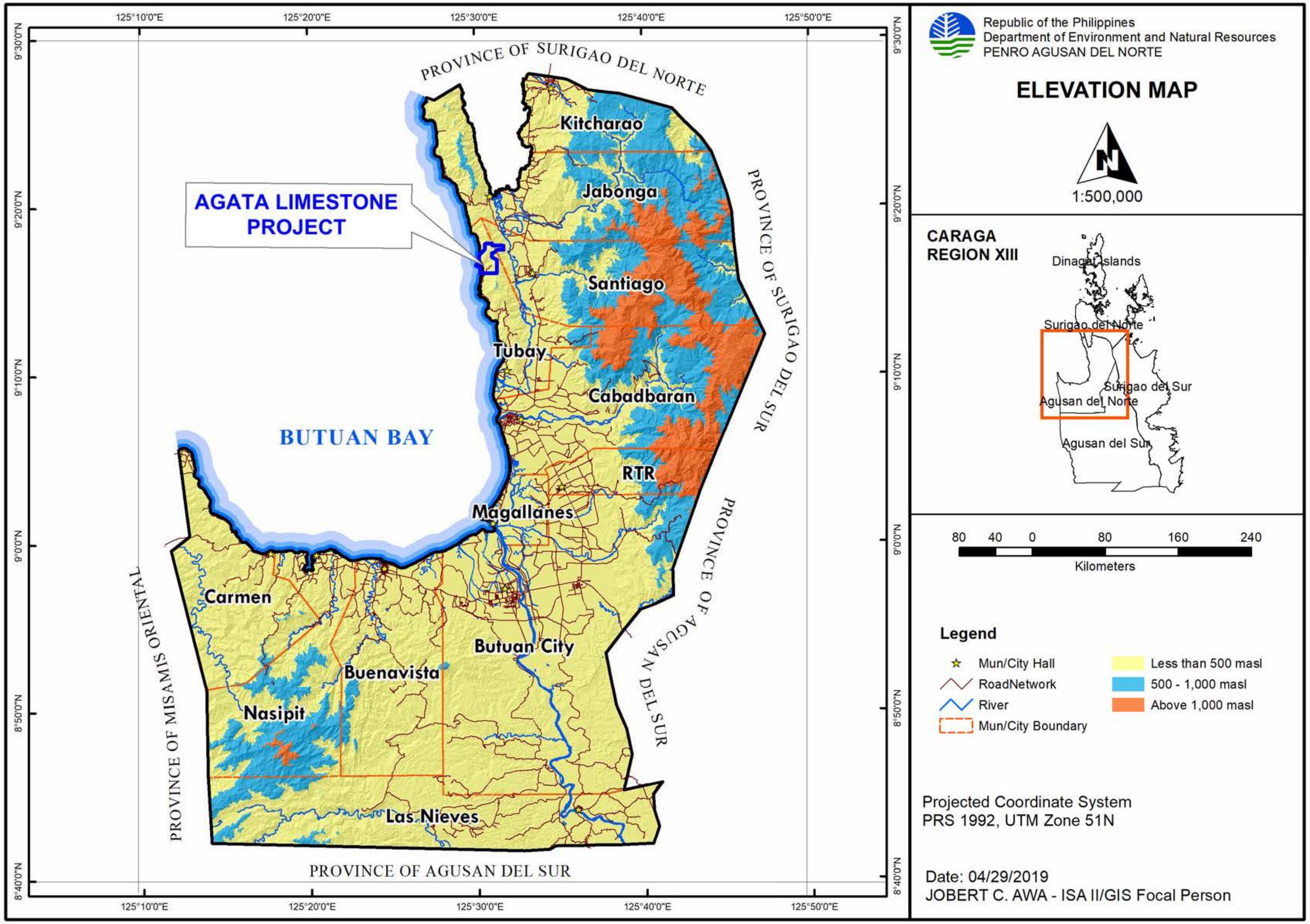


Figure 2-7-Elevation Map



2.2.1.1. Change in Surface Landform and Topography

The limestone deposit is compact and is situated in a single ridge located at Payongpayong area. This setting conveniently limits the excavated area within 52-hectares at most. The steep slopes at the Payongpayong ridge will be transformed into moderate, benched terrains that will be engineered to reduce susceptibility to landslides and erosions. The pre-mining condition of the limestone area, and the schematic landform change is shown in **Photo 2-1.**

Water runoff will be directed to the northwestern foot of the ridge thru a designed mine drainage system. Current nickel operation has settling ponds installed at the foot of the ridge. Additional settling ponds will be installed at the onset of the Agata Limestone Project.

The proposed crushing and screening sites are also being used as stockyard and access roads of the nickel project. Site will be levelled and compacted prior to construction.

Changes in landform, and its subsequent effects such as soil erosion and diversion of water discharge, will be mitigated by restoring disturbed areas to stable conditions while being used in operation and subjecting them to progressive rehabilitation activities as soon as possible. The progressive rehabilitation strategies will be done consistent with the post mining land use determined for the disturbed area.

Photo 2-1 Limestone Hill for Quarry Operations

2.2.2. Regional Geology and Stratigraphy

The interaction of three major lithospheric plates, namely the Pacific Plate, the Eurasian Plate and the Indo-Australian Plate, resulted in the development of the present-day tectonic features of the Southeast Asian Region including the Philippines.

The Philippines is one of the most active and most complex tectonic zones in the world. The archipelago, considered as the Philippine Mobile Belt (Rangin, 1991), is bounded by two major subduction zone systems – the Philippine Trench on the east and the Manila Trench on the west.

In the southern Philippines, the island of Mindanao is defined by the Philippine Trench on the east, the Cotabato Trench on the southwest and the Sulu-Negros Trench arc system on the northwest. Two main fault systems comprise the region – the Philippine Fault and the Mindanao Fault – including hundreds of fault splays and lineaments that crisscross the area.

The CARAGA Region in Mindanao straddles the eastern and central physiographic provinces of the Philippines. The eastern physiographic province is represented by the Diwata Range (Pacific Cordillera), while the central physiographic province is represented by the Agusan-Davao lowlands (Basin). Both physiographic features trend north to south and are regionally demarcated by the Philippine Fault Zone which also segments the Diwata Range in the Lianga, Surigao del Sur area.

The Diwata Range is rugged and has several peaks with elevations ranging from 900 m to 2,500 m. The western side of the range borders the eastern side of the Agusan-Davao Basin which has steep slopes. The eastern flank slopes steeply into the Philippine Trench. The eastern coastline is very irregular with high promontories between bays, wide estuaries, relic channels and stream valleys. On the other hand, the Agusan-Davao lowland is a 100 km by 45 km north to south structural valley between

the Diwata Range and the Mindanao Central Cordillera (MGB, 1982). It is generally flat and poorly drained with western hills merging with the Central Cordillera. Agusan River, one of the longest in the Philippines, drains the northern part of the basin and empties into Butuan Bay.

The southwestern part of the Northern Diwata Range is underlain by a Cretaceous basement, a Palaeogene plutonic-volcanic complex followed by a sequence of Neogene sedimentary formations and Quaternary Volcanics.

The basement rocks consist of the Concepcion Greenschist (UNDP, 1984) and metamorphic rocks of Cretaceous age. The rocks are overthrusted by the Cretaceous to Palaeogene pillowed Pangulanganan Basalts which in turn are overthrusted by the Humandum Ultramafics. Its emplacement probably occurred during the late Cretaceous.

The Humandum Serpentinites (Rohrlach, 2005) unconformably overlies the basement schists and forms as conspicuously peneplaned elevated ground. The ultramafic rocks consist of the serpentinized peridotites, pyroxenites, serpentinized harzburgites, and dunite, which are fractured and crossed-cut by fine networks of talc, magnesite and/or calcite veins. The rock was interpreted by UNDP (1984) to be emplaced over the Concepcion greenschists probably before the Oligocene, and before late Eocene deposition of the Nabanog Formation. MGB (2002) classified the Humandum Serpentinite as a dismembered part of the Dinagat Ophiolite Complex, which is established to be of Cretaceous age.

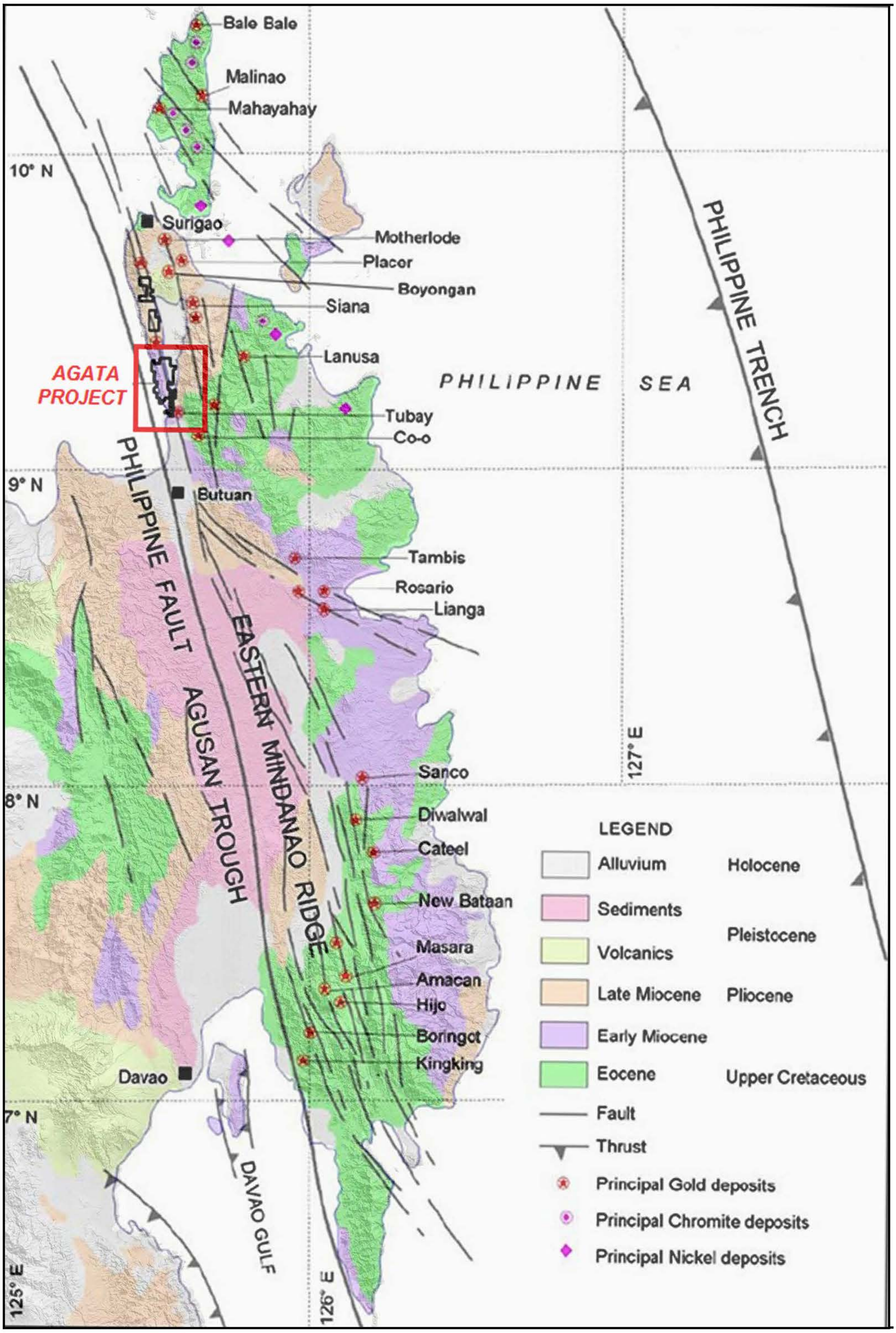
Overlying the Humandum Ultramafics is the Upper Eocene interbedded limestone and terrigenous clastic sediments of the Nabanog Formation. These are in turn overlain by a mixed volcano-sedimentary package of the Oligocene Nagtal-o Formation which comprises conglomerate, wacke with

lesser pillow basalt and hornblende andesite, and the Lower Miocene Tigbauan Formation. The latter is comprised of conglomerates, amygdaloidal basalts, wackes and limestone. Lower Miocene Kitcharao Limestone and the lower part of the Jagupit Formation overlie the Tigbauan Formation. The Jagupit Formation consists of conglomeratic sandstone, mudstone and minor limestone. Quaternary deposits consist of loosely consolidated fluvial, lacustrine, paludal and coastal deposits.

The widespread occurrence of harzburgite, peridotite, pyroxenite, their serpentinized equivalents, serpentinite, and localized lenses of dunite/serpentinized dunite comprise the lithology in the Project area. These rocks are confined to broad ridges extending down to the footslopes of the Western Range. The ultramafic bodies are of probable late Cretaceous age, and were emplaced as part of an ophiolite sequence during the Upper Eocene (Abrasaldo, 1999). Schists are also present in the extremities of the laterite area. Several of these rock types were likewise identified in petrographic/mineragraphic analyses of drill core and rock samples as wehrlite (peridotite), serpentinized wehrlite, serpentinized websterites (pyroxenite), websterites, serpentinites and cataclasite. Lineaments trending NE within the ultramafic (and underlying green schist) are interpreted as either fault splays or zones of weakness in the area.

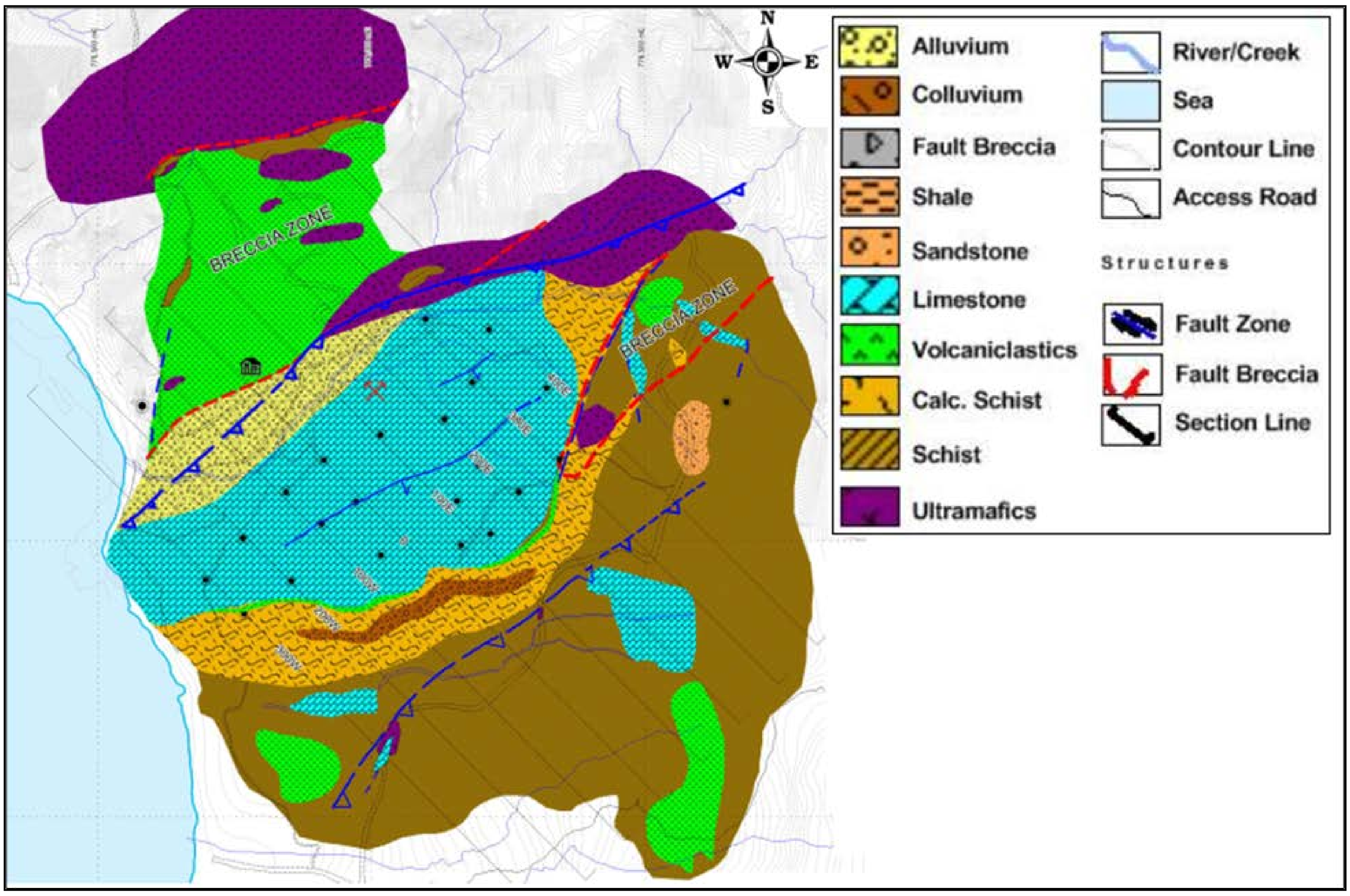
A regional geologic map of Eastern Mindanao, with major mineral deposits and faults is provided on **Figure 2-8.** A more localized Geologic Map is shown on **Figure 2-9,** while a stratigraphic column of the MPSA is on **Figure 2-10.**

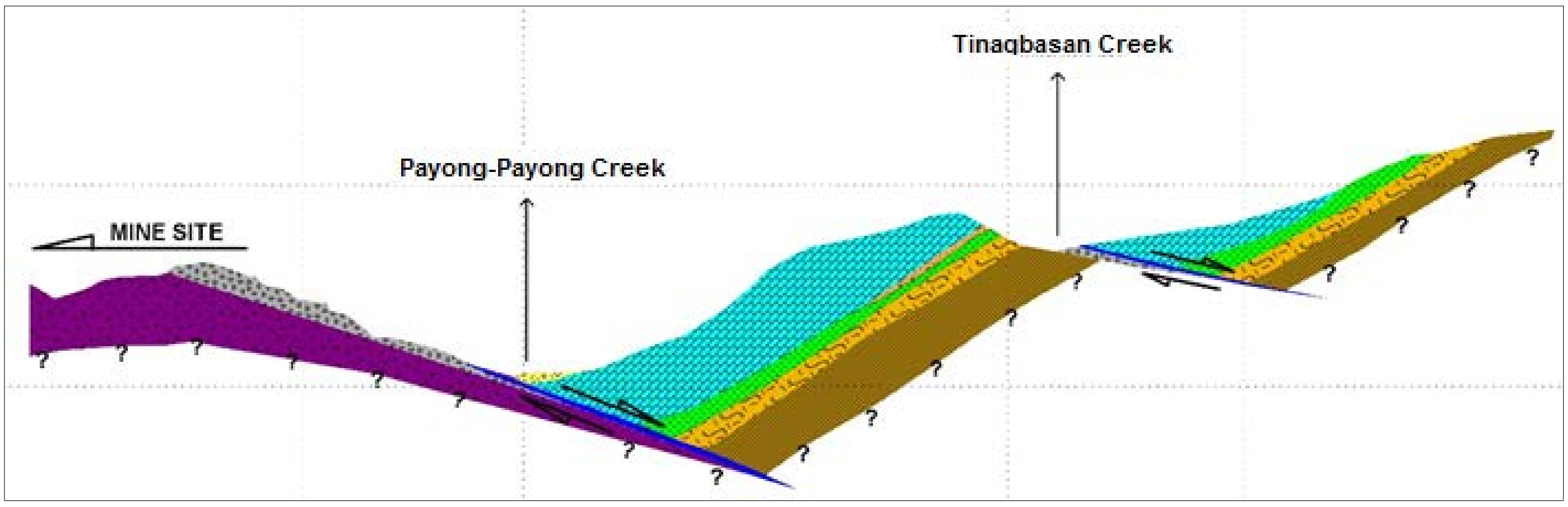
Figure 2-8 Regional Geology Map



Source: MRL Gold Philippines (2012)

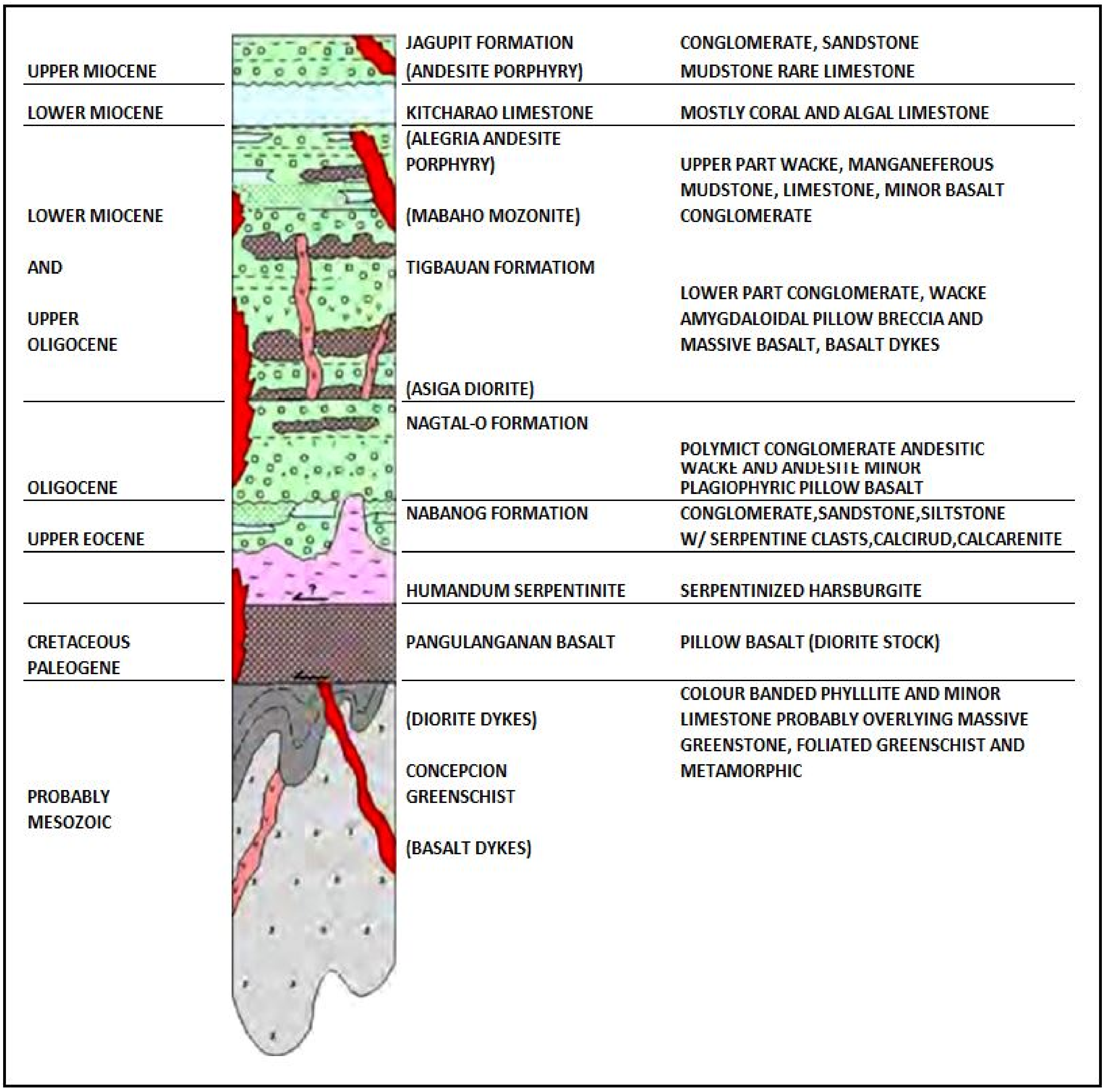
Figure 2-9 Local Geologic Map





Source: API (2017)

Figure 2-10 Stratigraphic Column of the Agata MPSA



Source: Adopted from UNDP (1984) and UNDP (1987)

2.2.3. Local Geology

The Project site is largely underlain by the Cretaceous basement rocks of the Humandum Serpentinite and the Concepcion Greenschist. The former, believed to be a dismembered part of the Dinagat Ophiolite, is found in thrust contact with the latter and other metamorphic rocks. Humandum Serpentinite rocks include peridotite, pyroxenite, dunite, serpentinite and minor distribution of gabbro. On the other hand, Concepcion Greenschist is an interbedded metasedimentary and metavolcanic sequence. Within the metasedimentary succession are calcareous layers where the recrystallized limestone deposit is located.

Low grade metamorphism developed coarse calcite crystals that occur as veinlets, fracture filling and replacement. The crystalline limestone is white to buff color; massive to bedded generally striking N60°E and dipping 32NW; less often exhibit gray bands, laminations and foliations cut by recrystallized calcite stringers; jointed; weakly weathered; and weakly oxidized. It covers an area of roughly 32 hectares with an average thickness of 53.28m. Minor schist and calc-schist rocks are also intercalated as irregular lenses within the bedding contact of the massive crystalline limestone layers.

<u>Mineralization</u>

Besides intercalated lenses, schist and calc-schist rocks also occur as layers interbedded in the crystalline limestone and andesitic volcaniclastic beds. Schist represents the upper layer of the formation while calc-schist and volcaniclastic are identified as the lower member.

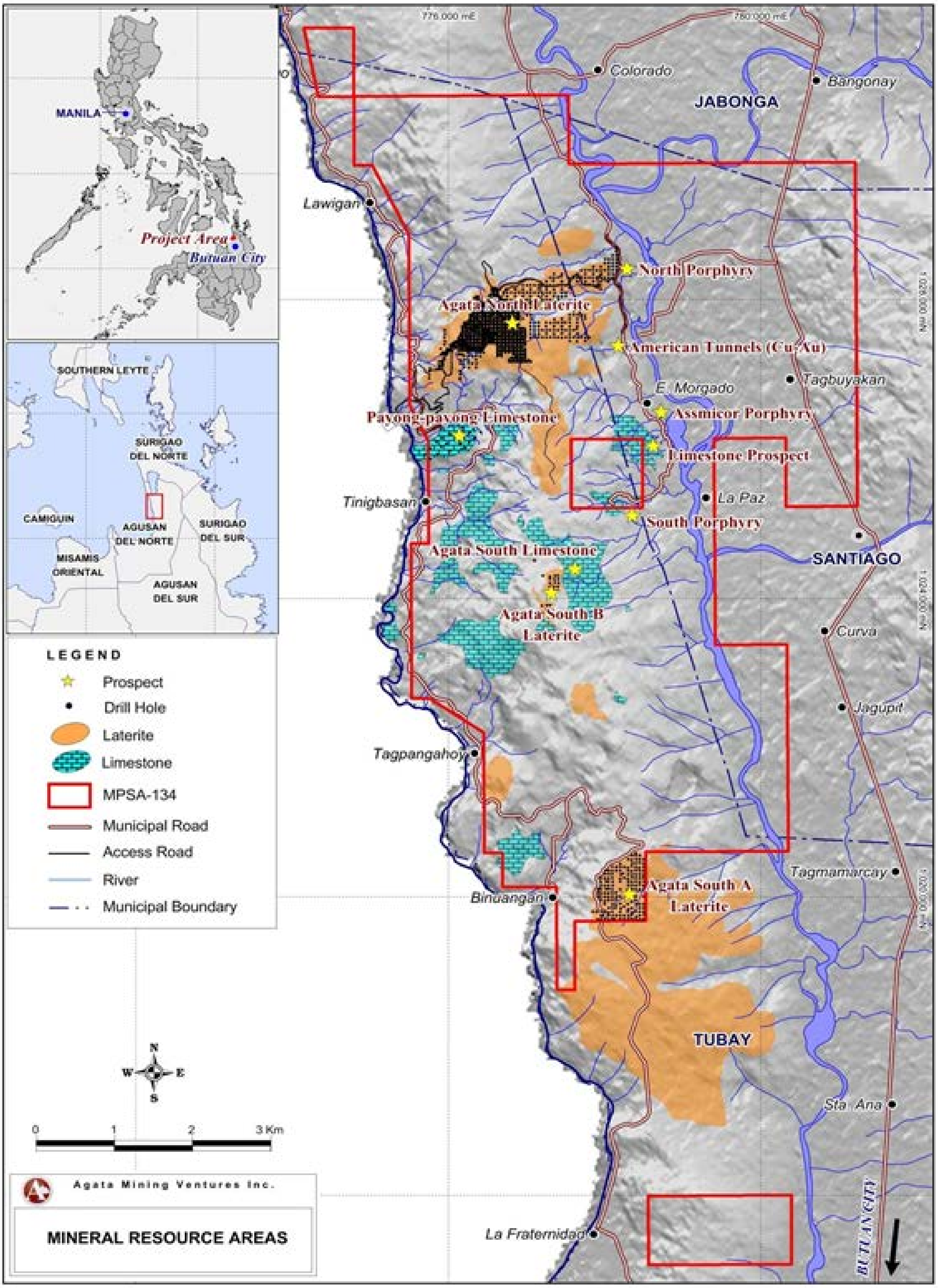
There are several styles of mineralization that occur on the Agata property. These include Au oxide mineralization in saprolite that is developed over shallowly-buried intrusions, Cu and Au mineralization associated with quartz veinlet and pyritic stockworks along the margins of monzonitic to dioritic plutons, Au associated with horizons of disseminated pyrite in sooty carbonaceous limestones, and nickel mineralization generated by surficial zones of nickel enrichment in laterites that are developed on ultramafic protoliths. A map of the mineral prospects within the MPSA is shown on **Figure 2-11.**

The Limestone Prospect area comprises an area of variably altered and mineralized limestone which lies to the south and west of the Assmicor Prospect. The limestones form part of the overlying roof rocks that are inferred to be intruded by monzonites and monzodiorites that are equivalent to those present at the Assmicor Prospect. Gold mineralization occurs in Fe-stained carbonates (sideritic) associated with disseminated pyrite and local brittle fracturing (Climie *et al*. 2000). The zones of Au mineralization intersected by drilling appear to be strata bound zones of mineralization that are characterized by elevated abundances of pyrite and locally by carbonates that are rich in organic material. The observed style of mineralization, comprising very fine grained and strata bound Au in organic rich calcareous rocks, is anomalous in arsenic, and has similarities to Carlin-type mineralization.

2.2.3.1. Change in Subsurface Geology

Quarry activities of the Project shall not involve deep subsurface or underground works. Excavation activities to mine the underlying limestone deposit will range from +170m to 0m MSL. To achieve good slope stability, bench forming shall extend to the shale and sandstone around the limestone deposit. Settling ponds that will be constructed at the alluvial plane will be about 5 meters deep. The excavated materials will be temporarily dumped at the stockpile areas and will be used for road and stockyard maintenance.

Figure 2-11 Mineral Prospects within the MPSA Area



Source: ANLP Exploration Report (2015)

2.2.4. Geologic Hazard Assessment

Geologic hazard assessments for the Project area focused on six risk categories; tectonic characteristics, regional seismicity, fault ruptures, liquefaction potential, landslides and flood hazards. Due to the location of the project area within a seismically active area, the risks associated with potential earth movement are the highest and of most concern. Discussions of each of the six risk categories are provided below.

A. Tectonic Setting

The Project area is located within a seismically active region characterized by the close proximity of the Philippine Fault Zone. Consequently, the northern Mindanao region, including the Agusan and Surigao Provinces is susceptible to earthquake generated by the Philippine Trench and its related subduction zone structures, and by the Philippine Fault System and its associated structures. The western traces of the Lake Mainit Fault bound the eastern side of Malimono Ridge, making the area prone to strike-slip earthquakes. A regional tectonic map showing these structures is provided on **Figure 2-12.**

The Philippine Trench is considered the most seismically active subduction zone in the Philippines. It is a north-south trending depression located east of Mindanao and the Visayas. The trench marks the boundary of the westward-subducting Philippine Sea Plate as it thrusts under the Philippine Mobile Belt. The trace of the fault has been mapped from Davao, in Mindanao to as far north as the East Luzon Trough.

The Philippine Fault system is a north- and northwest-trending fault system whose branches have been mapped for 1,200 km from the eastern part of Mindanao to northern Luzon. This fault is the largest active structural element with seismic activity and is considered to be the most destructive in the Country. Its trace passes through Davao, through Agusan and near the Malimono Ridge, through Leyte and Masbate, then through Ragay Gulf and Alabat Island and then into north Luzon. At its closest approach, the fault is approximately 2 km east of the Project area.

Slip along the Philippine Fault Zone is left lateral causing the land on the east and northeast to move to the north and northwest. Large historic earthquakes have been clearly associated with this fault. The most recent events were the 1973 Ragay Gulf earthquake and the 1990 Luzon earthquake.

B. Regional Seismicity

In the northern portion of eastern Mindanao, historical accounts show that offshore areas east of Mindanao have been subjected to intense seismic activities with hundreds of small to large magnitude earthquakes. Many of these seismic events are linked to the active subduction of the Philippine Trench that impinges against the overlying crust of the Philippine archipelago. Most of the major inland earthquakes occurred along the southern segment of the Philippine Fault Zone. The majority of these fault-related events cluster within the Agusan Valley. A regional seismicity map showing the spatial distribution of seismicity in the eastern portion of Philippine archipelago with Magnitudes 2 to 9 from 1907 to 1998 is shown on **Figure 2-13.**

The area around Malimono Ridge and the whole Agusan Valley has been host to a number of destructive earthquakes in the past. The proximity of the Philippine Fault to within a 2 km distance from the Project area presents a risk of a potentially large magnitude earthquake occurring in the future.

Figure 2-12- Regional Tectonic Map

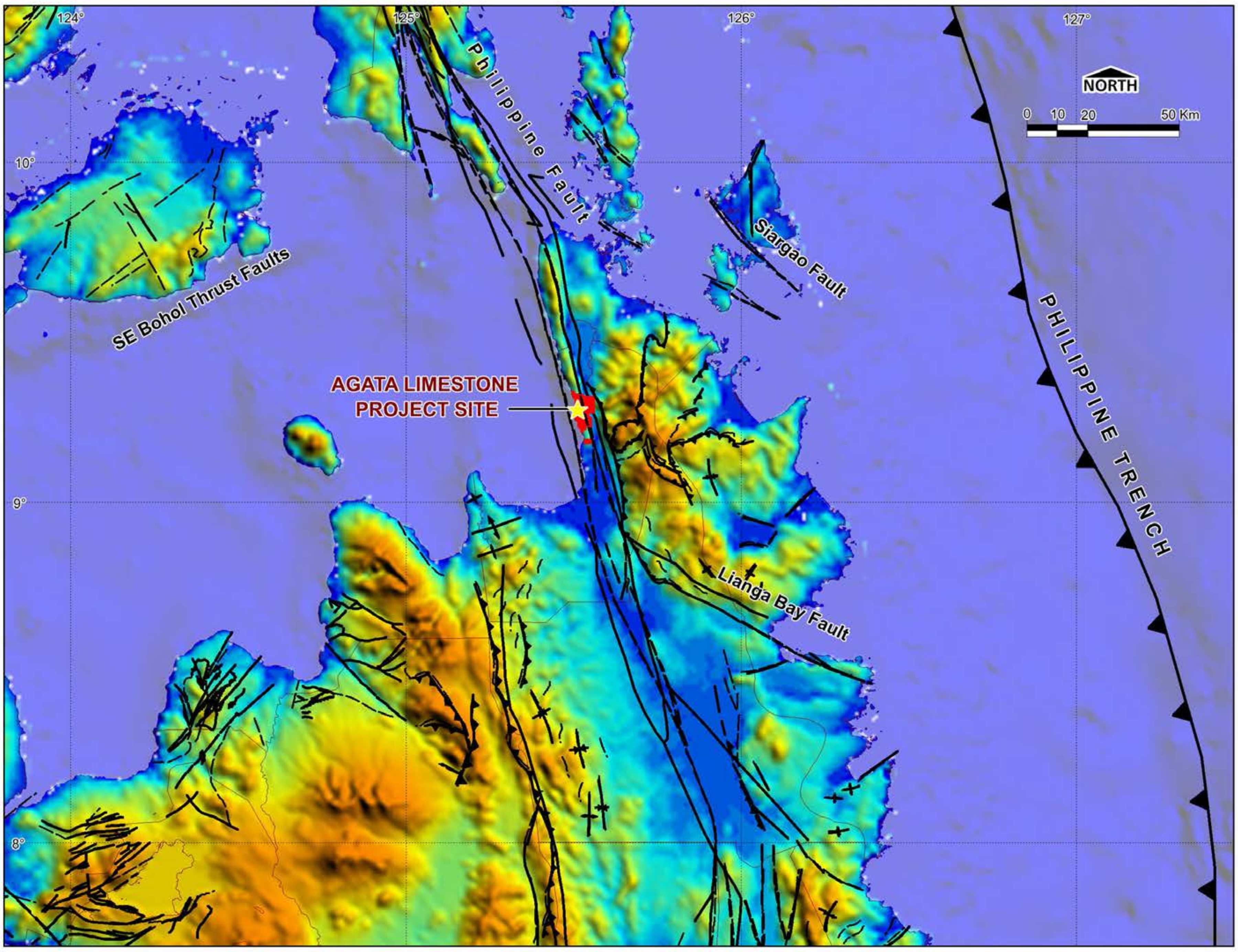
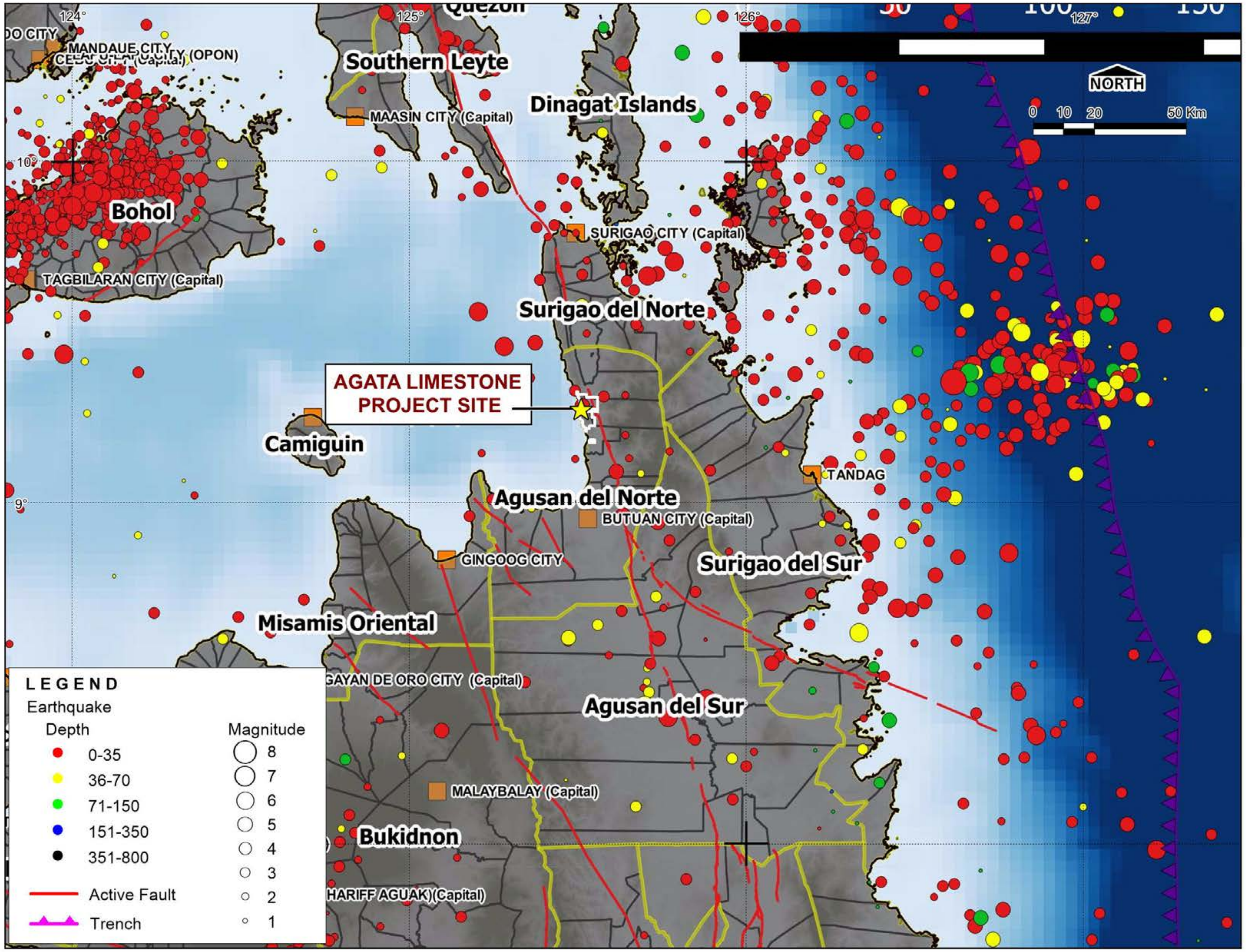


Figure 2-13- Regional Seismicity Map



Source: Philvocs (2014)

The Philippine Trench is another source of earthquakes that would likely affect offshore Mindanao. When the epicenters move inland, these earthquakes tend to be of deeper hypo central depths due to the inclination of the subduction zone.

C. Liquefaction Hazard

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. Liquefaction and related phenomena have been responsible for tremendous amounts of damage in historical earthquakes around the world.

Liquefaction occurs in saturated soils, that is, soils in which the space between individual particles is filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other.

Those areas subject to liquefaction hazards are located within the alluvial deposits and floodplain areas found in the valley, east of Malimono Ridge. Liquefaction hazards can be prevented by applying the appropriate type of structure foundation, depending on the soil materials in the construction areas. Artificial fill should be sufficiently compacted prior to construction of structures. These factors are considered in the construction of mine facilities. A liquefaction susceptibility map is provided on **Figure 2-14.**

D. Fault Rupture Hazard

The rupture hazard may arise during large earthquakes, with the ground being displaced along the fault that causes the seismic event. The hazard of rupture therefore is centered, expected along the trace of the active fault. In the case of the Project area, this hazard can be sited on the trace of the Philippine Fault along the western edge of the valley located east of the Project site, as shown in the Active Faults Map for Jagupit quadrant in **Figure 2-15.**

E. Landslide Hazard

Landslides that may accompany intense seismic shaking can potentially occur along steep slopes, particularly in areas where thick soil or deposits of loose rocks may be present. This threat may also be present during intense rainfall events, when the soil is saturated with water, and when pore pressures from water percolating into the ground may render some areas unstable. Geohazard evaluations are important for those areas that may be subject to landslides with attendant property loss or infrastructure damage.

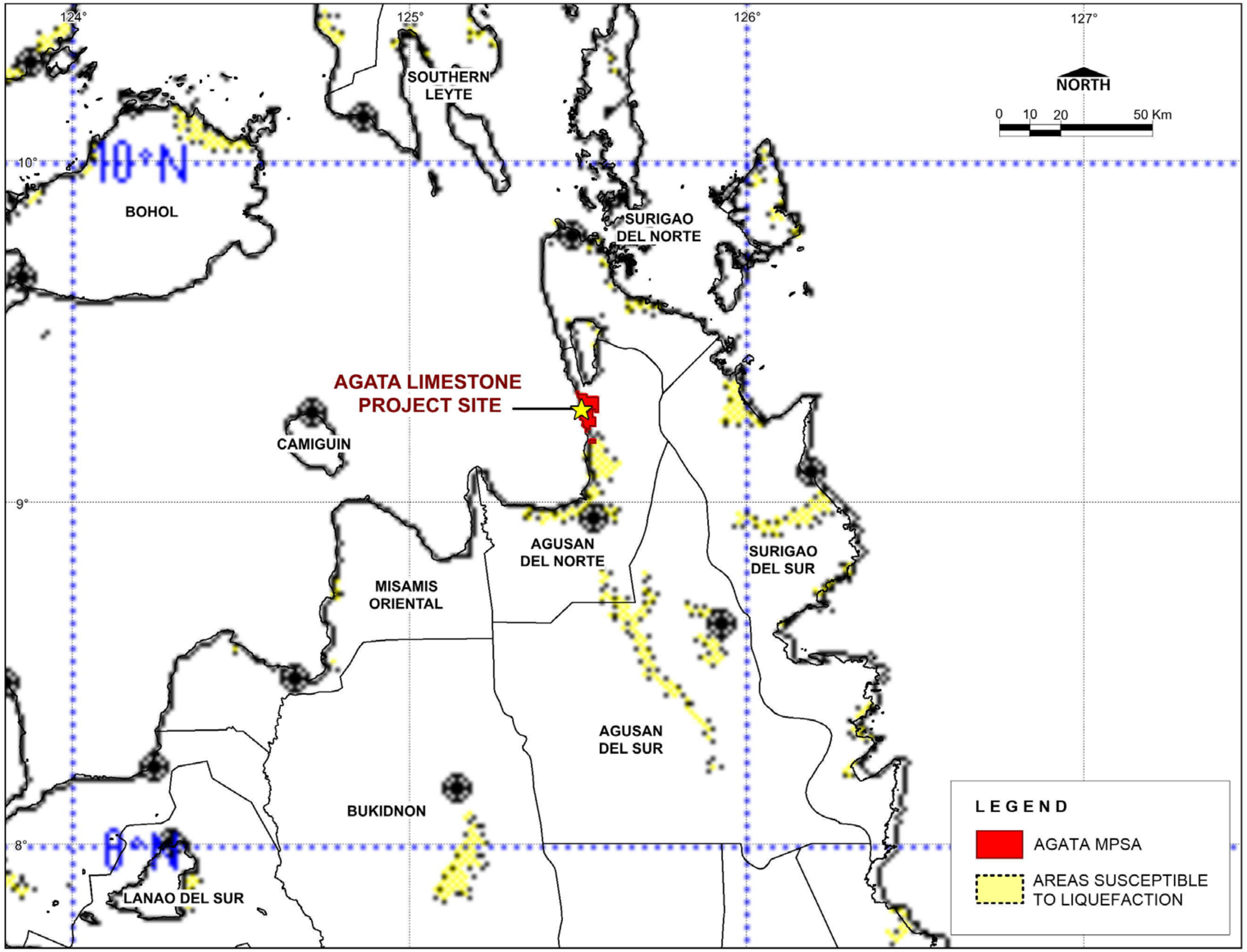
Based on the landslide and flood assessment done by the Mines and Geosciences Bureau (MGB) on November 2014, Sitio Payong-payong, to which the project is situated, is observed to have mass movements such as landslides and tension cracks. Ground slopes within the Project area range from flat to greater than 50%. Based on the earthquake triggered landslide map shown on **Figure 2-16,** the Project site is moderate to highly susceptible to landslides. Several areas were identified as susceptible to landslides and were subject to geohazard studies during the Project development stage.

Slope stability will be of primary consideration in the design parameters set for the surface mine. Mine benching to be employed during the operations will eliminate very steep slope cuts and will increase the stability of the mine area. Daily monitoring for signs of instability will also allow for immediate repairs and provision of additional enforcement to provide slope stability.

Other slope stabilization measures to be employed will include placement of coco nets and gabion baskets, and establishment of vegetation along slopes to minimize erosion and landslide incidents. Proper slope drainage system will also be established to facilitate continuous flow of water down slope, without eroding the soil materials.

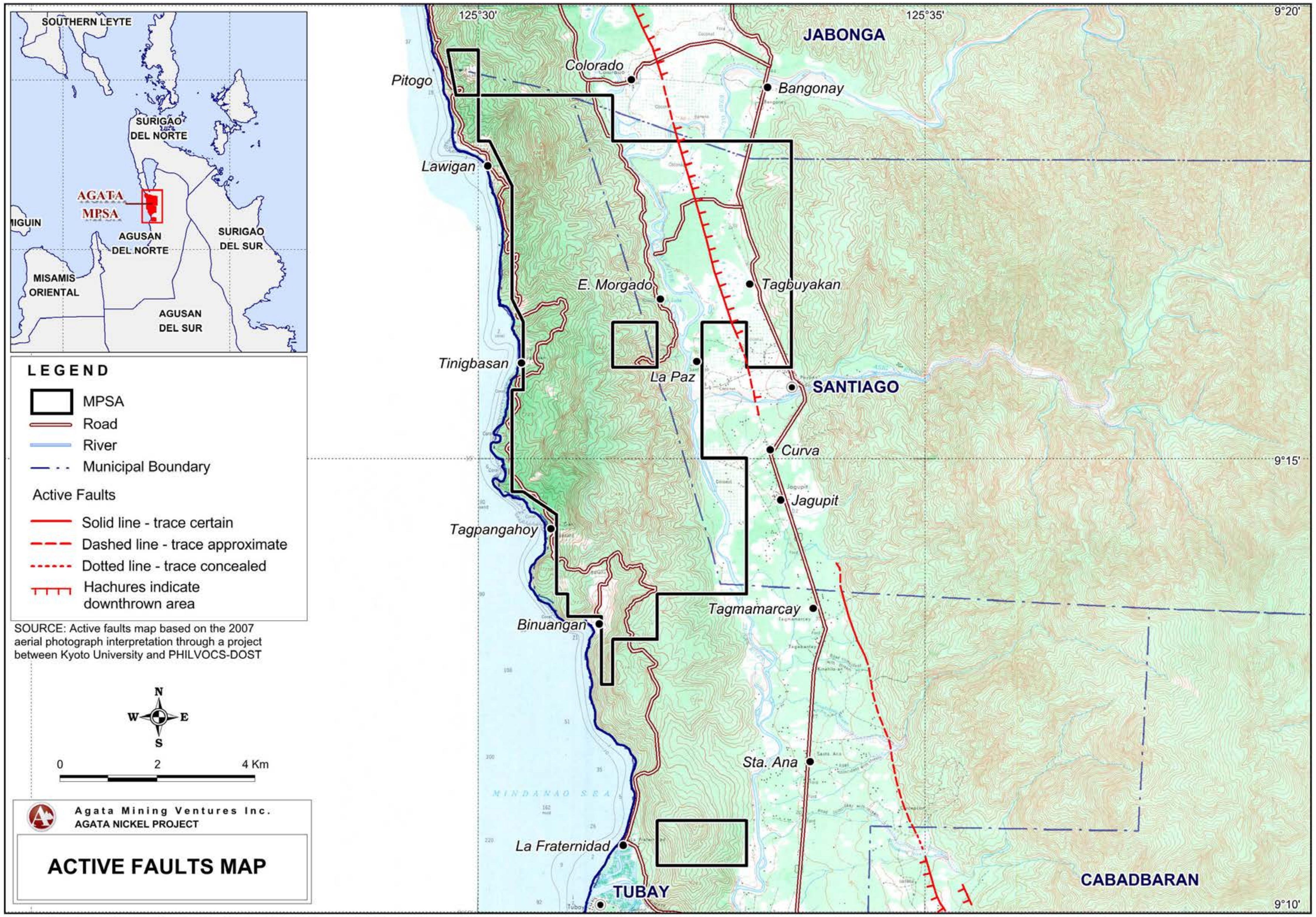
The coastlines of Sitio Payong-payong were also mapped to be prone to storm surges. Settlement along the coastlines is recommended to be regulated. Pre-emptive evacuation shall be done in advent of strong typhoons. Evacuation sites will have to be established.

Figure 2-14- Liquefaction Susceptibility Map



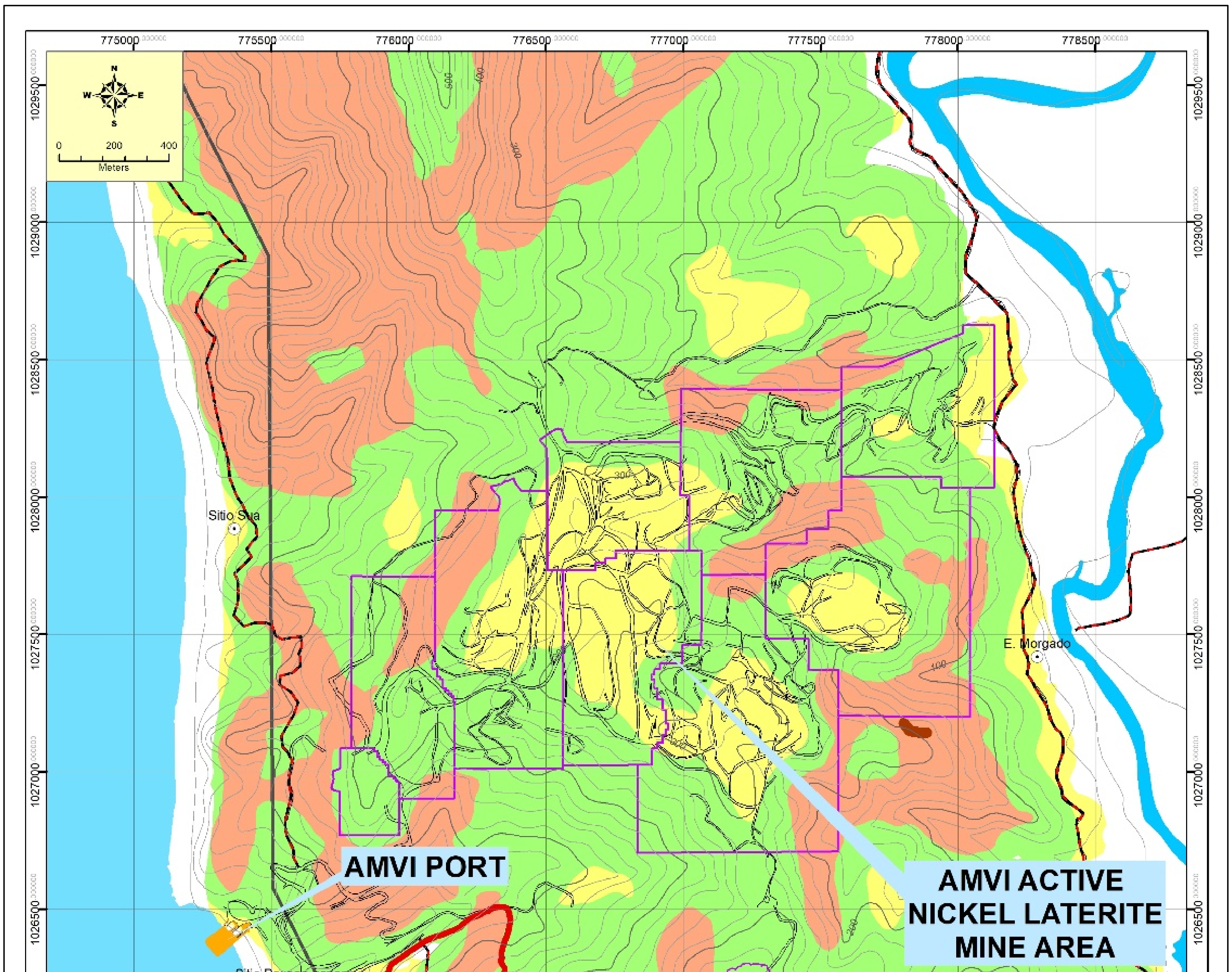
Source: Philvocs

Figure 2-15 Active Faults Map (MGB, Jagupit Quadrant)



Source: Kyoto University and Philvocs- DOST (2007)

Figure 2-16- Landslide Susceptibility Map and Flood Susceptibility Zones of the Project Area



Source: PPDO, Agusan del Norte

F. Flood Hazard

The active Project area is not considered a flood prone area according to the Mines and Geosciences Bureau's Geohazard Map of Agusan Del Norte as shown in **Figure 2-17.** During high rainfall periods, Lake Mainit water levels may increase by as much as 1 to 3 m (Tumanda et al., 2004). Also, it is observed that watermarks on the rocks along the coast are as high as 2.2 m above the normal water surface elevation. Flood susceptibility zones for the MPSA area also shown on **Figure 2-17.**

The alluvial plains along big rivers including the Tubay River are frequently affected by seasonal flooding. This is attributed mainly to the low physiography of river, its inability to accommodate high flood discharge, and the poor vegetative cover of the headwater. Flash floods usually occur during heavy rainfall from November to February. Most areas near the waterways have been identified to be flood prone. Among the areas with highest susceptibility to flooding are the impact municipalities of the Project, Jabonga, Santiago, Tubay. Historical records of the Provincial DRMMC showed that the Province experienced heavy floods in 1956, 1962, 1966, 1974, 1975, 1980, and 1981. The last two flood events incurred damages in the Province estimated at Php 57 million. In the last 10 years, 3 major typhoon induced flood events were recorded, reaching up to waist level flood water level in some low-lying areas and have resulted certain roads to be inaccessible. Damages in agriculture and infrastructure were also experienced.

In year 2011, despite the absence of typhoon, continuous rainfall resulted to the highest flood level recorded. As roads became impassable, rubber boats became the primary transportation. Typhoon Agaton in Year 2014 also brought high volume of rainfall which isolated the upstream municipality of Las Nieves in the southern part of the Province. This is the first flood event to submerge an entire barangay in flood water. The Typhoon Seniang, on the same year, resulted to flooding that submerged rice fields and destroyed footbridges.

G. Climate Change

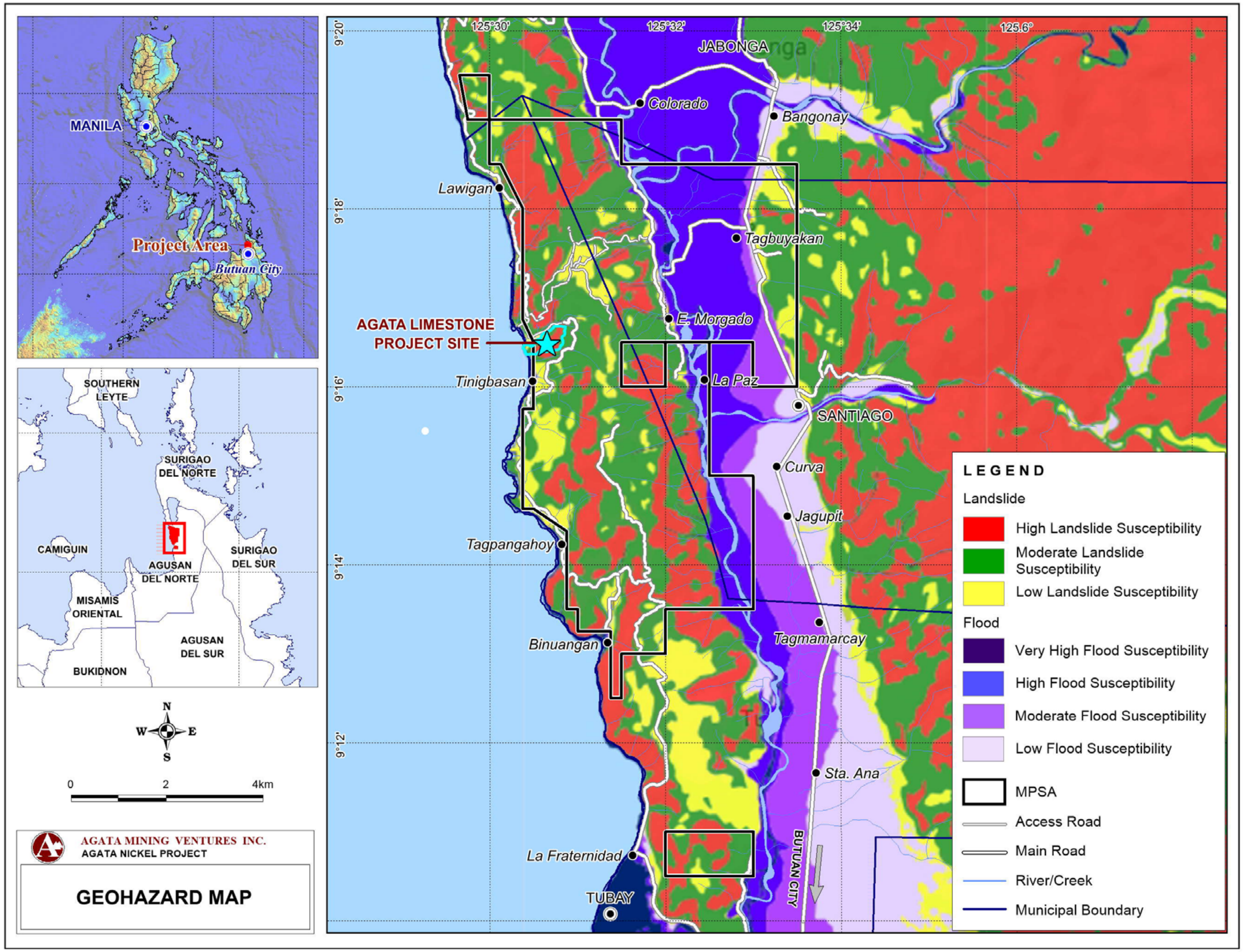
Based on the latest PAGASA Report on the Observed Climate Trends and Projected Climate Change in the Philippines, the province of Agusan del Norte is projected to have a net decrease in rainfall and net increase in temperature. This projection is based on a moderate emission scenario and will cover the period of Year 2036-2065. The temperature and rainfall projections for the province is shown in **Table 2-4.**

Table 2-4 Projected Climate Trends for Year 2036-2065 in Agusan del Norte Province

DJF		MAN		JJA		SON	
Projected Rainfall Changes							
% change	mm	% change	mm	% change	mm	% change	mm
-9.8	790.2	-14.2	379.4	-11.4	407.3	-21.2	495.5
Projected Temperature Changes							
% change	ºC	% change	ºC	% change	ºC	% change	ºC
1.2	27.4	1.3	28.9	1.2	29	1.2	28.6

Note: Median Values for Moderate Emission Scenario; Source: PAGASA, 2018

Figure 2-17- Geohazard Map of Agusan Del Norte



Source: Mines and Geosciences Bureau

A more quantitative discussion is provided in **Section 2.10.1.1**. Given that the project area will be receiving less rainfall, both the flooding and landslide hazards in the mine site will be even less. In mining where activities are contingent to weather condition, drier season is more preferred because it will allow continuous mining, processing, and loading activities. Given the heavy land disturbance from mining activities and the stockpiling of large volumes of loose materials, siltation from stormwater run-off is common. Less rainfall can somehow lessen the erosion and siltation. Nevertheless, water management facilities will be in place to manage stormwater run-off. Capacities will be computed based on the maximum expected rainfall in record. A location map of the proposed stockpile areas and sediment pond facilities is shown on **Figure 2-18.** A discussion on the capacities of the siltation ponds is provided in **Section 1.4.5.1.**

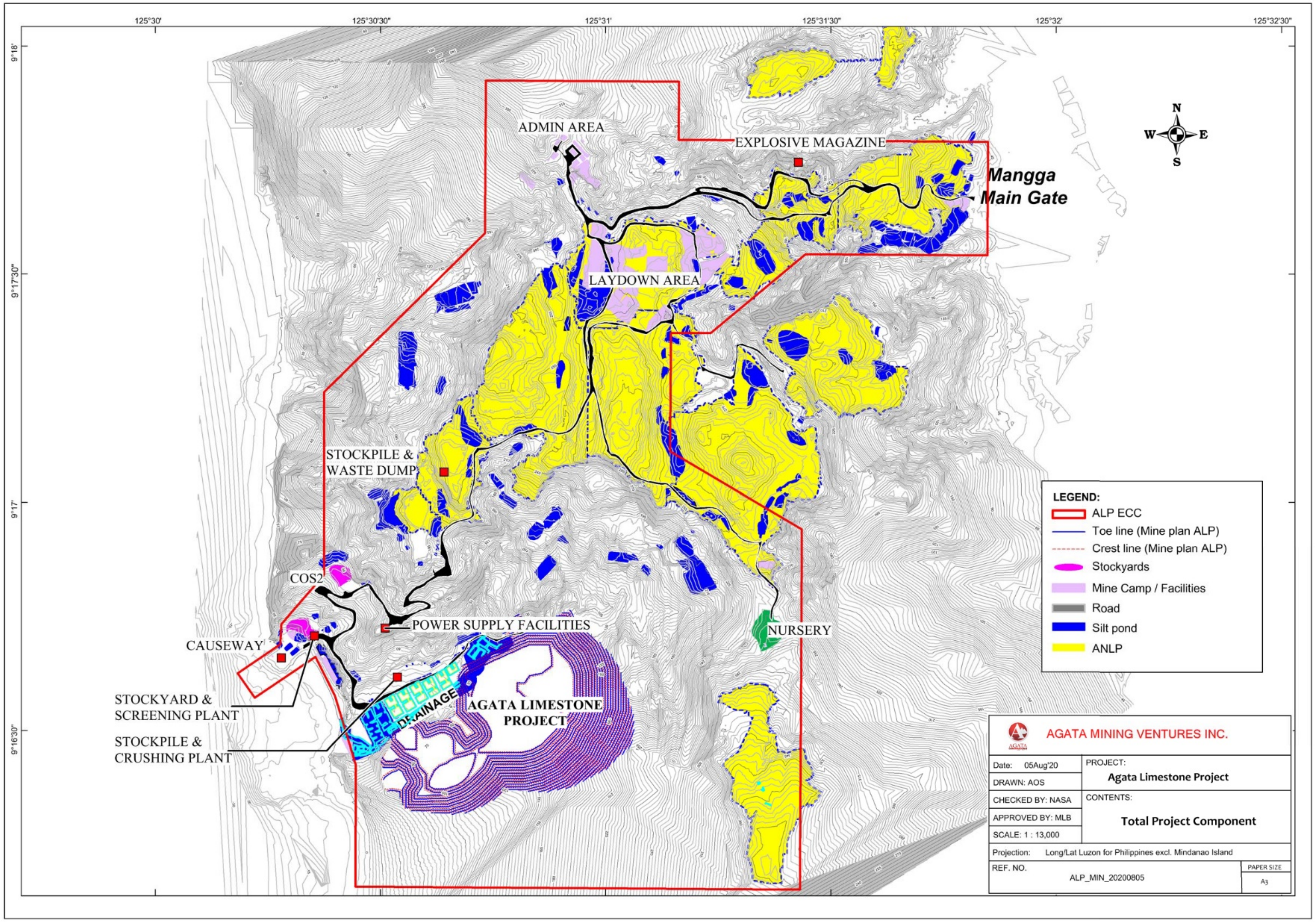
2.2.4.1. Inducement of Subsidence, Liquefaction, Landslides

Mine subsidence is the movement of the earth's surface resulting from natural causes such as earthquakes and from human activities such as underground mining or the extraction of groundwater from aquifers. Over time, gravity and the weight of rock overlying the voids cause the layers of rock to shift and collapse into the void.

The collapse and void may continue upward toward the ground surface where it may cause the creation of sinkholes, cracks, tilting and sags. The extent and degree of subsidence depends on the surface topography, geologic conditions and distance between the mine workings and ground surface. Mine subsidence can occur abruptly or gradually over many years.

The general potential for limestone to demonstrate karst topography increases the potential for subsidence from the creation of sinkholes. However, since the area with limestone materials will be mined and will not serve as foundation for any infrastructure, subsidence hazard is low. Subsidence and collapse activity are minimal from surface mining and quarrying. If ever, impacts will generally be localized, affecting a relatively small area within the overlying surface. Just the same, blasting activities will be controlled to minimize underground disturbance. The limestone material to be mined is deemed competent enough to withstand controlled blasting activities.

Figure 2-18 Stockpile Areas and Sediment Pond Location Map



2.2.5. Management and Monitoring Plan Relevant to Geology and Geomorphology

A summary of the management and monitoring plans relative to the potential impacts arising from geological and geomorphological impacts is provided in **Table 2-5.**

Table 2-5 Summary of Management Plan- Impacts to Geology and Geomorphology

Key Environmental Impact	Management Plan	Monitoring Plan
Change in surface landform/geomorphology/ topography/ terrain/slope	Restoration of final landforms to stable conditions and useable topographic conditions to support post mining rehabilitation programs. Active implementation of progressive rehabilitation activities.	Adherence to Mine and Operations Plans. Compliance with engineering design criteria. Implementation of final mine closure plans. .
Change in sub-surface geology/underground conditions	Limiting the disturbance within the planned operations area. Integration of slope stabilization (i.e benching) to mining activities.	
Inducement of subsidence, liquefaction, landslides, mud / debris flow, etc.	Implementation of controlled blasting e.g. pre-splitting, single hole firing, trim blasting, etc. Active implementation of progressive rehabilitation activities.	

2.3. Pedology

2.3.1. Soil Type and Quality

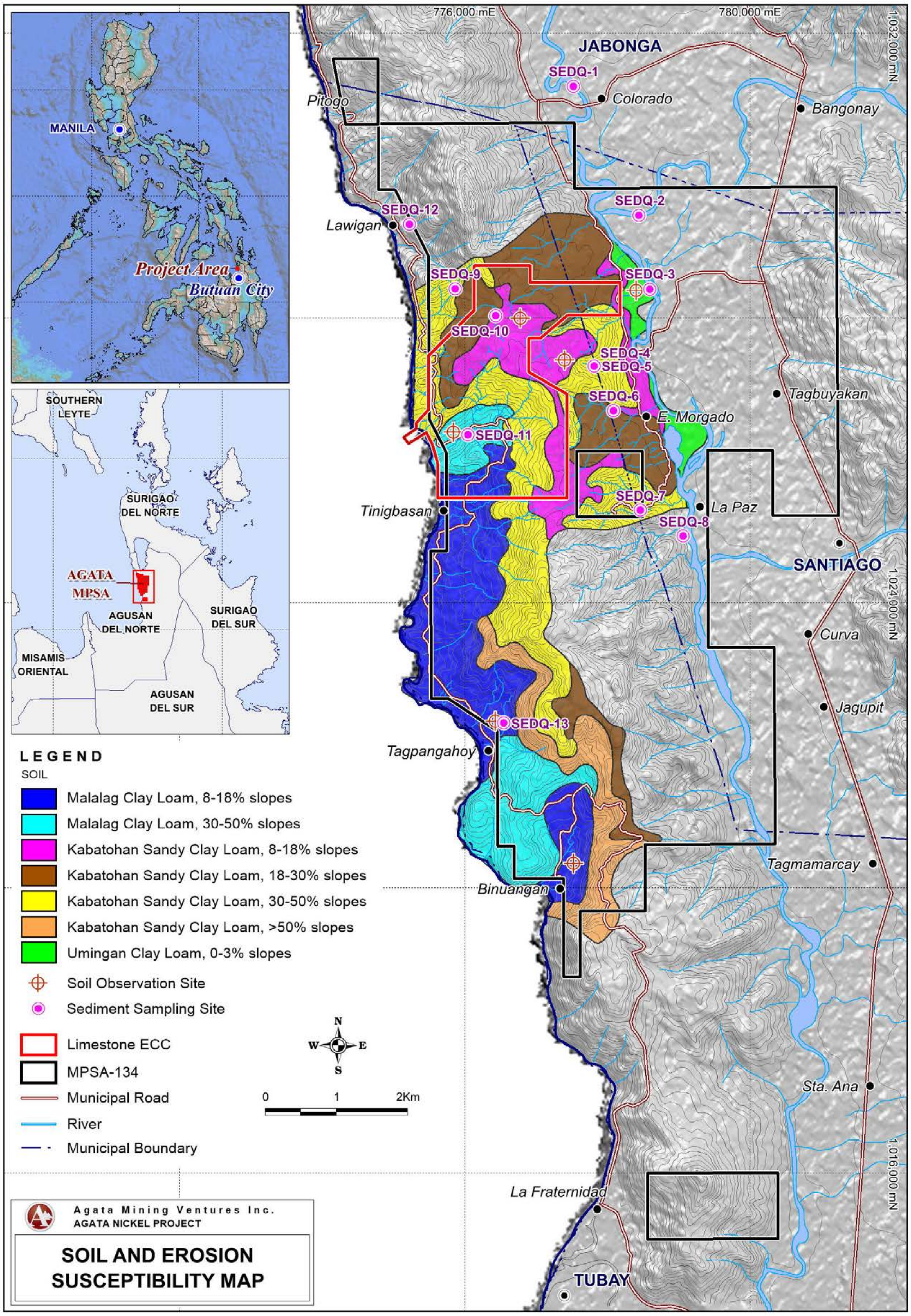
Soil characterization was done by Gaia South in Year 2012 through soil auger borings at representative sampling soil mapping sites within the project area. Location of each sampling points was recorded in GPS and is shown in **Figure 2-19.**

Guidelines from the UN Food and Agriculture Organization (FAO) were used as reference in soil profiling description. The soil color was determined using the Munsell Color Chart, while the slope gradient was also identified using an Abney Hand Level. In addition, soil samples were gathered for physico-chemical analyses (texture, pH, N, OM, P, K, and CEC) at the Bureau of Soils and Water Management (BSWM), while heavy metal analysis (As, Cd, Co, Cu, Fe, Hg, Ni, Pb) was done at Ostrea Mineral Laboratories Inc.

Three (3) soil types and seven (7) soil mapping units were identified and mapped within the MPSA area. A map of the soil type distribution within the Project area is shown in **Figure 2-19.**

The three (3) soil types consisted of the Malalag clay loam, the Kabatohan sandy clay loam and the Umigan clay loam. The Malalag clay loam was developed from the weathering of the metamorphic igneous rocks while the Kabatohan sandy clay loam was developed from the weathering of the ultramafic rocks. The Umigan clay loam was developed from the weathering of river and alluvial deposits.

Figure 2-19- Soil and Erosion Susceptibility Map



Ground slopes within the Project area range from flat to greater than 50%. Both the Malalag and Kabatohan soil types can be found on slopes within this range. The Umigan soil type is found on slopes ranging from flat to 3% gradients. The soil mapping units were defined by the slope of the land surface for each soil type.

The Malalag clay loam, 8% to 18% slopes was noted in the gently sloping to sloping valley of Brgy. Binuangan and on the rolling terrain from Brgy. Tagpangahoy to Brgy. Tinigbasan on the western watershed of the Jabonga-Tubay elongated mountain range.

The Malalag clay loam, 30% to 50% occurs on the steep hump-like spur between Brgys. Binuangan and Tagpangahoy, and on the steep slopes of Sitio Payong-payong watershed.

Kabatohan sandy clay loam, 8-18% slopes occur on the plateau-like sloping ridge top between Brgy. E. Morgado and Sitio Sua, Brgy. Lawigan, and on the foot slope at Brgy. E. Morgado.

Kabatohan sandy clay loam, 18-30% slopes occurs on the side slopes of the plateau-like ridge top on both the eastern (Brgy E. Morgado) and western (Sitio Sua, Barangay Lawigan) sides.

Kabatohan sandy clay loam, 30-50% slopes occurs on the upper slopes of the watershed from Brgy. Binuangan to Sitio Sua, Brgy. Lawigan on the western side.

Kabatohan sandy clay loam, >50% slopes occur on the upper slopes of the watershed from Brgy. Binuangan to Brgy. Tagpangahoy.

Umingan clay loam, 0-3% slopes occur on the flat to almost flat river terrace/alluvial plain along the Kalinawan River at Brgy. E. Morgado.

The result of the physico-chemical analyses performed for the soil samples collected is summarized in **Table 2-6.**

Table 2-6- Soil Analysis Result (Sampling Point Reference: **Figure 2-19**)

Sampling Station	Malalg Clay Loam			Kabatohan Sandy Clay Loam		Umingan Clay Loam
	Site No. 1 8-18%	Site No. 2 8-18%	Site No. 3 30-50%	Site No. 5-6 8-18%	Site No. 7 30-50%	Site No. 6 0-3%
Drainage	Moderately Well drained	Moderately Well drained	Moderately Well drained	Well drained	Well drained	Moderately Well drained
Textured	Clay loam	Clay loam	Clay loam	Sandy Clay loam	Sandy Clay loam	Clay loam
Soil Depth (cm)	40cm	>100cm	70cm	>100cm	>100cm	>100cm
Slope (%)	8-18 % slopes	8-18 % slopes	30-50 % slopes	8-18 % slopes	30-50 % slopes	0-3 % slopes
pH	6.15	5.4	5.8	5.88	5.88	6.66
Total Nitrogen	0.045	0.056	0.065	0.016	0.046	0.014
Organic matter	1.6	2.05	2.5	2.19	3.58	1.57
Phosphorus (mg/kg)	2.8	0.2	1.55	1.6	0.9	1.0
Potassium (cmol/kg)	0.16	0.06	0.1	0.045	0.14	0.07
CEC (cmol/kg)	19.24	20.26	34.75	3.17	18.36	20.17
Cadmium (mg/kg)	4.47	3.74	4.08	8.61	5.11	5.21
Cobalt (mg/kg)	43.49	35.00	65.12	298.77	343.26	280.15
Copper (mg/kg)	78.62	34.23	77.57	53.51	23.64	48.22

Table 2-6 River Sediment Metal Analysis (Sampling Point Reference: **Figure 2-19**) continued

Sampling Station	Malalg Clay Loam			Kabatohan Sandy Clay Loam		Umingan Clay Loam
	Site No. 1 8-18%	Site No. 2 8-18%	Site No. 3 30-50%	Site No. 5-6 8-18%	Site No. 7 30-50%	Site No. 6 0-3%
Iron (%)	4.08	3.23	4.33	30.47	10.04	11.60
Nickel (mg/kg)	145.62	113.37	415.26	5,297.5	2,234.68	4,654.79
Lead (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Mercury (mg/kg)	0.018	0.025	0.026	0.108	0.059	0.037
Copper (ppm)	3.29	0.67	2.34	1.40	1.17	1.86
Zinc (ppm)	0.49	0.71	0.66	1.65	1.3	0.57
Iron (ppm)	81.14	37.39	84.74	19.84	100.25	89.32
Manganese (ppm)	11.18	71.04	57.98	29.99	141.07	29.79

Malalag clay loam, 8-18% slopes in site 1 and 2 are moderately well drained clay loam soil. Soils are slightly acidic. Total nitrogen, organic matter, phosphorus and potassium are all very low, making the natural fertility of this soil poor. Cation exchange capacity is medium. For metals, copper, zinc, and manganese are low in both sites. The. The heavy metal (arsenic, cadmium, cobalt, copper, nickel, lead and mercury) content in both sites are all below the contamination level as prescribed by the Taiwanese and Dutch standards.

Malalag clay loam, 30-50% slopes in site 3 is moderately well drained, characterized by irregular/broken soil profile depth due to embedded weathering rocks. Soil is slightly acidic. Soil fertility is poor, with total nitrogen, phosphorus and potassium at low levels, same with the organic matter. The cation exchange capacity is high. Copper, zinc, and manganese are very low, while iron is medium. The heavy metals (arsenic, cobalt, copper, lead and mercury) are below the contamination level as prescribed by the Taiwanese and Dutch standards, except for nickel.

Kabatohan sandy clay loam, 8-18% slopes in site 4 & 5 is well-drained, deep sandy clay loam soil. Soil reaction is slightly acidic. Total nitrogen, phosphorus, potassium and cation exchange capacity are very low. Organic matter is low, hence poor natural fertility. There were also detected concentrations of copper, iron, zinc, and manganese. The heavy metals (arsenic, copper, lead and mercury) are below the contamination level as prescribed by the Taiwanese standards, except for cadmium and nickel which exceeded the contamination level. Iron content is above the range of natural iron in soil of 0.3–10%.

Kabatohan sandy clay loam, 30-50% slopes in site 7 is well-drained deep sandy clay loam soil. Soil reaction is slightly acidic. Natural fertility of the soil is also poor with very low content of Total nitrogen, phosphorus, potassium, and organic matter. Iron, manganese, zinc, and copper were detected at low to medium levels. The heavy metals (arsenic, copper, lead and mercury) are below the contamination level of the Taiwanese standards. Exceptions include cadmium and cobalt which both exceeded the same standard. Iron content of 10.04% is on the highest range of natural iron in soil.

Umingan clay loam, 0-3% slopes in site 6 is moderately well drained, deep clay loam soil. Soil is neutral. Similar to the previous soil types, the soil fertility is low, with the Total nitrogen, organic matter, phosphorus and potassium at very low levels. Copper, zinc, iron, and manganese are still detected in this soil type. The heavy metals (arsenic, copper, lead and mercury) are below the contamination level as prescribed by the Taiwanese standards. While the cadmium, cobalt and nickel content exceeded the prescribed levels. Iron with 11.60% is above the range of natural iron in soil.

2.3.1.1. Soil Erosion, Loss of Topsoil

Erosion susceptibility within the MPSA area is identified based on four (4) criteria—rainfall, soil depth and texture, land use/vegetation and slope. The erosion susceptibility for the different land use units ranged from slightly susceptible to moderately susceptible. As shown on **Figure 2-19**, the Payongpayong limestone site is part of the Malalag Clay loam at 30-50% slopes and is considered an area with high susceptibility to erosion.

In relation, a recent Soil Loss Estimation Study conducted by students of the Caraga State University along the Malimono Ridge of Agusan Del Norte indicated that erosion risk along the steep slopes of Malimono Ridge is considered medium (erosion rate ranging 13.7- 26.7%) to high (erosion rate 26.7-47.4%). The calculated annual average soil loss the Revised Universal Soil Loss Equation (RUSLE) ranges from 8,216 to 17,755 ton/ha/yr.

Also included in the Gaia South study is sampling of river sediments at thirteen (13) locations within the Project area to characterize the quality of the soil lost by erosion and transported to the local streams. Twelve (12) creeks were sampled and eight (8) heavy metals were tested. Results of the sediment sample testing and the station locations are summarized in **Table 2-7.**

Table 2-7 River Sediment Metal Analysis (Sampling Point Reference: **Figure 2-19**)

Sampling Station	Arsenic (mg/kg)	Cadmium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (%)	Nickel (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
SEDQ 1	<0.017	2.56	31.64	156.86	7.09	98.44	<0.10	0.021
SEDQ 2	1.60	2.20	137.37	31.61	7.85	1237.85	<0.10	<0.004
SEDQ 3	<0.01	1.95	116.32	27.12	7.82	2621.13	154.06	<0.004
SEDQ 4	0.71	2.19	165.43	16.33	10.32	4196.00	<0.10	<0.004
SEDQ 5	14.70	1.83	51.86	136.91	4.80	903.77	23.30	<0.004
SEDQ 6	16.49	2.01	63.70	65.60	5.98	125.05	<0.10	0.055
SEDQ 7	9.79	1.75	48.94	113.49	5.84	499.20	<0.10	0.195
SEDQ 8	6.07	2.01	26.19	152.54	5.96	36.86	<0.10	<0.004
SEDQ 9	3.39	1.84	22.94	183.94	5.85	58.71	28.31	<0.004
SEDQ 10	<0.01	1.74	46.03	94.0	5.51	785.66	<0.01	<0.004
SEDQ 11	4.13	2.29	53.74	34.71	5.26	1131.64	<0.01	<0.004
SEDQ 12	2.50	3.46	36.82	49.79	3.77	347.47	41.93	<0.004
SEDQ 13	4.13	2.20	47.68	71.0	5.59	598.84	<0.10	<0.004

List of River Sediment Sampling Locations:
SEDQ 1 Kalinawan River at confluence with Bangonay River
SEDQ 2 Nangka Creek downstream of road culvert along Nangka Creek
SEDQ3 Paiton Creek upstream of road culvert along Paiton Creek
SEDQ 4 Mantiawas Creek upstream of Mantiawas Reforestation Area
SEDQ 5 Duyangan Creek downstream of small scale mining tailings disposal and upstream of road culvert
SEDQ 6 Agata Creek downstream of road culvert
SEDQ 7 Dinaringan Creek downstream of Dinaringan Creek and upstream of confluence with Kalinawan River
SEDQ 8 Kalinawan River at midstream of the river
SEDQ 9 Sua Creek No. 1 downstream of Sua Creek No. 1

SEDQ 10	Sua Creek No. 2 downstream of Sua Creek No. 2
SEDQ 11	Payong payong Creek downstream of Payong payong
SEDQ 12	Tinigbasin Creek along the confluence of two tributaries of Tinigbasin Creek
SEDQ 13	Tagpangahoy Creek

Since majority of the support facilities will be reused from the nickel operations, the crushing plant construction site and the limestone lime area are considered to be the major sites to subject to surface clearing and topsoil loss. Development phase will require removal of topsoil and overburden waste materials to access the deposit for extraction. Based on the current mining plan, approximately 52 hectares will be disturbed by the quarry operations. Development of additional roads will also contribute to loss of topsoil materials. Active excavation sites from construction activities and mining operations will be contributing to soil erosion.

To mitigate impacts from erosion, vegetation clearing, and topsoil removal will be limited to the identified areas of disturbance to maintain a small footprint. The surface mine design is characterized by mine benches to promote slope stability. For road construction, slope stabilization materials such as installation of coco net, geotextile, wattlings, and fascines will be installed as necessary. They will provide slope stability to minimize soil transport and sedimentation within local streams. This is in addition to the appropriately designed drainage system to manage the stormwater runoff.

Furthermore, reforestation and landscaping activities will be done to minimize exposed soil surface. When the land is covered with vegetation, the roots of the plants and trees interlock and interlace to bind the soil particles. This helps by not allowing the soil particles to be carried away by wind or water and not allowing free flow of water over the soil which prevent erosion of soil by flowing water.

2.3.1.2. Change in Soil Quality and Fertility

Storage and placement of soil and rock overburden, if improperly done may result in the burial and loss of topsoil and exposure of underlying rocks, which will be less productive medium for future reforestation activities. Consequently, less wildlife will thrive in unproductive areas because they are unable to provide sufficient food source and cover. Without rehabilitation, areas stripped with topsoil must go through a weathering period, which may take many years before vegetation can be re-established.

To prevent soil loss and soil quality degradation, management of the overburden/topsoil materials will be performed as follows:

- Soil profiling will be undertaken to initially mark the topsoil depth ranging from 50 to 300mm.
- Subsequently the topsoil or overburden will be removed in slices of 100mm using a bulldozer.
- The topsoil will be collected and brought to the designated overburden /stockpile area for interim storage. Each stockpile area will be designed to hold a specific volume with the placement of material in a staged manner to increase the stability and prevent landslides and slope failures.
- The overburden/topsoil piles will be ramp piled and/or covered with laminated sack to prevent erosion. Diversion of surface runoff around the area will also be maintained. During this holding period, the topsoil materials will be conditioned to retain its productivity or fertility.

- Compaction of the topsoil will be prohibited during stockpiling. The quality of topsoil in the stockpile will be maintained by measures including protection against contamination from other materials, minimizing stockpiling periods and prevention of erosion by surface runoff or wind. Spraying will also be done to maintain the moisture content of the soil.

- Introduction of soil ameliorants to the topsoil to maintain and improve the quality of the soil until rehabilitation commences. The stockpiled overburden/ topsoil will then be backfilled or return to the mined-out area for restoration.

2.3.2. Management and Monitoring Plan Relevant to Pedology

A summary of the management and monitoring plans relative to the potential impacts arising from soils and soil quality changes is provided in **Table 2-8.**

Table 2-8 Summary of Management Plan- Impacts to Pedology

Key Environmental Impact	Management Plan	Monitoring Plan
Soil Erosion, Loss of Topsoil	Limited footprint to planned areas of disturbance. Installation of slope stabilization methods (i.e. benching and terracing at the quarry area and roadsides) and materials (i.e. coco nets, geotextiles, etc.) Proper drainage system around disturbed areas. Increase in ground cover/ vegetation by reforestation. Landscaping at and around auxiliary areas and facilities.	Progressive Rehabilitation based on the Environmental Protection and Enhancement Program. Final Mine Rehabilitation and Decommissioning Plan.
Change in Soil Quality/Fertility	Interim storage of removed topsoil. Proper topsoil storage (non-compaction, spraying, covering, soil conditioning with ameliorants, etc.)	Progressive Rehabilitation based on the Environmental Protection and Enhancement Program

2.4. Terrestrial Ecology

A terrestrial flora and fauna baseline assessment of the limestone area was conducted by Green Environment Defenders Consultancy during the period July 16-19, 2020. The “Guidelines on Biodiversity Assessment and Monitoring System for Terrestrial Ecosystems” was the primary basis used in the conduct of the Biodiversity assessment with a slight modification as to its methods particularly in the collection of herpetofauna. The study covered the assessment of two watersheds: limestone quarry project site – the primary impact area, and the adjacent watershed Tinigbasan site. The areas are shown on **Figure 2-20** and location coordinates of the sampling plots are identified in **Table 2-9**.

Figure 2-20 Terrestrial Flora and Fauna Study Site

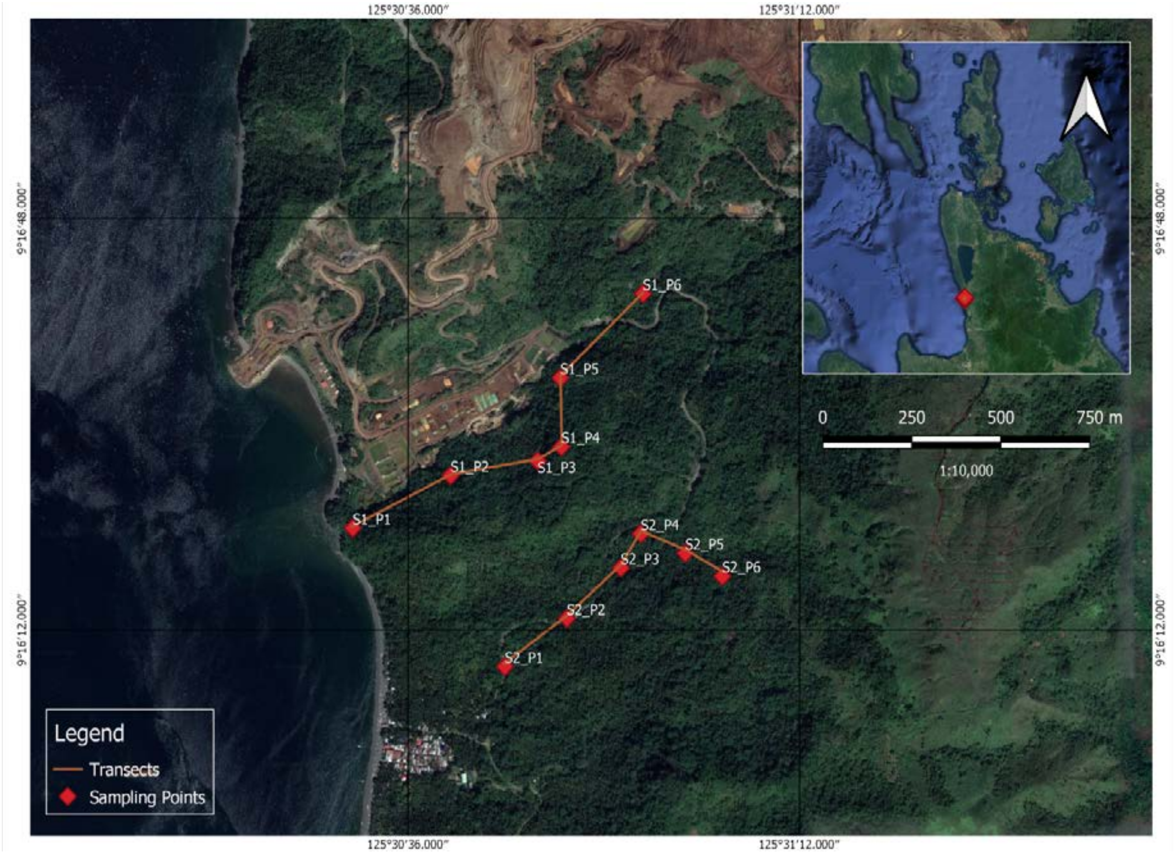


Table 2-9 Terrestrial Ecology Survey Stations

Study Area	Point	Latitude	Longitude
Payong-Payong (Site1	1	9°16'20.90"N	125°30'30.90"E
	2	9°16 '25.50"N	125°30'39.90"E
	3	9°16'26.80"N	125°30'47.90"E
	4	9°16'28.02"N	125°30'50.10"E
	5	9°16'34.04"N	125°30'50.00"E
	6	9°16'41.40"N	125°30'57.60"E
Tinigbasan (Site 2)	1	9°16'8.80"N	125°30'44.90"E
	2	9°16'13.00"N	125°30'50.60"E
	3	9°16'17.42"N	125°30'55.56"E
	4	9°16'20.40"N	125°30'57.40"E
	5	9°16'18.70"N	125°31'1.50"E
	6	9°16'16.70"N	125°31'4.90"E

The Project area is generally characterized by three ecosystem types; forest over ultramafic rocks, tropical lowland evergreen rain forest and plantations. The ultramafic forest is the primary vegetation type with only a few tall and large trees. The tropical lowland evergreen forest is found in patches throughout the Project area and may be remnants of the vegetation that previously existed. The forest patches are generally found along the ridges and the streams/valleys within the Project area.

2.4.1. Terrestrial Flora

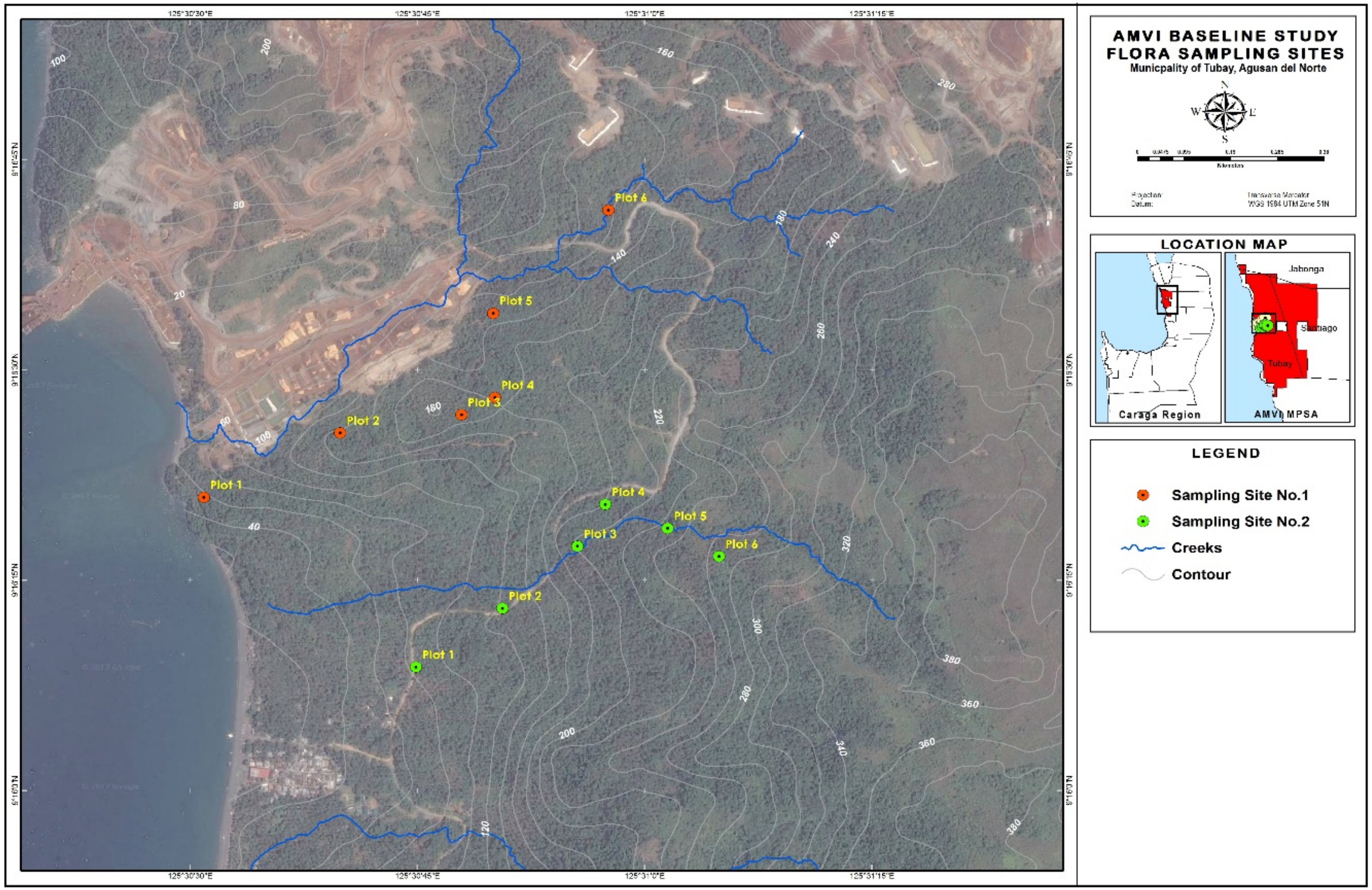
Maps from the company were used to initially assess and identify the terrestrial flora biodiversity assessment area. A Rapid Resource Assessment was employed to determine the present condition of floral species within the direct impact of the proposed Project. Two sites were identified: Site 1 was located within the direct impacts are possibly observed (Limestone Forest) and Site 2 was located in Sitio Tinigbasan adjacent to Site 1 and outside the proposed quarry project (**Figure 2-21**). Two kilometer transect were established in each identified site. Along the transect, six (6) plots were established measuring 20 by 20 meter. These plots were used to measure the species richness and diversity of the flora. Smaller subplots measuring 5 by 5 meters was also employed for the lower canopy and ground cover. All species of flora were accounted inside the established plot. A GPS was used to determine the location of each plot. Transect walks were also done between plots. The Transect Walk is a rapid biodiversity assessment technique that employs a hike, recording of species, and physical attributes. This method seeks all major ecosystems, determines stratified zones, and map the areas across the established transects.

In situ identification of plant species was conducted along the 20 by 20 meter quadrat and along the two (2) kilometer transect. Sampling sites of terrestrial flora covering Payong-payong and Tinigbasan watershed is presented in **Figure 2-21.**

Plant species were identified through the help of local guides, photographs, field taxonomic keys and books (Madulid, 1995; Barcelona et al.1996; Rojo, 1999). The plants were identified to the lowest taxon possible. Documentation of diagnostic features (i.e flowers, fruits, leaves, and roots) was also conducted. Assessment of status of each species was determined whether threatened, endemic, rare or economically important. The floral species was assessed based on the National List of threatened Philippine Plants (DAO 2017) and the IUCN (2019).

Species diversity indices were analysed using species richness, abundance, evenness, and dominance and Shannon diversity. The trend of diversity profile was generated to compare the diversity between sites. Paleontological Statistics software (PAST) was used to analyse the diversity indices. The most important species in the area was determined using the species importance value (SIV) index (English et al., 1997). The forest structure data (i.e. tree abundance and composition) were analysed using PRIMER 6 software. Multivariate analyses employing the cluster, nMDS, ANOSIM, and SIMPER were performed.

Figure 2-21 Flora Sampling Sites in within the Agata Limesone Project in Tubay, Agusan Del Norte



A. Taxonomic Values

The assessment of plants recorded a total of 206 species belonging to 78 families and 145 genera as shown on **Figure 2-22.** There were 181 species of angiosperms belonging to 66 families and 130 genera, while 25 species, 12 families and 15 genera for Pteridophytes. Of the 206 species, 116 species were recorded within the plot. Comparatively, Site 2 (85 species) has a the higher number of species than the Limestone forest (61 species). Attached in the **Appendices** is a complete list of the Flora observed during the inventory.

The most represented plant families were *Moraceae* (15 species), followed by *Arecaceae* and *Fabaceae* (9 species) and, *Euphorbiaceae* and *Anacardiaceae* (8 species), as shown in **Figure 2-23.** The *Moraceae* family commonly known as mulberry or fig family has many representative species with cosmopolitan distribution and widely spread in different habitats of the tropical region. Family *Fabaceae* can thrive well in ultramafic areas with low amounts of essential nutrients because of its ability to fix nitrogen in the atmosphere with the help of associated Rhizobacteria in their roots. Family *Arecaceae*, or the palm family, have various growth forms and can grow best in moist and shady areas and usually among the most cultivated plant families.

Figure 2-22 Summary of Classified Flora

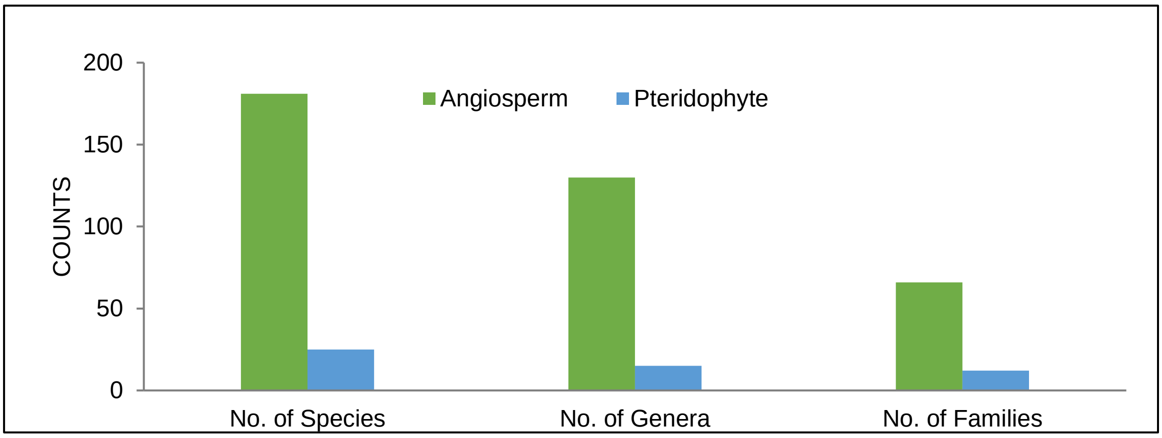
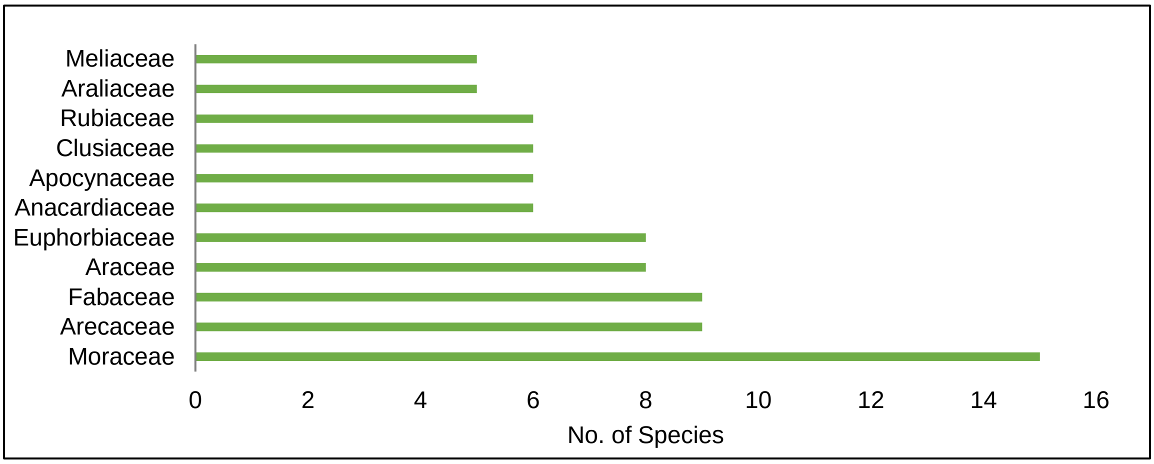
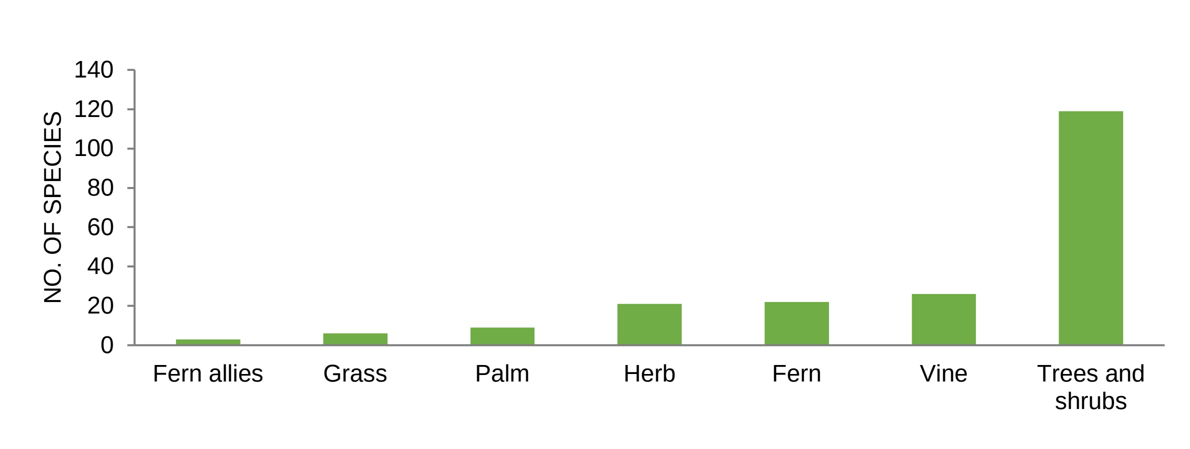


Figure 2-23 Top ten Families with the Abundant Number of Floral Species.



The plant species recorded in the area were characterized into seven (7) plant habit groupings including herbs, grass, vine, palm, ferns, fern allies, and trees and shrubs. When plants are grouped into plant habit, results revealed that trees and shrubs (119 species) had the highest number of species among the group (**Figure 2-24**). The least number of species belongs to the fern allies with only 3 species.

Figure 2-24 The seven growth habit groupings of plants in the area



B. Species Importance Value

Dominance and ecological success of a species is expressed as a single value in terms of Importance Value Index (IVI). This index utilizes three parameters: relative frequency, relative density and relative dominance or basal area. In case of shrubs and herbs, only two (2) former parameters were taken into consideration. High IVI values of a species indicate its high regeneration capacity and greater ecological amplitude.

A total of 150 individual trees, consisting of 40 species were found within the established plots in site 1 and site 2. *Vitex parviflora* (Tugas), *Adinandra robinsonii* (Sagimsim) and *Radermachera whitfordii* (Magasili) obtained the highest importance value in site 1 while in site 2, *Artocarpus blancoi* (Antipolo), *Paraserianthes falcataria* (Falcata) and *Gmelina arborea* (Gmelina) dominate the area (**Table 2-10**). The results suggest that these species are the most influential and important species with higher counts and greater frequency per unit area. The removal of these species in the area may have an effect to the survival of the other species. Furthermore, many wildlings and samplings of these species were found in the vicinity indicating that these particular trees had a very good capacity for regeneration.

Collections of wildlings as well as cuttings from these species prior to its removal will be prioritized for propagation and this shall be incorporated as part of nursery standard operating procedures and final mine rehabilitation process under the Land Resource Management of ALP based from the established/existing measures and practices from the ANLP. The method of propagation shall include non-mist cloning from collected cuttings and direct nursery potting from collected wildlings to ensure success rate.

The established Central and Satellite nurseries from the ANLP shall be retained for use during the operation, progressive rehabilitation and final mine rehabilitation activities of the Agata Limestone Project. The Central Nursery which can accommodate and propagate 600,000 seedlings will be used mainly for propagation of forest-tree and endemic species, while the Satellite Nursery which can accommodate 25,000-30,000 seedlings is used mainly for the propagation of fruit-bearing tree species.

Another satellite nursery is also established for the ornamental plants in line with the objective of employing thematic landscaping in the final rehabilitation areas. The operation of these nurseries will be in accordance to the established Land Resource Management Procedure under ISO 14001:2015 Environmental Management System of the company.

Site 1 has more species of trees (31) but stunted in growth compared to site 2, with 21 species with bigger and taller species. The DBH of trees in Site 1 has a mean diameter of 18.13cm while site 2 has 21.55cm. Among the species, *A. blancoi* is the most distributed tree species in whole area and was observed to have the largest canopy cover. The average height of trees in area ranges from 3 meters to 20 meters. As such, the vegetations are dominated by naturally stunted trees in a limestone forest.

Table 2-10 Top 3 species with the Highest Importance Value in each site

Site	Species	SIV (%)
Sit 1 (Limestone Forest)		
Tugas	*Vitex parviflora*	24.42
Magasili	*Radermachera whitfordii*	18.34
Sagimsim	*Adinandra robinsonii*	17.59
Site 2 (Tinigbasan)		
Antipolo	*Artocarpus blancoi*	35.17
Falcata	*Paraserianthes falcataria*	33.52
Gemelina	*Gmelina arborea*	28.56

C. Diversity and Community Structure

The floristic data collected in the two sampling sites were subject to biodiversity analyses. The diversity measurements were calculated using species richness, evenness, and dominance, abundance, and Shannon diversity.

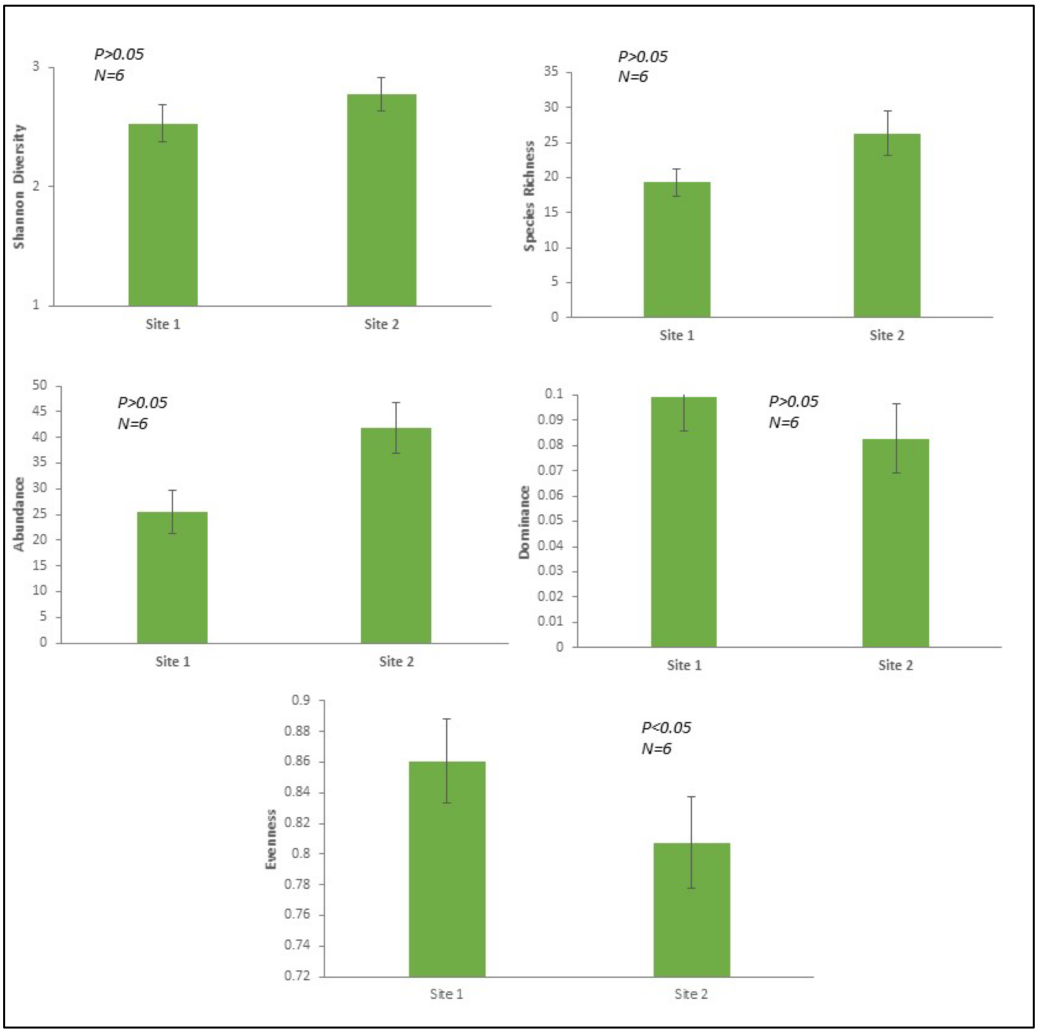
The project area has a composite Shannon diversity (H') of 3.97 which is considered a "high diversity" based on classification set by Fernando et al., 1998 (Table 3). Other attributes showed a generally higher abundance (404 individuals) and species richness (116), moderate evenness (0.64), and lower dominance (0.02). There is no significant variation ($p>0.05$, $n=6$) of plant diversity between sites, and that, both the limestone forest (H'=3.49) and Brgy.Tinigbasan (H'=3.76) harbors a high diversity of plants (**Table 2-11, Figure 2-25**).

The high diversity in limestone forest is attributed mainly to lower dominance (0.04) and higher evenness (0.74). The analysis also detected a significantly lower evenness ($p<0.05$, $n=6$) in Limestone forest than in Tinigbasan. This suggests that no particular species dominate the area and that most of the species present are evenly distributed across the site. On the other hand, the relatively higher diversity in Tinigbasan might be explained by the higher abundance (282 individuals), richness (85 species) and, lower dominance (0.03) of plant species.

Table 2-11 The computed diversity metrics (actual values) in the two sampling sites

Diversity Variable	Limestone (S1)	Tinigbasan (S2)	Overall Diversity
Species Richness	61	85	116
Abundance	122	282	404
Dominance	0.04	0.03	0.02
Shannon Diversity	3.49	3.76	3.97
Evenness	0.74	0.66	0.64

Figure 2-25 The comparison of biodiversity indices in the two sampling locations



The community structure of plants based on species abundance was analyzed using a series of ecological community structure analysis including cluster analysis, non-metric multidimensional scaling (nMDS), Analysis of Similarities (ANOSIM), and Similarity Percentages (SIMPER). Prior to the analysis, the abundance data was transformed using square root transformation technique and was subject to Bray-Curtis similarity coefficient. Then, the similarity matrix was used to analyze the community structure of plants using the previously mentioned analyses.

The Bray Curtis Cluster and nMDS analyses were used to find natural grouping patterns of sampling units (plots) with similar species assemblages **(Figure 2-27).** The cluster analyses showed two grouping patterns at 25% similarity. The two sampling sites clustered independently into two separate groups. They are composed of 6 plots from Tinigbasan (plus plot 2 in limestone) as one big group, and the five plots from Limestone forest as a separate group. However, higher Bray Curtis similarity (30%) revealed three clustering groups. Tinigbasan plots were divided into two: plot 2, 3, 4, 5 as one group, while plot 1, plot 6 both from Tinigbasan, and plot 2 from limestone forest as another group. The third group is the clustering of five plots located within limestone forest. These findings were consistent with the result of nMDS analysis as shown in **Figure 2-26**. The ordination showed a clear dispersion of plant communities in the two sites similar to the grouping as depicted in cluster analysis.

The nMDS also showed a stress value of 0.15 suggesting a good representation of the differences in the dataset. The clustering and proximity of plots within a group as depicted in the graph indicates higher similarity of plant community which likely share similar species composition. Conversely, the separation of the sampling plots as a distinct group relative to the other indicates lower species similarity which likely have a unique set of plant species composition.

Figure 2-26 The Cluster Analysis of sampling sites using Bray Curtis similarity index.

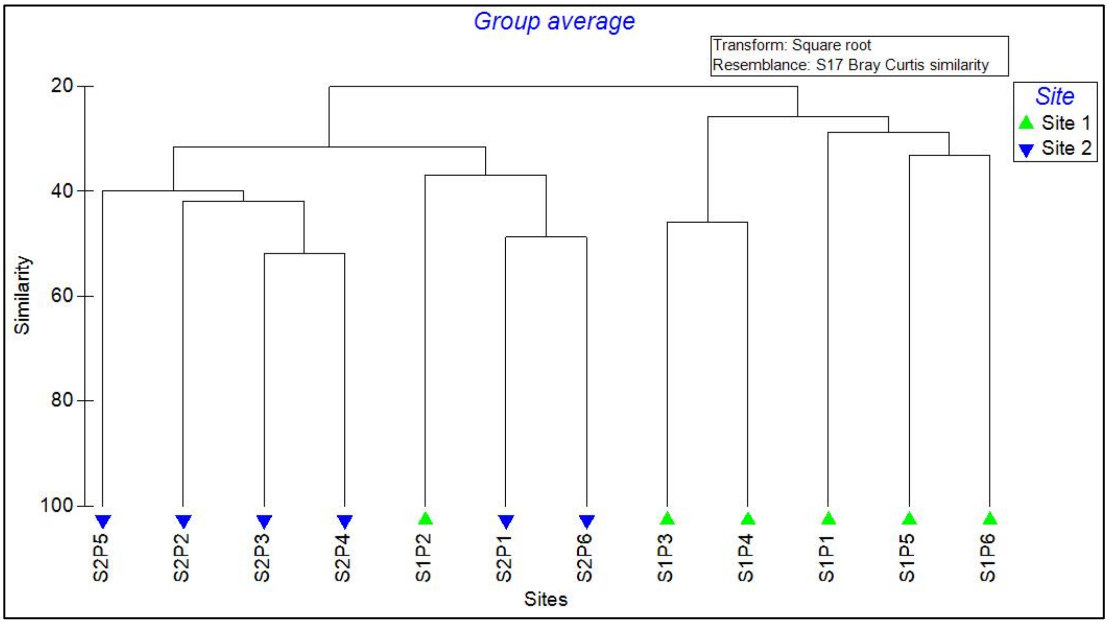
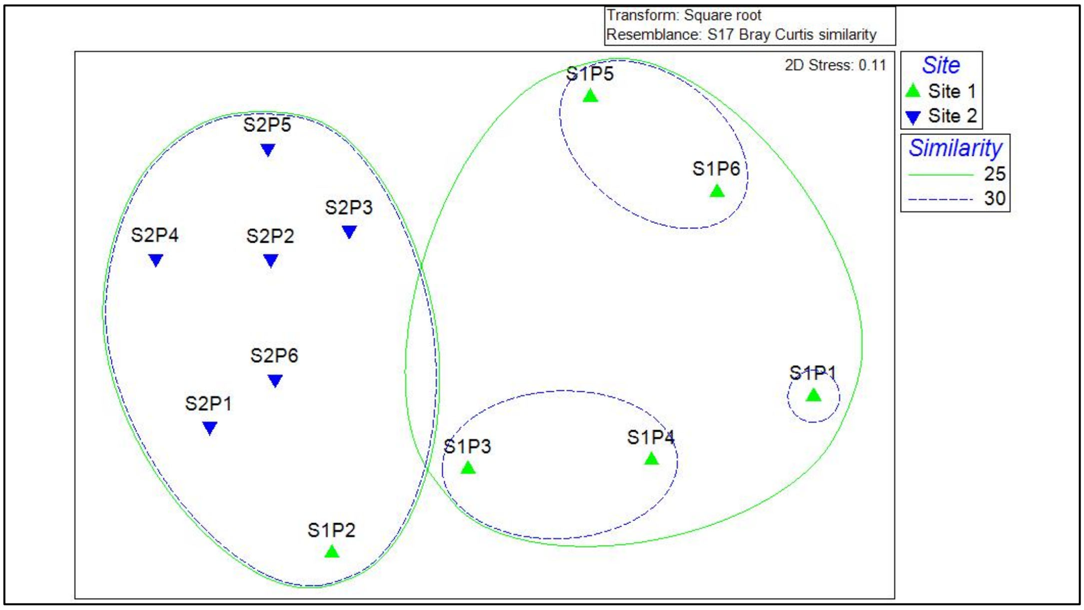


Figure 2-27 Spatio-temporal comparison of the community structure of plants using Bray Curtis similarity



Using ANOSIM, the differences between the two sampling sites as observed in nMDS and Cluster analyses are highly significant (Global R=0.7, p<0.001). The ANOSIM result showed moderate to high dissimilarity of species between the two sites. Hence, the plant species composition and structure differ significantly between limestone forest and Tinigbasan site. Despite the similarly higher diversity, it can be argued that both sites harbors unique plant species grouping, and that, some species can only be found and dominates, thereby shaping the community structure of the area. This further suggests that the combination of diversity, vegetation and community structure analysis and determination is necessary to better inform decision making.

D. Endemicity, Conservation Status and Invasiveness

The area holds a higher number of endemic species (34) and threatened species (16) (**Figure 2-28**). Endemic species means that the species can only be found in the Philippines, and/or in a specific area in the country (highly endemic). Threatened species are plants that face the brink of extinction due to variety of factors (e.g. Habitat degradation, Land-use changes etc.), and can be categorized into three; vulnerable, endangered, and critically endangered.

There are 7 vulnerable, 8 endangered and 1 critically endangered species, which is 8% (16 out of 206 species) of the total number of species recorded (**Figure 2-29** and **Figure 2-30**). The above-mentioned species of plant communities are not only observed in the direct impact area. There are four (4) threatened species that can be found only in the direct impact area, (hereto referred as Payong-payong site), however, there are also four (4) species located in adjacent site (Tinigbasan site). Other seven (7) species can be found in both study sites. The list of threatened species, with the specific site/s where they can be found is included in the **Appendices**.

The presence of endemic and threatened species demonstrates the need of concerted and pragmatic conservation and management efforts from the company and other stakeholders in order to preserve these species in the area. This includes establishment of a small portion of forest reserve (referred in the report as buffer zone) within the direct impact area for the protection and conservation of these species.

Continuing the best Land Resource Management practices of ANLP, the collection of wildlings of threatened species in the area for planting in the proposed forest reserve will be prioritized. A suitability assessment shall be done prior to the establishment of forest reserve.

The propagation and an establishment of forest reserve shall follow the following criteria:

- Good to excellent regeneration potential (e.g numerous seedlings or wildlings);
- Healthy and good forest condition (e.g larger over story trees with high DBH and Height);
- Proximity to the water source.

Furthermore, a suitability assessment shall be done prior to the establishment of forest reserve.

On the other hand, there are also invasive plants (17 species) present in the area, primarily angiosperms (15 species; Figure 8). Some of these are listed as the top worst invasive species in the world including *Chromolaena odorata* (Hagonoy) and *Scleria scrobiculata* (Daat). Invasive species are known to have a negative impact on naturally growing native species because of competition of resources, space and light attenuation as well as alteration of habitat or ecosystem.

Figure 2-28 The number of endemic, invasive and threatened plants in two sampling sites

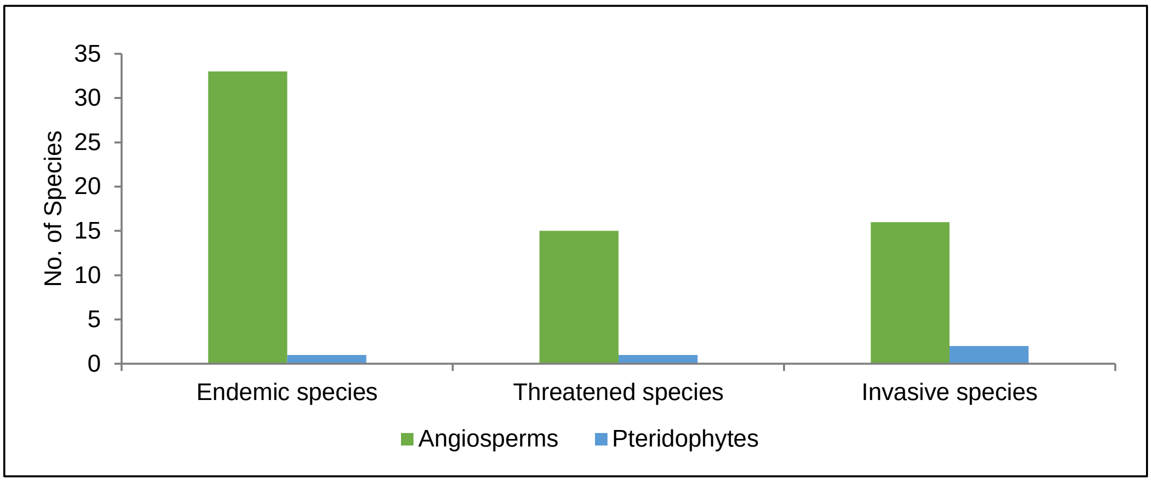


Figure 2-29 The number of threatened species of plants

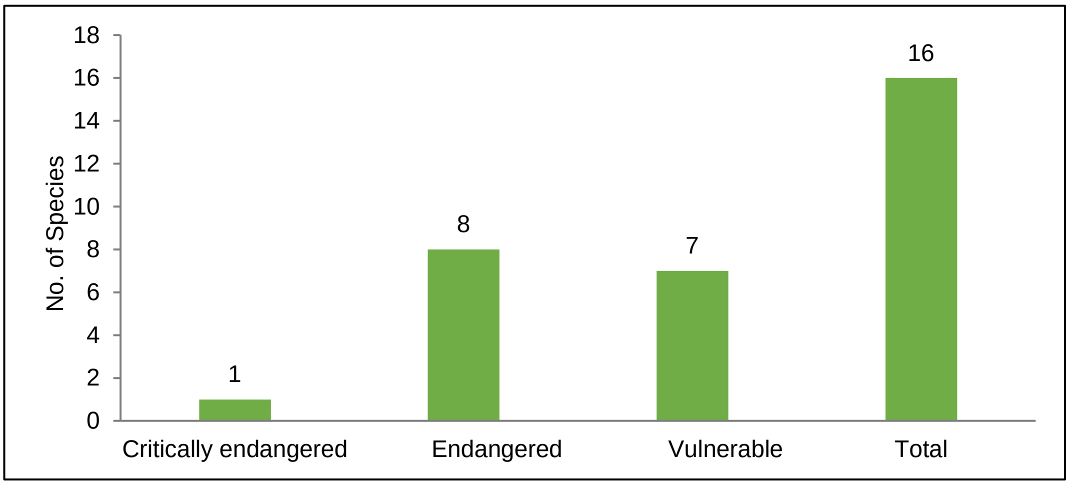
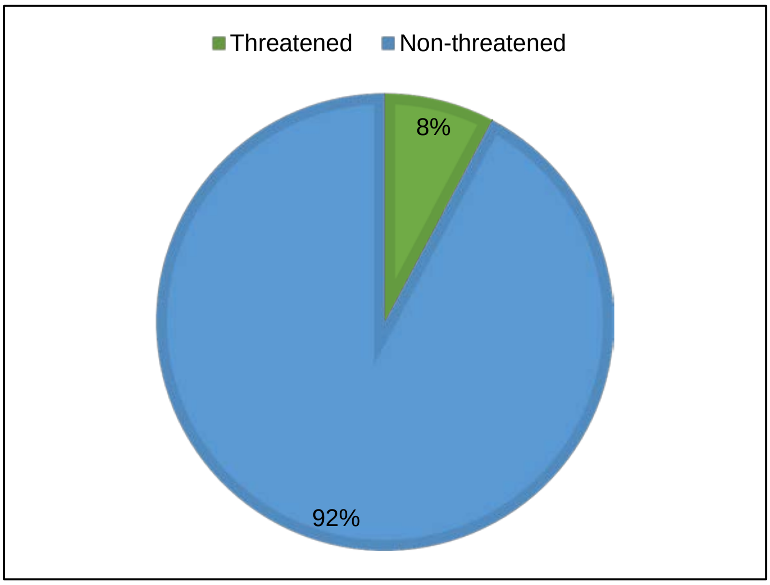


Figure 2-30 The proportion of threatened to non-threatened species of plants.



2.4.1.1. Vegetation Removal and Loss of Habitat

The removal of vegetation is incidental to the quarry operation and effectively removes some specific habitats currently present within the area. Noise generated by equipment and human traffic can also disturb species sensitive to sound. Animals that have broad habitat range may also be hindered in their feeding behavior. All of these factors will affect the biodiversity of the area. It is anticipated the fauna will either adapt to the new habitat changes or migrate to other areas with similar habitat.

Vegetation removal is one of the unavoidable impacts of quarrying/mining and consequently the loss of habitat of faunal species. However, the removal or exposure of the land resources will be limited to the

quarry/mine area, waste, stockpile and crushing area. Approximately 66.94 hectares of the MPSA will be subject to direct disturbance while the infrastructure and access roads will disturb another 487.06 hectares. The total disturbed area will be approximately 554 hectares.

Using the classical area frame sampling approach derived from the satellite image interpretation, a conservative forest area cover was estimated. The potential dominant tree and vegetation species to be affected by the operations is coconut trees and miscellaneous naturally grown trees. The final number of trees that will be affected by the operations will be determined during the actual field survey for the Tree Cutting Permit application to the DENR.

Significant portion of the disturbed area will be affected by forest vegetation removal. This is a direct impact of the quarry/mining operations but is considered short term. Progressive rehabilitation activities including reforestation will mitigate this impact somewhat during the operations period. Final mine rehabilitation and reclamation will further help to mitigate this impact following mine closure.

The consequent loss of vegetation will cause a loss of habitat for the wildlife species in the area. The baseline information however is indicative of the current disturbance with about 30% of the ECC application area converted to agricultural area. Some species of birds and the low turnout of bats, reptiles and amphibians were assumed to be indicators of the already present disturbance within the vicinity of the Project area.

2.4.2. Terrestrial Fauna

A. Amphibians and Reptile

A 3-day rapid assessment on the herpetofauna was conducted in the proposed quarry area in the limestone ecosystem in Payong-payong on July 17-19. 2020. In addition, the adjacent Tinigbasan watershed was also covered in the baseline survey. Within the 2-kilometer transect line in the study sites established, the collection of herpetofauna was done during peak hours in the morning when species are active basking and hunting for food, 0900 to 1200 hours. Searching was also done in the late afternoon (1600 to 1800 hours) and during the night (1900 to 2200 hours) when herpetofauna are on their way to resting place and hibernate. The extensive, intensive opportunistic technique was employed in collecting the samples.

The 3-day rapid assessment yielded only five species of anurans and three species of reptiles. Anurans include *Rhinella marina*, *Limnonectes magnus*, *Limnonectes leytensis*, *Occidozyga laevis*, and *Pulchrana grandocula*. Of the five species of anurans, L. magnus (**Photo 2-2**) of Family *Dicroglossidae* is categorized as Other Threatened Species (OTS) of DAO 2019-09 **(Table 2-12**). This indicates that the species is vulnerable to being endangered in the near future and their population is declining. Also, out of the five anurans, three are Philippine endemics (60%), one non-endemic species (20%), and one invasive species (20%). Anurans accounted for 88.24% of the total individuals of herpetofauna collected during the sampling. For reptiles, all species captured and recorded are categorized as Least Concern, two species are Philippine endemics (*D. bimaculatus* and *G. mindorensis*), and *E. multifasciata* is the only non-endemic reptile species collected. The sighted flying lizard, *Draco bimaculatus* was hard to capture since they are highly mobile and like other reptiles, this agamid is a cryptic species. The *G. mindorensis* (**Photo 2-3**) is likely to be found in secondary and limestone forests. The species also is commonly observed in places near residents and in houses and accounted for 5.88% of the recorded herpetofauna in the study sites.

Photo 2-3 *Gekko mindorensis, (Taylor, 1919) commonly named as "Mindoro Narrow-disked Gecko" is a Least Concern and Philippine endemic species.*

Photo 2-2 *The Limnonectes magnus (Stejneger, 1910) commonly named as "Mindanao fanged frog" is a Near Threatened and Philippine endemic species*

Table 2-12 The herpetofauna species with their conservation and distribution status, abundance and relative abundance

Family Name	Species Name	Common Name	Philippine Red List Status	Conservation Status	Distribution Status	Abundance (Rel.abundance, %)
Bufonidae	Rhinella marina	Cane Toad	OWS	LC ↑	IAS	2 (2.94)
Dicroglossidae	Limnonectes magnus	Mindanao Fanged frog	OTS	NT ↓	PE	22 (32.35)
	Limnonectes leytensis	Leyte Wart Frog	OWS	LC ↓	PE	1 (1.47)
	Occidozyga laevis	Common puddle frog	OWS	LC ─	NE	3 (4.41)
Ranidae	Pulchrana grandocula	Big-eyed frog	OWS	LC ─	PE	32 (47.06)
Agamidae	Draco bimaculatus	Two-spotted flying lizard	OWS	LC ─	PE	*3 (4.41)
Gekkonidae	Gekko mindorensis	Mindoro narrow-disked gecko	OWS	LC ─	PE	4 (5.88)
Scincidae	Eutropis multifasciata	Common Mabuya	OWS	LC ─	NE	*1 (1.47)
Total						68

*Legend: Philippine Red List Status = OTS- Other Threatened Species, OWS- Other Wildlife Species (DAO2019-09) ; Conservation status = LC- Least Concern, NT- Near-Threatened; Distribution Status = NE- Non Endemic, PE- Philippine Endemic, IAS- Invasive Alien Species; Population Trend = ↑- Increasing, ↓- Decreasing, ─ - Stable, ? – Unknown; *sighted*

Table 2-13 The herpetofauna species recorded in the study sites with their abundance and relative abundance

Family Name	Species Name	Common Name	Inside (Limestone Site)	Outside (Tinigbasan Site)	Inside (Limestone Site)
			2020 Data	2018 Data	2020 Data
Amphibians					
Bufonidae	marina	Cane Toad	1 (7.14%)	17 (8.63%)	1 (1.85%)
Dicroglossidae	leytensis*	Leyte Wart Frog	-	1 (0.51%)	1 (1.85%)
	*L. magnus**	Mindanao Fanged frog	13 (92.86%)	113	9 (16.67%)
	*laevis**	Common puddle frog	-	1 (0.51%)	3 (5.56%)
Ranidae	*grandocula**	Big-eyed frog	-	39 (19.80%)	32 (59.26%)
Rhacophoridae	*Polypedates leucomystax*	Common Tree Frog	-	11 (5.58%)	-
Reptiles					
Agamidae	*bimaculatus**	Two-spotted flying lizard	-	2 (1.02%)	3 (5.56%)
	*Hydrosaurus pustulatus**	Philippine Sailfin Lizard	-	4 (2.03%)	-
Gekkonidae	*Cyrtodactylus agusanensis**	Mindanao Bow-fingered Gecko	-	1 (0.51%)	-
	*mindorensis**	Mindoro Narrow-disked Gecko		-	4 (7.41%)
	Hemidactylus frenatus	Common House Gecko	-	1 (0.51%)	-
Scincidae	*E. multifasciata*	Common Mabuya		1 (0.51%)	1 (1.85%)
	*Lamprolepis smaragdina**	Emerald Skink	-	1 (0.51%)	-
	*Tropidophorus misaminius**	Misamis Waterside Skink	-	1 (0.51%)	-
Colubridae	*Ahaetulla prasina*	Jade Vine Snake	-	2 (1.02%)	-
	Chrysopelea paradisi	Golden Flying Snake	-	1 (0.51%)	-
Elapidae	*Naja samarensis**	Samar Cobra	-	1 (0.51%)	-
Total # of individuals (N)			14	197	54
Species Richness (R)			2	16	8
Total # of endemic species			1 (50%)	9 (56.25%)	6 (75%)

Table 2-13 shows the abundance and relative abundance of species during the 2020 field sampling is decreasing compared to 2018 data, wherein there were 197 individuals and 16 species captured and recorded. The abundance of species is the most significant ecological quantity required for understanding the dynamics of populations and decision-makings in biodiversity management and conservation (Yin and He, 2014). In the recent rapid assessment conducted in Payongpayong, data on species abundance was hard to record because speeding sampling period. Rapid assessment does not give comprehensive data on the species abundance, which is important in assessing risk of endangered species, monitoring invasive species, managing threatened species populations, and identifying keystone species in an ecosystem. With the recent results, it is not conclusive to compare the populations in different times considering the time allotted to collect the samples.

Reptiles and amphibians are very sensitive to environmental pressures (Barrows, 2011; Solania and Gamalinda, 2018; Böhm et al. 2016). Any change in the limestone ecosystem of the site, Payongpayong perhaps influence the abundance and diversity of herpetofauna in the area. The dispersal process of these organisms is not long range, hence, any disturbance along their route might eliminate them.

Based on the previous and recent results of the study, one of the possible reasons for the decline number of species collected aside from the time spent in collecting the samples is the on-going activities near the study site. Noise and other human activities may influence the foraging behavior, reproduction, and survival of amphibians and reptiles.

B. Bird Assessment

Rapid assessments of birds were conducted within and outside (Tinigbasan Site) the proposed limestone mining project of Agata Mining Ventures Inc in Tubay, Agusan del Norte. The survey was limited only to a total of 12-man hours. Eight (8) man hours were spent in the two (2) kilometer transect within the proposed project and four (4) man hours in the one kilometer transect outside the proposed project. The map showing the location of the sampling sites and points is presented in **Figure 2-21**. In general, the vegetation cover within and outside the proposed limestone project is mixed agricultural. However, the area of the proposed project is more forested compared to the adjacent sampling which is highly dominated by coconut and planted trees species.

A total of 217 individuals of birds belonging to 22 families, of 29 genera and 31 species were recorded in this survey (**Table 2- 14**). One hundred sixteen individuals (116) from 14 families, 16 genera and 18 species were observed within the proposed limestone mining site, while 101 individuals from 18 families consisting of 23 genera and 24 species were listed outside. Mostly are resident species, followed by endemic species (**Figure 2-31**). The five most abundant species listed in the survey are *Pycnonotus goiavier* (20%), *Haliastur indus* (12%), *Dicaeum australe* (6%), and *Aplonis panayensis* and *Cinnyris jugularis* with 5% observation respectively. The families *Pycnonotidae* (26%), *Accipitridae* (12%), *Dicaeidae* (7.8%), *Columbidae* (7.3%), and *Nectariniidae* (6.5%) are the most dominant families observed. The rarest are the families *Alcedinidae*, and *Pandionidae*, *Ardeidae* and *Pittidae* with 0.92% and 0.42% observations respectively.

Rapid assessment of birds were conducted within and outside the proposed limestone mining project of Agata Mining Ventures Inc in Tubay, Agusan del Norte. The procedure particularly followed the simple line transect count which was limited only to a total of 12 man hours. And the outside transect was traversed for four (4) man-hours every 5:00 to 9:00 in the morning. Eight (8) man-hours were spent in the two kilometers transect within the proposed project. The transect was divided into eight (8) central points marked at every 250 meters and traversed at every 5:00 to 9:00 in the morning and in the afternoon at 3 to 6 PM for a period of two days. Birds seen were recorded in a prepared data sheet. Meanwhile, the extent of the outside transect is only one kilometer since it already reached the population center.

A complete list of the inventoried birds, along with their conservation status are provided in the **Appendices.**

Figure 2-31 Residency status of the birds observed within and near the proposed limestone project

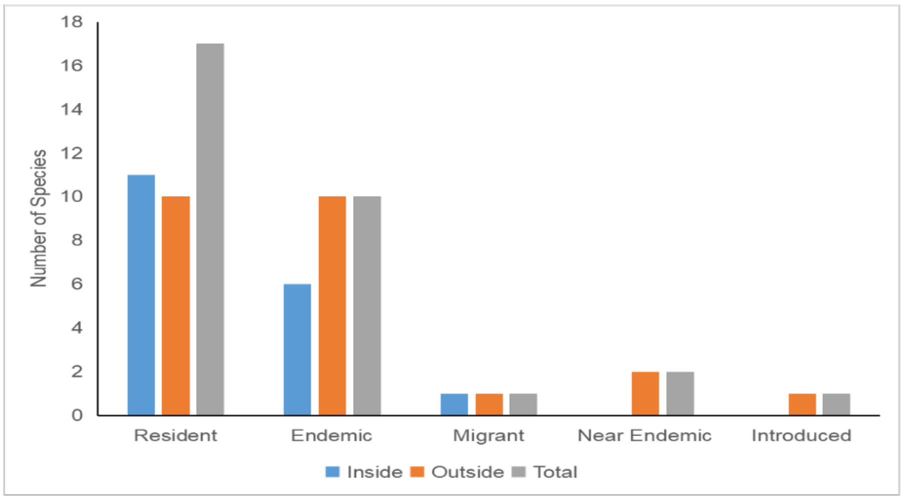


Table 2- 14 Composition and Diversity

Classification	Limestone Area	Tinigbasan Site	Total
Family	14	18	22
Genera	16	23	29
Individuals	116	101	217
Species	18	24	31
Shannon_H	2.47	2.83	
Evenness_e^H/S	0.66	0.70	

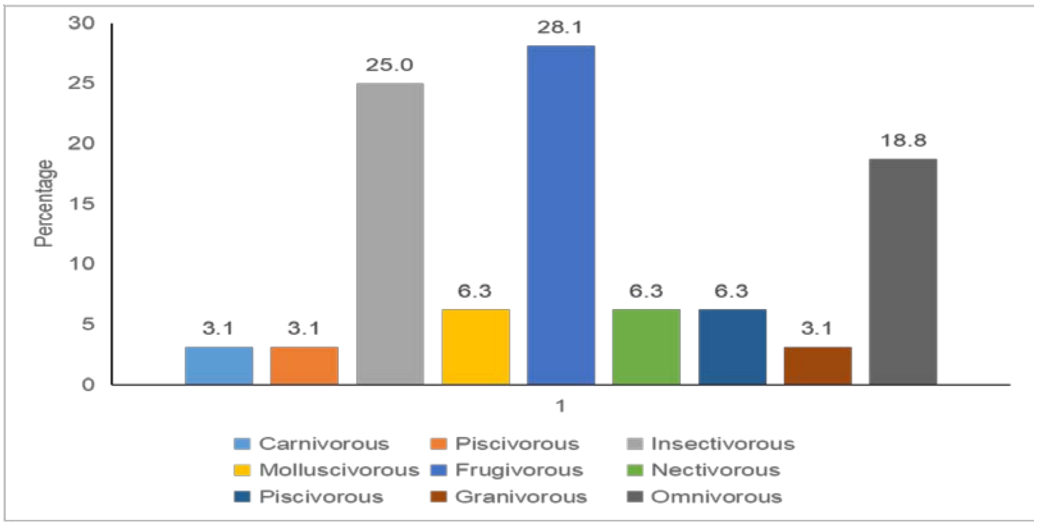
Photo 2-4 *Representative photos of birds recorded in the sampling sites.*

The diversity of birds was determined using the PAST software version 3. Species diversity and richness is a bit lower in the Limestone area (H'=2.47), while moderate diversity (H'=2.83) was noted at Tinigbasan site. Majority of the listed birds are resident species (53%) while 32% are endemic. There are also near endemic (6%) and introduced and migrant species with 3% respectively. There is no threatened species listed during the survey.

The feeding behaviours of birds were noted and were grouped into nine as shown in **Figure 2-32**. Results showed that most of the birds listed are frugivores (28%) followed by insectivores (25%) and omnivores (19%). The rarest are the carnivores, piscivores, granivores with 3% respectively. Obtaining information of the feeding types of the birds provides a clue for the type of habitat in an area.

Monitoring species composition, relative abundance, and diversity of birds provide baseline that can be useful for future environmental measures.

Figure 2-32 Feeding guilds of birds observed within and near the proposed project



C. Mammal Fauna

Eight (8) mammalian species belonging to four (4) families, represented by three (3) non-volant mammals namely: Philippine warty pig (*Sus philippensis mindanensis*), Asian civet cat (*Paradoxurus hermaphroditus*), and common field rat *(Rattus tanezumi)* were recorded. Of the non-volant mammals, only *R. tanzumi* was captured in a live trap during the sampling period. Meanwhile, the Philippine warty pig and Civet cats were not captured however, their notable occurrence was observed in the area. Indices of presence were detected such as foot markings, fecal remains, and other remnants of species activities. Five Mega-chinopteran fruit bat species were also recorded in this survey belonging to *Pteropidae* family represented by *Cynopterus brachyotis, Ptenochyrus jagori, Ptenochyrus minor, Rousettus amplexicaudatus, and Macroglossus minimus.*

A total of 195 of individuals of fruit bats were captured comprising of: *P. jagori* with 73 (37.44 %) and was most abundant followed by *C. brachyotis* 41 (21.03%), *R. amplexicaudatus* 40 (20.51%), *M. minimus* 21 (10.77%), and *P. minor 20 (10.26%)* recorded least. All fruit bat species were encountered in both sampling sites. The majority is recorded within Limestone site, with 114 (58.46%), while Tinigbasan has 81 (41.54%) captured. This survey recorded 108 (55.38%) of male fruit bats and 87 (44.62%) females. Adult dominated the age-structure composition with 144 (73.85%) abundance, while juvenile has 51 (26.15%) total captured fruit bats (**Table 2-15**). This survey also reported three (3) species of mammals that are endemic in the Philippines represented by *P. jagori*, *P. minor*, and *S. philipppinsis mindanensis.*

In terms of Conservation status, only *S. philipppinsis mindanensis* is threatened species categorized as Vulnerable by International Union Conservation of Nature (IUCN) and endangered species categorized by DENR-Administrative Order (DAO-2010), this species was recorded only in Tinigbasan site. Meanwhile, the other seven (7) species classified as Least Concern. A complete list of the inventoried mammals, along with their conservation status are provided in the **Appendices**.

Table 2-15 Community structure of fruit bats collected within Payong-payong and Tinigbasan watershed, Tubay Agusan del Norte

Species	Limestone Site	Tinigbasan Site	Total	Abundance (%)
Ptenochyrus jagori	49	24	73	37.44
Ptenochyrus minor	13	7	20	10.26
Macroglosos minimus	15	6	21	10.77
Russettus amplexicaudatus	26	14	40	20.51
Cynopterus brachyotis	11	30	41	21.03
Sex				
Male	84	24	108	55.38
Female	65	22	87	44.62
Ages				
Juvenile	39	12	51	26.15
Adult	110	34	144	73.85

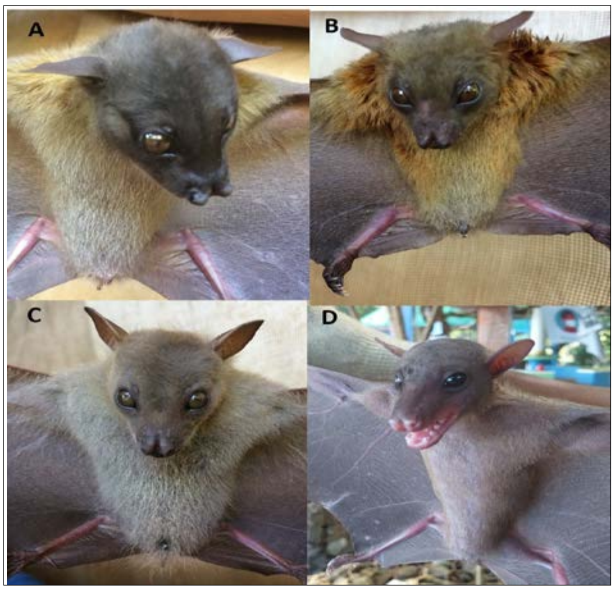


Photo 2-5 *Captured Mammals within the MPSA, Tubay, Agusan del Norte: A. Ptenochyrus jagori B. Ptenochyrus minor C. Cynopterus brachyotis, D. Rousettus amplexicaudatus E. Macroglossos minimus F. Rattus tanezumi*

C.1. Non-volant mammals

This survey recorded Philippine warty pig (*Sus philippensis mindanensis*); a member of the *Suidae* family with two pairs of warts and a tuft of hair extending warts closest to the jaw outwards. The conservation status of this species is categorized as Vulnerable by IUCN and endangered species classified by DAO-2010. The distribution is confined and endemic to the Greater Mindanao faunal region (Oliver 1995, 2001). Previously, this species was abundant from sea-level up to at least 2,800 meters in virtually all habitats (Rabor, 1986). Now it is common only in remote forests (Heaney et al., 1987). In this survey, foot marks and other indices of warty pig presence observed in the Tinigbasan sampling site that depicts this species' activities, indicating that the said mammal is still present in the area.

Asian palm civet (*Paradoxurus hermaphroditus*) was also recorded in Tinigbasan area. Indices of presence observed in this area a consumed fruit remains and fecal matter of a civet cat. This species is native to some Asian countries and widely distributed to forest habitats, including the Philippines. It usually inhabits in primary forest, but also occurs at lower densities in a secondary and selectively logged forest (Grassman, 1998). This species is thought to lead a solitary lifestyle, except for brief periods during mating (Thohari and Santosa, 1986: Joshi et al., 1995). It is both terrestrial and arboreal, showing a nocturnal activity pattern with peaks between late evening until after midnight. The Asian palm civet is an omnivore feeding foremost on fruits such as berries and pulpy fruits. Accordingly, it helps to maintain tropical forest ecosystems through seed dispersal as this species eats fruits and insects (Grassman, 1998). This species is widely distributed in the different faunal regions in the country, including Greater Mindanao with Least Concern conservation status.

Common field rat (*Rattus tanezumi*) is a highly adaptable non-native rat species that is commonly found in and around villages and agricultural areas. In the Philippines, it is common in disturbed lowland and montane forest up to 1,800 meters (Heaney *et al*., 1998). This species is commonly found in rice field habitats. Agricultural areas are mostly affected since rice has been identified as the main component of the *R. tanezumi* diet during the ripening to harvest stage of the rice crop. However, during off-season months, when rice grain was absent, insects, snails, and crabs were identified as dominant food items of this wild rats (Brown et al., 2017). The recent survey captured five individuals of *R. tanezumi* in Limestone site, particularly in a semi-agroforest area vegetation harbors with coconut trees and other fruit trees that may favor the proliferation of this species. During the survey, coconut and fruit remain consumed by *R. tanezumi* was observed in the area.

C.2 Volant Mammals

This survey reported five species of fruit bats from the Pteropodidae family comprising: *Cynopterus brachyotis, Ptenochyrus jagori, and Ptenochyrus minor, Rousettus amplexicaudatus, and Macroglossus minimus.* Of these fruit bat species, *only P. minor* and *P. jagori* are endemic species in the Philippines (Figure 1; Table 1). Both species are common inhabitants of primary, secondary forest, and occurrence may be attributed to the intact primary forest in the area. However, these species sometimes are forced to venture out in disturbed habitats to find suitable places that also harbor fruit trees in forested land for foraging activities (Rickart, 1993).

In this survey, *P. jagori* was captured in both sampling sites with a total of 73 individuals. This Philippine endemic bat is widely occurring throughout the archipelago except in the Palawan region. This species plays a vital role in forest regeneration that served as seed dispersers of trees in- and outside of the forest. Several individuals within the forest were observed foraging where vegetation is dominated with fruit trees member of the *Moraceae* family. This bat species will occasionally roost at the openings of caves. The current survey reported this species as the most abundant bat species captured with 37.44%.

Meanwhile, *P. minor* is the Philippine endemic where it is found only in the Mindanao faunal region and some island in the Visayas. It has been recorded from sea level to 1,600 meters above sea level. This species assessed as least concern, which common and widespread in arrange of suitable habitats. It is common in primary lowland and mountain forests and sometimes present in moss forests and can also be common in lightly degraded secondary forests. Its population is considered stable, and the species occurs in several protected areas (Heaney *et al.* 1998; Flores et al., 2015). This species is co-existed at upper elevation with *P. jagori*, and it was also reported that this found uncommon in lower elevation mossy-montane forest that had been subjected to habitat alteration (Heaney et al., 2006). In this survey, this species was also encountered in both sampling sites Limestone and Tinigbasan site with 13 and 7 number of individuals respectively, this species was recorded with the least captured bats (10.26%) in this survey.

Reusettus amplexicaudatus is a species of megabat or Old-World fruit bat, and it has brown or grey-brown bodies; their heads are usually darker than their underparts. This species is widely distributed in subtropical and tropical areas. They prefer lower elevations near coasts and roost in large limestone caves near the primary and secondary forest. *R. amplexicaudatus* fly over water barriers and the agricultural regions to reach their foraging and roosting sites (Kompanie, 2001). This species appears to have the same seasonality and synchrony of reproduction with the other three nectarivorous Philippines bats (Zubaid, 2004; Mould, 2012). In this survey, *R. amplexicaudatus* was encountered in both sampling sites, 26 individuals were captured in Limestone site, and 14 in Tinigbasan, and it has 20.51% total abundance.

Macroglossus minimus (long-tongued fruit bat) is amongst the smallest of the family Pteropodidae (Gunnell et al., 1996). This species is commonly found in urban coastal areas to denser forested areas at elevations from sea-level up to 1500 meters (Michleburgh et al., 1992). *M. minimus* usually roosts in rolled leaves either in-ground plants or trees or under tree branches and roofs. They feed primarily on nectar, pollen, and also drinks the juices of soft fruit (Nowak, 1991). This survey recorded a 10.77% abundance of this species and encountered in both sampling sites with 15 individuals in the Limestone area and six individuals in the Tinigbasan area.

Cynopterus brachyotis is the most frequent species that can thrive in a semi disturbed and disturbed habitats. In this preset survey, this species was recorded the most abundant in Tinigbasan area with a total of 30 individuals captured, and 11 individuals in Limestone site this species recorded high abundance (21.03%) next to *P. jagori*. *C. brachyotis* is common throughout the Philippines and is widely distributed in Southeast Asia. This species is generally brown to yellowish-brown with a brighter collar (Nowak, 1997). They prefer to roost in small groups in trees, under leaves, and in caves. They are frugivorous and prefer aromatic fruit, especially mangoes, and feed on small fruits by sucking out the juices and soft pulp and eating nectar and pollen (Payne et al., 1985). This fruit bat species plays an essential role in regenerating forests as seed dispersers of pioneer tree species (e.g., *Ficus spp*.) in open areas.

Fruit bats age-sex structure is the composition of a population in the area this determined by the number or proportion of males and females and age category (Table 2). This survey observed fair distribution of males and females in both sampling sites though the bat population is dominated by males with 108 individuals (55.38%) while females have 87(44.62%). It is worth noting that some encountered female bats during sampling periods were lactating and were carefully released immediately to avoid bats species from stress. The population's age-sex structure is the collective result of preceding trends in fecundity, mortality, and migration. Information on age-sex composition is essential for the description and analysis of many other types of demographic data. This survey recorded the age structure of bats community dominated by adults in both sampling sites comprising 144 (73.85%) total number of individuals captured while juvenile has only 51(26.15%).

The abundance of captured adults and male bats might be explained in their reproductive seasonality; pregnancy rates increased in females in July and peaked by females until September. Delpietro et al. (2017) reported that lactating females increased from this month to September to a peak of 60% in February. The bat's age-structure in a population is influenced by season timing in response to their habitat and climate factor. For example, plants undergo from flowering to pollination to fruit-bearing season. Most bats species are highly dependent on the availability of food items as essential requirements for gestation and reproduction. A recent survey implies that the bat population in the area has a stable population to withstand. Determining the sex-age structure of the bat's community is essential to determine the fecundity and productivity of bats species to assess the decreasing or increasing trend of population crucial for conservation.

In general, bats (*Chiroptera*) provide several ecosystem services and reflect the status of the plant populations on which they feed and pollinate as well as the productivity of insect communities (Jones et al., 2009). Fruit bats play an essential role in the environmental recovery of a particular area, which has experienced extreme degradation. Most notably in agricultural and mining areas such as the Caraga region. In addition to that, they can be a keystone species in which large aggregations of bats create guano used in fertilizing fields. They pollinate flowers of important orchard crops such as durian, and they contribute to forest restoration by dispersing tree seeds. The present survey implies that forest habitat Limestone and Tinigbasan area can still support and be suitable for fruit bats to thrive in where current data reported that sampling sites could harbor fruit bats species that were also found in intact forest. The recovered species is a signpost of a forest habitat that experienced moderate disturbance. These endemic or range-restricted species typically are viewed as less tolerant of a disturbance than are widespread species, presumably because of greater ecological specialization (Brown, 1995).

The adjacent forested area of the Tinigbasan site possesses a habitat that can be a relocation site for bats and other mammal species. Mammal community, species diversity, and abundance are excellent indicators to assess a particular area due to their sensitivity to habitat changes in the environment, such as vegetation, ground cover, and food resources (Whitmore, 1984; Gitonga et al., 2016). The total capture of this present survey indicates that the area has a moderate abundance of bat species. It is worth noting that the current study recorded some bat species that can serve as keystone species essential for the recovery of particular habitat that experienced extreme environmental degradation. With this information, it recommended designating a conservation site for bats and other mammal species found in these areas.

2.4.2.1. Threat to existence and/or loss of important local flora and fauna species

Based on the baseline data, the dominant tree species in the canopy, intermediate and ground forest layers that will be potentially cut include the *Vitex parviflora* (Tugas), *Adinandra robinsonii* (Sagimsim) and *Radermachera whitfordii* (Magasili). Tugas is considered Endangered tree species.

Other Endangered and Vulnerable species that will be possibly cut are presented in **Table 2- 16**. Tree species identified as Endangered and Vulnerable are based on International Union for Conservation of Nature 2020. All other floral species potentially affected by the Project construction and operation, identified during the baseline assessment, are considered common species within the country and the region. Preservation of this species is already implemented by the Company thru the establishment of a cloning facility. Relative to the faunal wildlife, the primary disturbance area will be concentrated at the Quarry Area. This area is more vegetated than the other proposed features of the Project and provide a more extensive habitat. Faunal species potentially to be impacted are summarized in **Table 2-17.**

Table 2- 16 Vulnerable and Endangered Flora Potentially Disturbed by the Project

Species	Common Name	Conservation Status
Anisoptera thurifera	Palosapis	Vulnerable
Artocarpus blancoi	Antipolo	Vulnerable
Cyathea contaminans	Anonotong	Endangered
Diospyros philippinensis	Kamagong gubat	Endangered
Litsea leytensis	Bantuling	Endangered
Myristica philippenses	Duguan	Endangered
Pterocarpus indicus	Narra	Endangered
Securinega flexousa	Anislag	Vulnerable
Shorea negrosensis	red lawaan	Vulnerable
Vitex parviflora	Tugas	Endangered
Xanthotemon verdugonianus	Mangkono	Endangered

Table 2-17 Important Local Fauna Species Potentially Disturbed by the Project

Taxa	Common Name	Scientific Name	Conservation Status
Amphibian	Mindanao Fanged frog	*Limnonectes magnus*	Near-Threatened

Most of the species identified within the proposed construction and operation areas of disturbance are classified Least Concern. Only one Near Threatened Frog was identified within the operation area. Migration of the species located within the disturbed areas to other undisturbed habitat areas is possible. The close proximity of the relatively undisturbed habitat areas e.g. Tinigbasan watershed that houses some endangered species and the availability of wildlife movement corridors will minimize the impacts on the faunal species.

2.4.2.2. Threat to abundance, frequency and distribution of flora and fauna species

With respect to the important forest species and distribution, *Vitex parviflora* (Tugas), *Adinandra robinsonii* (Sagimsim) and *Radermachera whitfordii* (Magasili) will be the most at threat species. These species have been identified as the highest Species Importance Value (SIV) and the most dominant species. These species were the most influential and important species with higher counts and greater frequency per unit area. Construction and operation activities will significantly impact the Tugas, Sagimsim and Magasili given its abundance within this particular area.

Artocarpus blancoi (Antipolo) was the most distributed tree species in whole area and was observed to have the largest canopy cover. The average height of trees in area ranges from 3.0meters to 20 meters.

As such, the vegetation is dominated by naturally stunted trees in a limestone forest. Other vegetative species are well and evenly distributed. Removal of this species within the impact area will significantly change in the diversity values of the area.

Relative to the faunal environment, most of the species identified are categorized from least concern to near threatened. A decrease in the abundance, frequency and distribution of the faunal species observed at the proposed quarry area may be significant during the construction and operation of the Project. Other areas may exhibit higher values in abundance but similar frequency and distribution values in the future. This is due to the migration of the species from the disturbed areas to adjacent areas not impacted by the Project. The adjacent forested area of the Tinigbasan site possesses a habitat that can be a relocation site for herpetofauna, bats and other mammal species. A no poaching of faunal species policy will be strictly enforced during the operations and closure phases of the operation.

Changing the landscape will directly impact movement ecology of wildlife particularly slow-moving fauna. It is expected the fauna will either adapt to the new habitat changes or migrate to other areas with similar habitat. The adjacent forested area of the Tinigbasan watershed can be a relocation site for wildlife fauna.

2.4.3. Management and Monitoring Plan Relevant to Terrestrial Ecology

A summary of the management and monitoring plans relative to the potential impacts to flora and fauna is provided in **Table 2-18.**

Table 2-18 Summary of Management Plan- Impacts to Terrestrial Ecology

Key Environmental Impact	Management Plan	Monitoring Plan
Vegetation Removal and Loss of Habitat	Implementation of Progressive Rehabilitation and Preservation of tree species thru cloning	AEPEP/ MMT
Threat to existence and/or loss of important local flora and fauna species	Offsetting of facilities. Establishment of biodiversity preservation zone.	Annual Flora and Fauna Monitoring
Threat to abundance, frequency and distribution of flora and fauna species	Offsetting of facilities. Establishment of biodiversity preservation zone.	AEPEP/ MMT

2.5. Hydrology and Hydrogeology

The Agata Limestone Project is located in the catchment of Payongpayong Creek and the road system towards project site, affecting the Tinagbasan Creek. The drainage basin is bounded by a natural topographic and geologic divide which separate one drainage area or watershed from the other. The drainage basin supplies water to streams and their tributaries. Streams are classified based on consistency of flows, namely: perennial, intermittent and ephemeral stream.

2.5.1. Watershed Characteristics

Based on its geographical location, two (2) sub- western watersheds of the ANLP site are directly affected by the Project activities, these are Payongpayong Creek (W12) and Tinigbasan Creek (W13). All these drains westerly directly to Payongpayong Bay. The western watersheds encompass a total tributary area of approximately 73.7 The individual watershed areas range in size from 23 hectares to 50 hectares. ANLP Project area watershed map, **Figure 2-33.**

The primary impact of the project site is within the Payongpayong Creek. Tinigbasan North Creek which is the adjacent watershed divide is considered as the secondary impact watershed. These two creeks have separate draining outlets directly towards Tubay Bay. A watershed map of the project site is shown in **Figure 2-34.**

Streamflow characteristics of the affected bodies of water are measured at sampling sites shown on **Figure 2-35**. The streamflow measurements are presented in **Table 2-19**, **Table 2-20 Table 2-21**, and **Table 2-22**.

Table 2-19 Local Watershed Rainfall-Runoff Characteristics

Catchment Basin	Drainage Area (sq.km)	Mean Annual Rainfall (mm)	Mean Annual Runoff Depth (mm)	Coefficient of Runoff	Estimated Annual Losses (MCM)	Estimated Annual Runoff (MCM)
Payongpayong Creek	2.057	2,891	481,958	0.57	0.045	991.4
Tinigbasan Creek 1 (Near Project Site)	0.48	2,891	411,264	0.36	0.018	197.4
Tinigbasan Main Creek	1.243	2,891	465,934	0.18	0.050	579.2

Table 2-20 Summary of Stream Flow Measurement within the Project Area

Creek Name	Tributary Watershed (km^2)	Stream Width (m)	Flow Area (m^2)	Mean Velocity (m/s)	Discharge (m^3/s)	Unit Discharge (m^3/s/km^2)
Payongpayong Creek	2.057	0.3	0.013	0.47	0.006	0.003
Tinigbasan North Creek	0.48	No Data	No Data	No Data	No Data	No Data
Tinigbasan South Creek	1.243	1.14	0.043	0.3	0.013	0.010

Figure 2-33- Watershed Map of the Agata Project Area

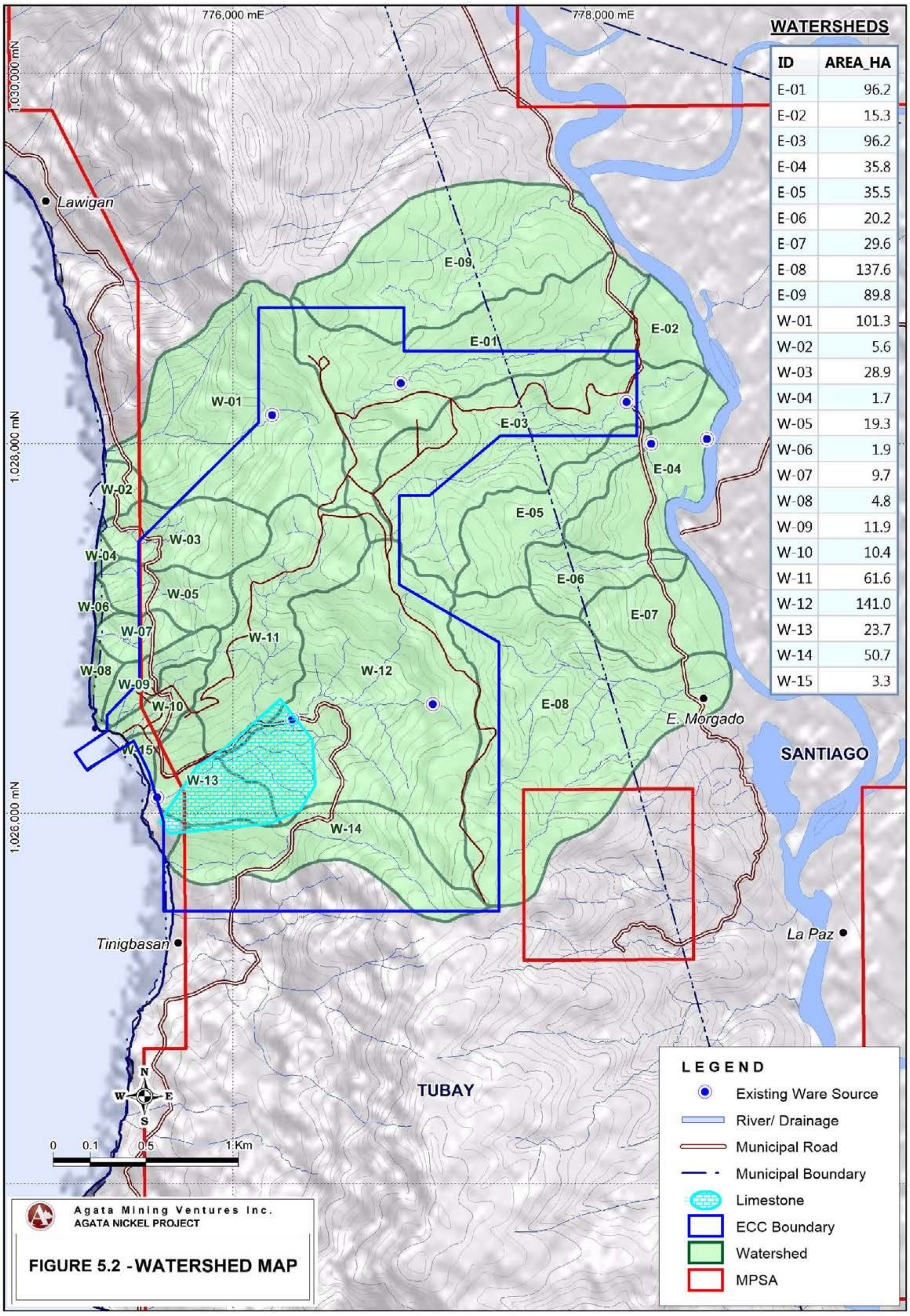


Figure 2-34 Limestone Project Site Watershed Area

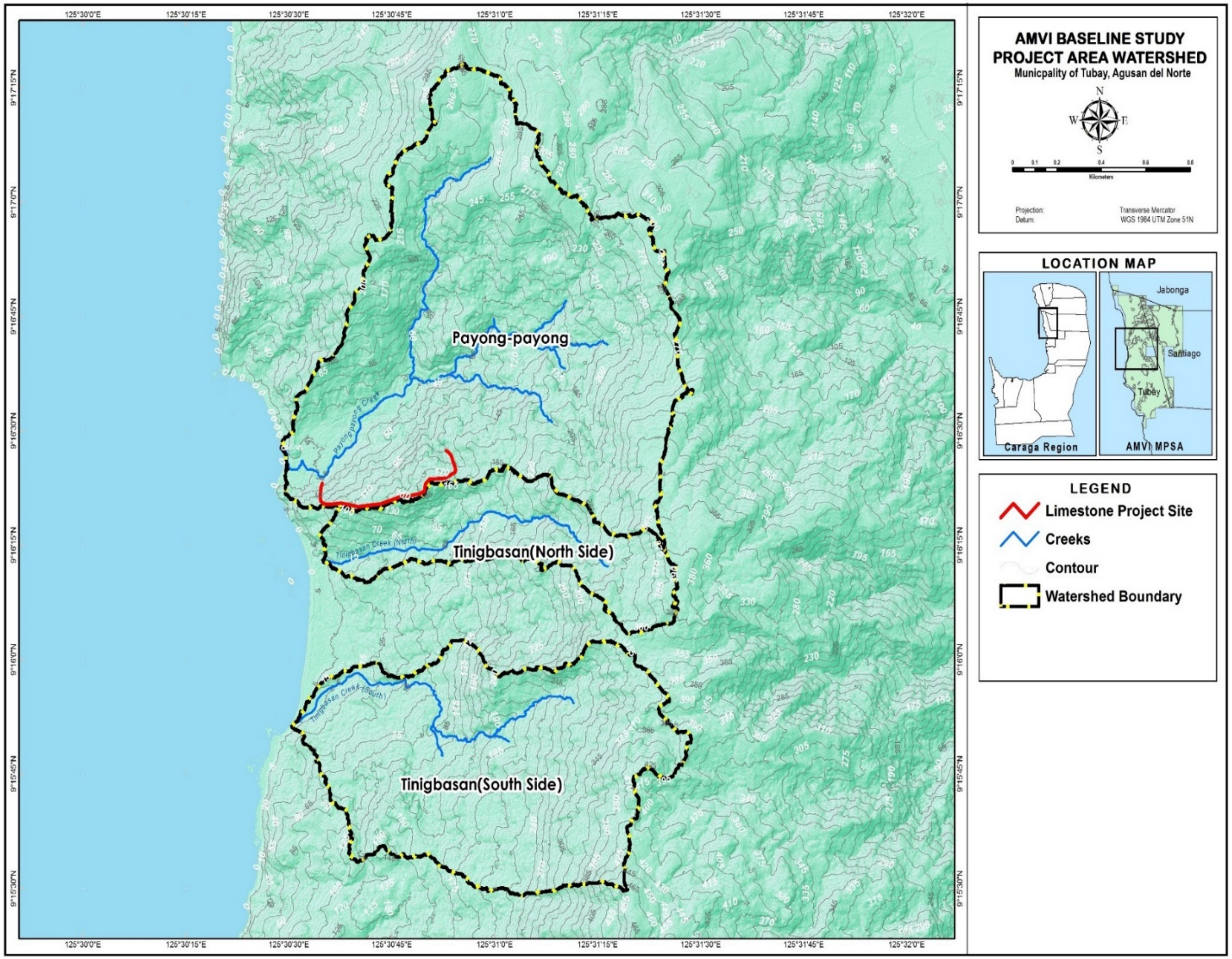


Figure 2-35 Watershed Stream Flow Sampling Site

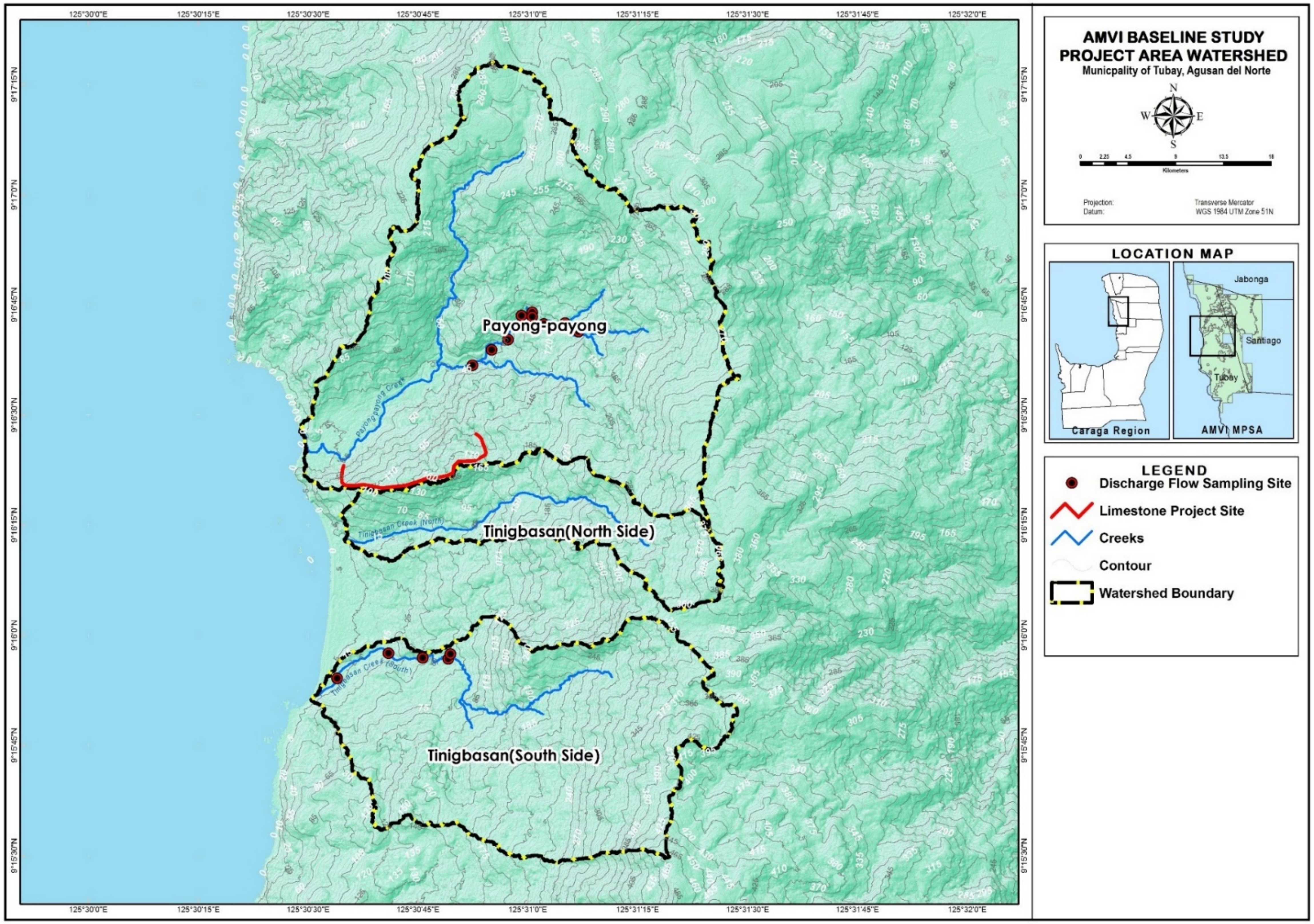


Table 2-21 Estimated Mean Monthly Total Stream Total Flow for Project Area Creeks (in cubic peters per second)

Creek	Discharge Units	Drainage Area (sq.km)	Jan 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 30	Sep 31	Oct 30	Nov 31	Dec 31
Payongpayong Creek (2014-2019)	m^3/s	18.93	7.62	7.80	6.67	6.47	10.85	7.97	7.67	9.33	9.23	9.82	13.48	18.93
Payongpayong Creek Unit Stream Flow	m^3/s/km^2	9.20	3.70	3.79	3.24	3.14	5.27	3.87	3.73	4.54	4.49	4.77	6.55	9.20
Tinigbasan North Creek (2014-2019)	m^3/s	4.27	1.53	1.45	0.85	1.25	2.40	1.28	1.12	1.87	1.90	2.03	2.95	4.27
Tinigbasan North Creek Unit Stream Flow	m^3/s/km^2	8.8889	3.1944	3.0208	1.7708	2.6042	5	2.6736	2.3264	3.8889	3.9583	4.2361	6.1458	8.8889
Tinigbasan South Creek (2014-2019)	m^3/s	11.40	4.65	4.93	4.05	4.05	6.50	4.72	4.50	5.67	5.45	5.90	8.15	11.40
Tinigbasan South Creek Unit Stream Flow	m^3/s/km^2	9.17	3.74	3.97	3.26	3.26	5.23	3.79	3.62	4.56	4.38	4.75	6.56	9.17

Table 2-22- Estimated Mean Monthly Stream Base Flow for Project Area Creeks (in cubic meters per second)

Creek	Discharge Units	Drainage Area (sq.km)	Jan 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 30	Sep 31	Oct 30	Nov 31	Dec 31
Payongpayong Creek (2014-2019)	m^3/s	2.057	3.92	3.75	4.13	4.00	4.13	4.00	4.60	4.65	4.50	4.65	4.50	4.65
Payongpayong Creek Unit Stream Flow	m^3/s/km^2	-	1.90	1.82	2.01	1.94	2.01	1.94	2.24	2.26	2.19	2.26	2.19	2.26
Tinigbasan North Creek (2014-2019)	m^3/s	0.48	0	0	0	0	0	0	0	0	0	0	0	0
Tinigbasan North Creek Unit Stream Flow	m^3/s/km^2	-	-	-	-	-	-	-	-	-	-	-	-	-
Tinigbasan South Creek (2014-2019)	m^3/s	1.243	2.58	2.35	2.58	2.50	2.58	2.50	2.58	2.58	2.50	2.58	2.50	2.60

Tinigbasan North Creek Unit Stream Flow	m^3/s/km^2	-	2.08	1.89	2.08	2.01	2.08	2.01	2.08	2.08	2.01	2.08	2.01	2.09 [KB1] [KB2]

2.5.1.1. Change in drainage morphology/inducement of flooding/Reduction in stream volumetric flow

Changes in topography due to the construction and operation of the limestone quarry will alter the natural drainage pattern of the area. Some natural bodies of water may be rechanneled to divert the water flow away from the disturbed areas. The removal of vegetation may reduce infiltration and water holding capacity of the watershed, resulting to higher flow velocities and peak discharges during rainfall events. These impacts, however, will likely be reversible once the progressive rehabilitation programs are initiated and the post mining closure and reforestation activities are implemented.

Construction and operation of the Limestone Quarry Area, Stockpile and Crushing plant will have the most visible and pronounced impacts on the watershed(s) drainage patterns. These will be direct and both short term and long term. They are also unavoidable and can likely be considered as irreversible.

Midstream portion of Payong-payong creek will be filled with limestone materials. The creek will be rechanneled or divert the water flow away from the disturbed areas. Natural stream flows as they currently exist will no longer be present. The peak flows during rainfall events will likely be higher due to the removal of vegetation and faster watershed response times for surface water runoff. Construction of drainage control facilities and conveyance canals will also increase the watershed response time and contribute to higher flow velocities and peak discharges.

2.5.1.2. Change in stream, lake water depth

Removal of vegetation and exposure of the underlying rock at the Quarry will reduce the infiltration capacity and water holding capacity within the watershed. This will result in less vadose zone and groundwater storage and may reduce the longer-term flows from springs and seeps. This in turn may reduce the longer-term watershed base flow. This will likely be reversible once the progressive rehabilitation programs are initiated and the post mining closure and reforestation activities are implemented.

The more significant impact to watershed base flow yields is associated with trans-basin diversion of water from one watershed into another. This may occur as operations water demands exceed the available water with Payong-payong Creek watershed. Water may be diverted from one of the other two immediate watersheds. The impact will likely be limited due to the close proximity of each watershed.

2.5.1.3. Depletion of water sources/competition in water use

The Municipality Tubay depend mainly on springs and creeks for their domestic water requirements. The location of water supply sources and the population they serve are summarized in **Table 2-23.** These water sources are typically located higher than the communities they serve. Concrete spring boxes and small dams are used to store the water while galvanized iron (GI), polyethylene (PE) and polyvinyl chloride (PVC) pipes connected to these structures convey the water by gravity to Level 2 and Level 3 water systems. A regional map of the groundwater sources is shown on **Figure 2-36**, while a map of the different water sources near the project site is presented in **Figure 2-37.**

Table 2-23 Community Water Sources

Water Source Location	Station No.	Service Coverage
Brgy. Lawigan, Tubay	CR3	100 Households
Brgy. Lawigan, Tubay	CR4	30 Households in SItio Sua
Brgy. Tinigbasan, Tubay	SP 2	169 Households

*Source: AMVI,2020; Note: Reference **Figure 2-37** for water source locations.*

The presence of shallow wells in the Tubay River floodplain indicates that the groundwater level in this area is shallower than 6 meters. While there are no wells in the adjacent mountains any occurrence of groundwater in this area will reside mainly in the weathered zone and will be situated shallower than the base of the weathered zone. Since groundwater moves from high to low elevation head, it will follow the topographic gradient and generally move from the mountains towards the floodplain. The groundwater in the floodplain will follow the direction of Tubay River and move southward to similarly discharge at Butuan Bay near Tubay town proper. The aquifers in the floodplain are recharged from direct rainfall infiltration, infiltration from the Tubay River and its tributaries and groundwater movement from high to low areas. Based on the water balance, the area takes in approximately 6% of the rainfall as groundwater recharge.

These water sources serve the communities surrounding the Project area but none of these resources can be affected by the project activities. Water requirement for the project activities shall be taken from other sources near to the project site, hence there will be no competition on the water use.

The sources experience reduced discharge during the drier seasons and increased turbidity during the rainy seasons. There are no long-term data relative to the discharge rates of these water sources.

Water supply for the mining operations is sourced from creeks and springs situated within or near the Project area and the Tubay River near the Project area. A list of the sources and flow rates are presented in **Table 2-24.** Daily consumption is approximately 1,400 liters for domestic use and another 20,400 liters for industrial use. This results in a total daily water demand of 21,800 liters. Drinking water is supplied by others and is not sourced from the Project operation sources identified in **Table 2-25.**

The supply sources for the Project needs have a discharge capacity in excess of 500,000 liters per day. This is significantly greater than the Project needs and allows for an increased supply availability for the community. Based on the available supply, the community water demands are not expected to be affected by the Project water demands. The community supply sources will remain intact and operational throughout the Project operations period. The opportunity is also available for further development of the different sources in the future such the community water supply needs increase.

Table 2-24 Water Supply Sources for Project Operation

Source	Station Number	Location	Flow Rate
Coboy Creek	CR9	778,262.69 E / 1,028,003.34 N	0.83 liter/ sec
Mantiawas Creek	CR10	778,128.81 E / 1,028,227.17 N	0.82 liter/ sec
Payon payong Creek	CR11	775,591.35 E / 1,026,092.37 N	0.99 liter/ sec
Solana Creek	CR12	776,320.30 E / 1,026,513.93 N	0.81 liter/ sec
Paiton Spring	SP11	776,907.00 E / 1,028,329.00 N	1.03 liter/ sec
Sua Spring	SP12	776,213.80 E / 1,028,158.16 N	0.96 liter/ sec
Kalinawan River	CR13	778,561.89 E / 1,028,029.41 N	0.43 liter/ sec
Payongpayong Spring	SP13	777,081.93 E / 1,026,595.35 N	0.77 liter/ sec

Source: API, 2016; Note: Reference **Figure 2-37** *for water source locations.*

Table 2-25 Discharge Measurements at Local Water Supply Sources April 2014

CR-1	CR-2	CR-4
0.4 L/sec	0.6 L/sec	0.3 L/sec
34,560 L/day	51,840 L/day	25,929 L/day

Source: API, 2014

Figure 2-36 Groundwater Availability Map

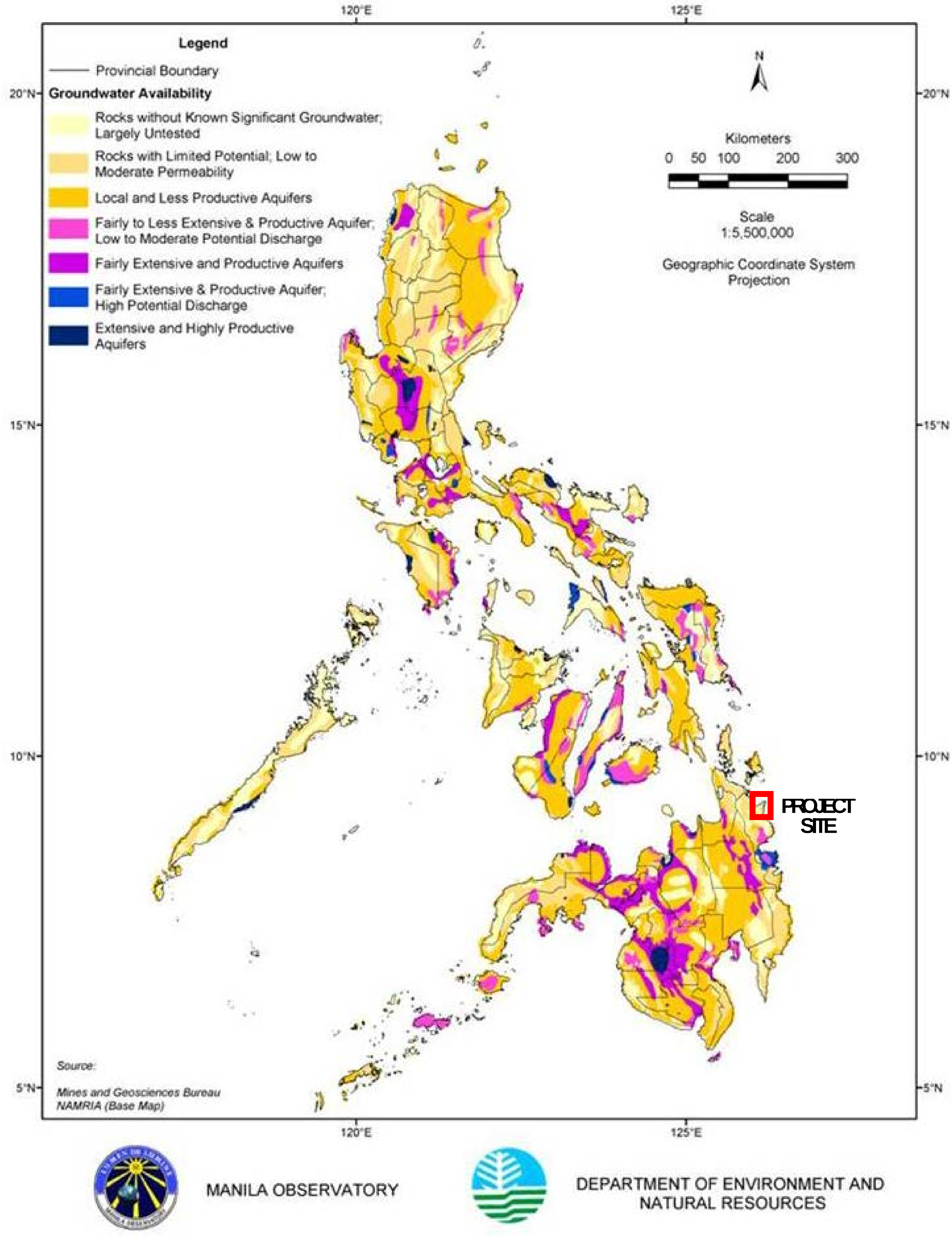
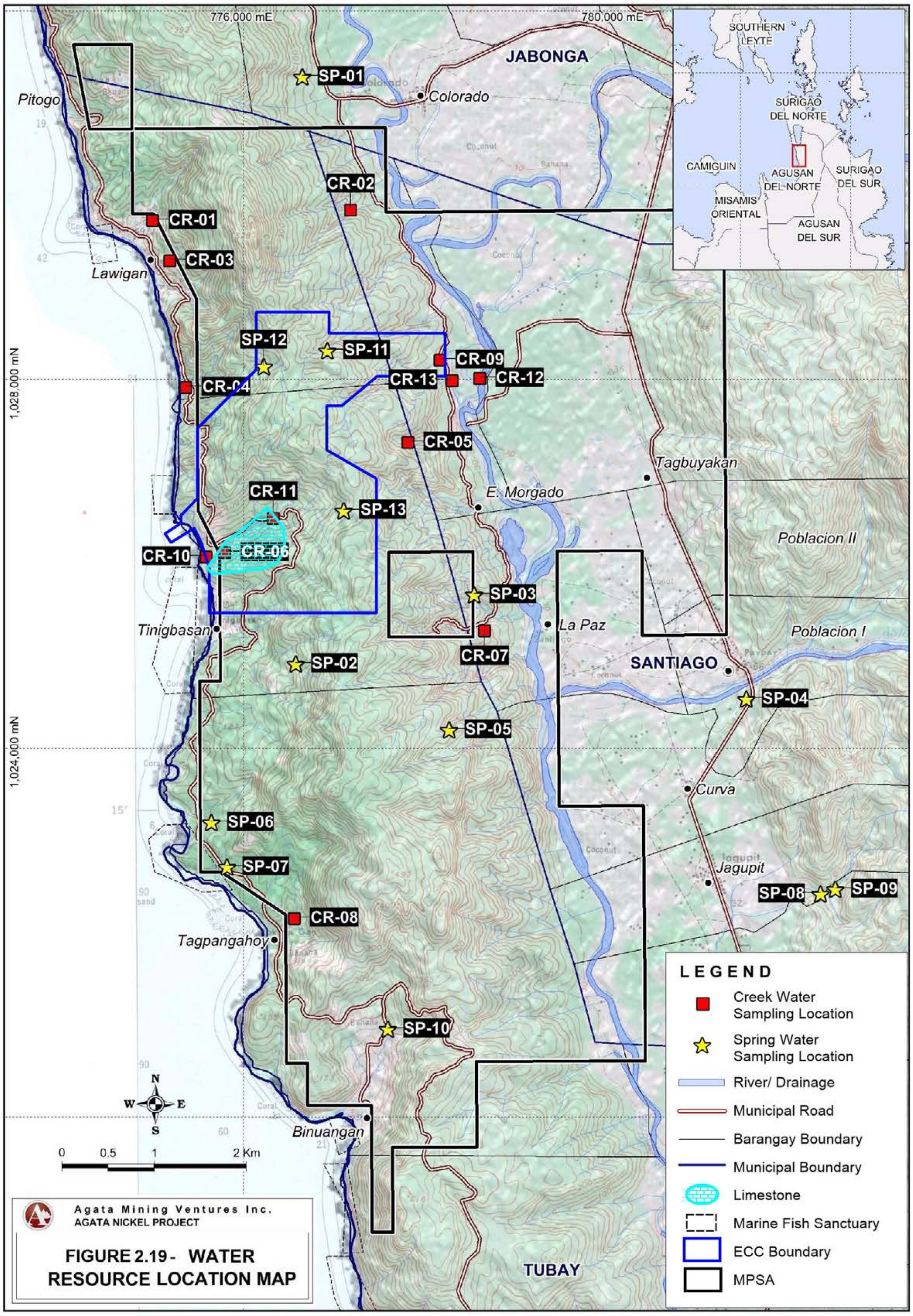


Figure 2-37- Water Source Map



2.5.2. Management and Monitoring Plan Relevant to Hydrology and Hydrogeology

A summary of the management and monitoring plans relative to the potential impacts to flora and fauna is provided in **Table 2-26.**

Table 2-26 Summary of Management Plan- Impacts to Hydrology and Hydrogeology

Key Environmental Impact	Management Plan	Monitoring Plan
Change in drainage morphology/inducement of flooding/Reduction in stream volumetric flow	Provision of buffer zones between the areas of disturbance and rivers and creeks. Erosion control measures including diversion canals, soil stabilization programs and re-vegetation of disturbed areas to reduce the soil loss potential.	Develop master infrastructure drainage plan for the project area.
Change in stream, lake water depth	Development of overall Drainage Plan to balance volume flow of water within the Project site.	Establish stream flow monitoring stations at selected locations in the project.
Depletion of water sources/competition in water use	Implement water recycling and conservation Programs. Iec programs for water use and water Conservation.	Prepare and monitor water balance data to determine input and output requirements in the process operation and determine areas for potential water conservation measures.

2.6. Oceanography

A baseline study from Gaia South Inc. before the construction of Port facility was conducted. Three oceanographic stations were established along the Butuan Bay coastline. The first station (OC1) is located near Binuangan, the second station (OC2) is located near Tagpangahoy and the third station (OC3) is located near Payong-payong. Ocean current data was collected from current meters moored at the three stations (5 meters below the ocean surface) and by drogues near each of the current meters. Current velocity and seawater temperature data are summarized in **Table 2-27.**

Table 2-27 Ocean Current Data by Current Meter Measurements

Station	Ebb Tide Current (cm/sec)		Flood Tide Current (cm/sec)		Seawater Temperature (C)
	Current Velocity	Direction	Current Velocity	Direction	
OC 1	1.4 to 24.4	WSW to NNW	3.2 to 12.8	WNW to N	28.9 to 29.5
OC 2	2.8 to 16.4	To NW	0.6 to 29.0	To NW	28.9 to 29.8
OC 3	2.0 to 24.0	SSE to WSW	4.8 to 16.0	S to SE	29.25 to 30.25

Source: Gaia South Inc.(2012)

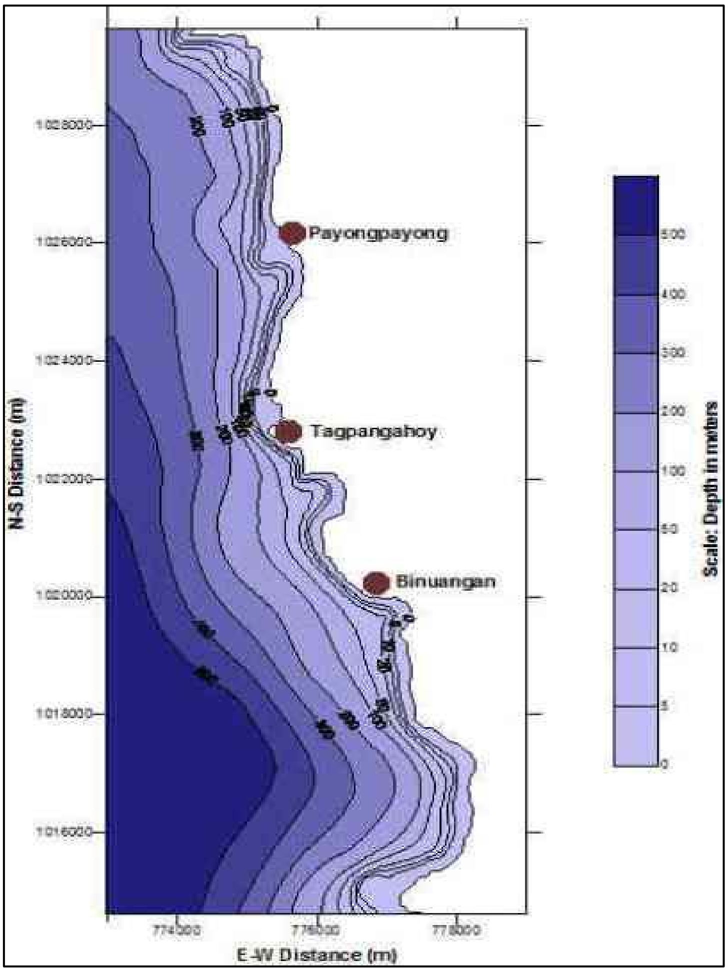
Bathymetry data were collected at the 3 stations to establish their depth profile. The depth profile at Station OC1 (Binuangan) indicates a gradient of 5.3% within the first 140 meters from the shore with a maximum water depth of 10 meters. From 140 meters to 220 meters from the shore the gradient increases to 47.9% with a maximum water depth of 40 meters.

The depth profile at Station OC2 (Tagpangahoy) indicates a gradient of 13.6% within the first 70 meters from the shore with a maximum water depth of 10 meters. From 70 meters to 200 meters from the shore the gradient increases to 39.1% with a maximum water depth of 47 meters.

The depth profile at Station OC3 (Payong-payong) indicates a gradient of 2.4% within the first 440 meters from the shore with a maximum water depth of 10 meters. From 440 meters to 560 meters from the shore the gradient increases to 23.8% with a maximum water depth of 38 meters.

A more localized bathymetric survey was done in the Port location prior to its construction in Year 2014 and is shown in **Figure 2-38.** The bottom profile showed a gradual bathymetric change from the shore to the 250 meter length of the causeway. Beds of subtidal boulders or less rough textured rocks and/or large stones with growths of algae which cover the surface of the rock are a common feature of the first 20 meters off shore. After this region is a fringing coral reef in poor to fair condition (20 to 130m away from shore with a depth range of 1.0 to 6.0m). Sandy substrates make up the remainder of the sea bottom (130 to 250 m away from the shore with a depth range of 6 to 18m). Much of its surface is covered by a very thin sheet of silt and mud. The deposited sediment is loosely packed and highly re-suspendable with only little disturbance.

Figure 2-38 Bathymetric Map Along West Coast of the Project Area



Source: Gaia South Inc. (2012)

2.6.1. Impacts to Coastal Oceanography

Ports may cause changes in current patterns and littoral drifts due to alteration of wave refraction, diffraction, and reflection and consequently lead to erosion in shore zones. Altered currents and reflected waves may cause changes in river flow and waterfront drainage. Breakwaters and landfills also cause water stagnation behind the structures, which accelerate sediment deposition at the sea bottom.

Careful site selection was employed to mitigate the impacts. The lay-out of the Port is such that the access road development does not interfere with the flow of Payong-payong Creek. Beach erosion is prevented by establishing gabion baskets to serve as sea wall.

The extraction volume will not entail expansion of Port facility; hence no further alteration of the seabed from reclamation will occur. Impacts to coastal oceanography identified from the existing operation will be the same given the expanded operations.

2.6.2. Management and Monitoring Plan Relevant to Coastal Oceanography

A summary of the management and monitoring plans relative to the potential impacts to oceanography is provided in **Table 2-28.**

Table 2-28 Summary of Management Plan- Impacts to Oceanography

Impact	Management Plan	Monitoring Plan
Change/disruption in water circulation pattern, littoral current, and coastal erosion and deposition	Planned site selection to reduce footprint. Construction of pier facility according to approved design. Installation of gabion baskets as sea wall No causeway expansion for the ALP.	Adherence to Annual EPEP MMT Activities

2.7. Water Quality

2.7.1. Physico-chemical Characterization

Water quality monitoring sampling and testing is performed internally by the Environment Department as part of the quarterly audit by the ANLP Multipartite Monitoring Team. A total of 32 locations are sampled, of these, 17 locations are surface water streams and creeks, nine (9) are groundwater or spring sources and six (6) locations are marine water sources. Out of this water sampling stations, six (6) stations are within the affected watershed of the Limestone Project. These locations are FW-11 Downstream Payongpayong Creek, FW-12 Tinigbasan Creek Confluence of Tributaries, DW-2 Sitio Payongpayong Water Source, DW-3 Brgy. Tinigbasan Water Source, MW-2 Payongpayong Coastal Area and MW-3 Tinigbasan Coastal Area.

The location of each sampling point (surface water, drinking water and marine waters) is shown on **Figure 2-39** and **Figure 2-40.** The location reference for each station is shown in **Table 2-29.** Sampling activities are done weekly or monthly depending on the requirements and parameters monitored.

Water quality monitoring activities include in-situ measurement of physical parameters such as pH, turbidity, and temperature. Laboratory analysis of chemical parameters include Nitrate, Phosphate, Hardness, DO, Ammonia, Fluoride, surfactants, arsenic, cadmium, lead, iron, manganese, total suspended solids, oil and grease, BOD. The laboratory testing is done by accredited third party laboratories. Bacteriological testing is also done to determine fecal and total coliform levels.

Selection of sampling stations were based on the topographic characteristics and watershed delineations within the Project area. Surface water sampling stations begin at or near the mouth of the river or creek and progress upstream. Sampling locations are selected from both the west and east watersheds to support full water quality characterization of the Project area. This applies to all rivers, creeks and streams including intermittent and ephemeral creeks.[ML3]

Furthermore, the sampling stations are distributed following these criteria; number of contributing tributaries and pollutant discharges, safety, accessibility and Project activity considerations that may affect the water quality of the affected stream.

Marine sampling stations in Butuan Bay were selected based on geographical location, tidal and sea current movement of the water. Samples are taken 50-150 meters from the shoreline or from the activity area to establish ambient conditions of the water prior to and during the activity.

Groundwater stations for drinking water monitoring are selected based on the geographical location of the source within the Project area and level of importance to the community.

Results of the laboratory testing were compared to the DENR standard for Class C freshwater and Class SC marine water, respectively; while drinking waters results are compared to Philippine National Standard for Drinking Waters (PNSDW). Water quality data reported in the Quarterly Self-Monitoring Report is presented in **Table 2-30**, **Table 2-31**, **Table 2-32** for the surface water, marine water, and drinking water sampling stations, respectively.

Figure 2-39- Water Sampling Map ANLP Monitoring

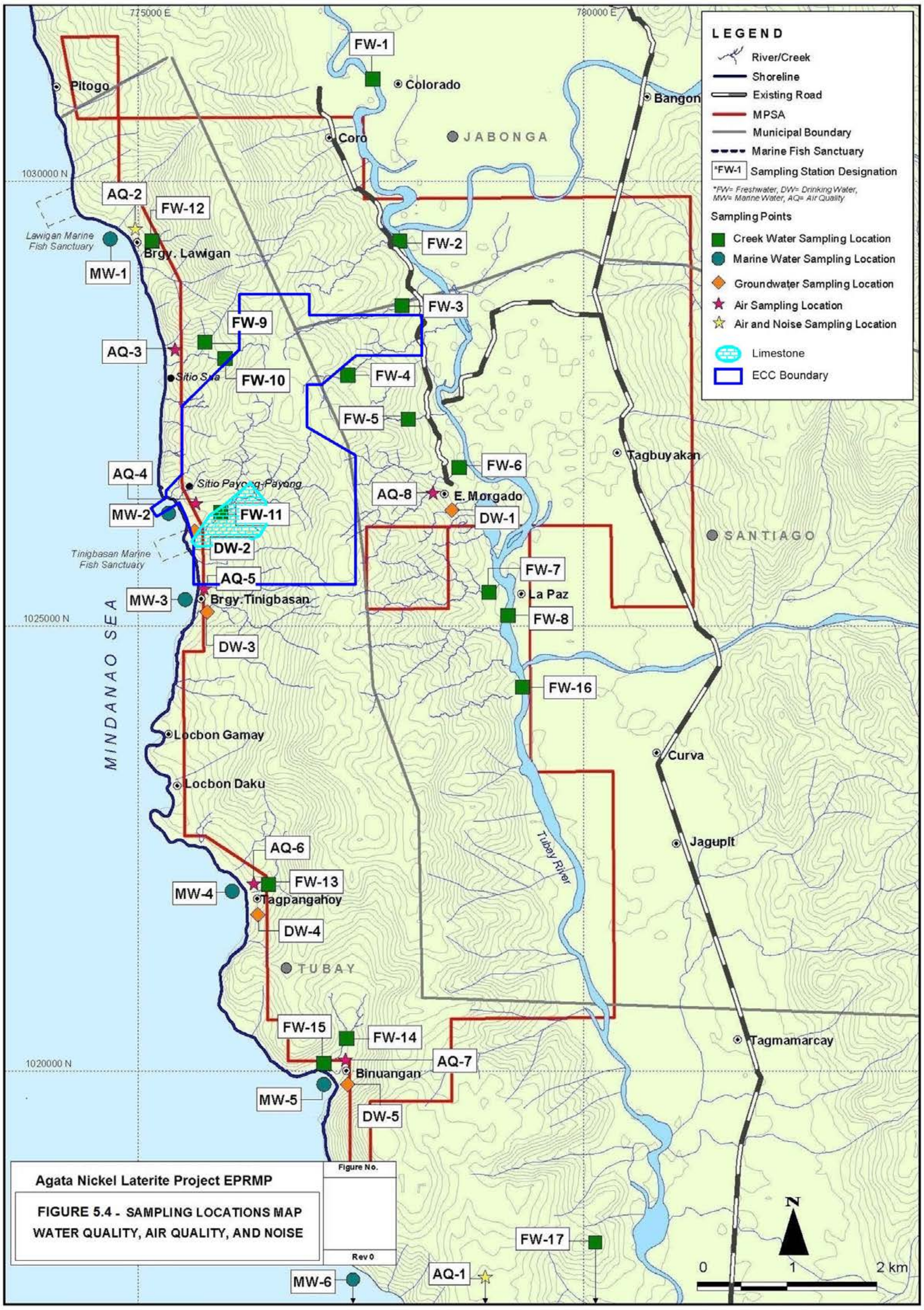


Figure 2-40- Sampling Location Map for Water Quality, Air Quality and Noise Quality Monitoring for the Limestone Project

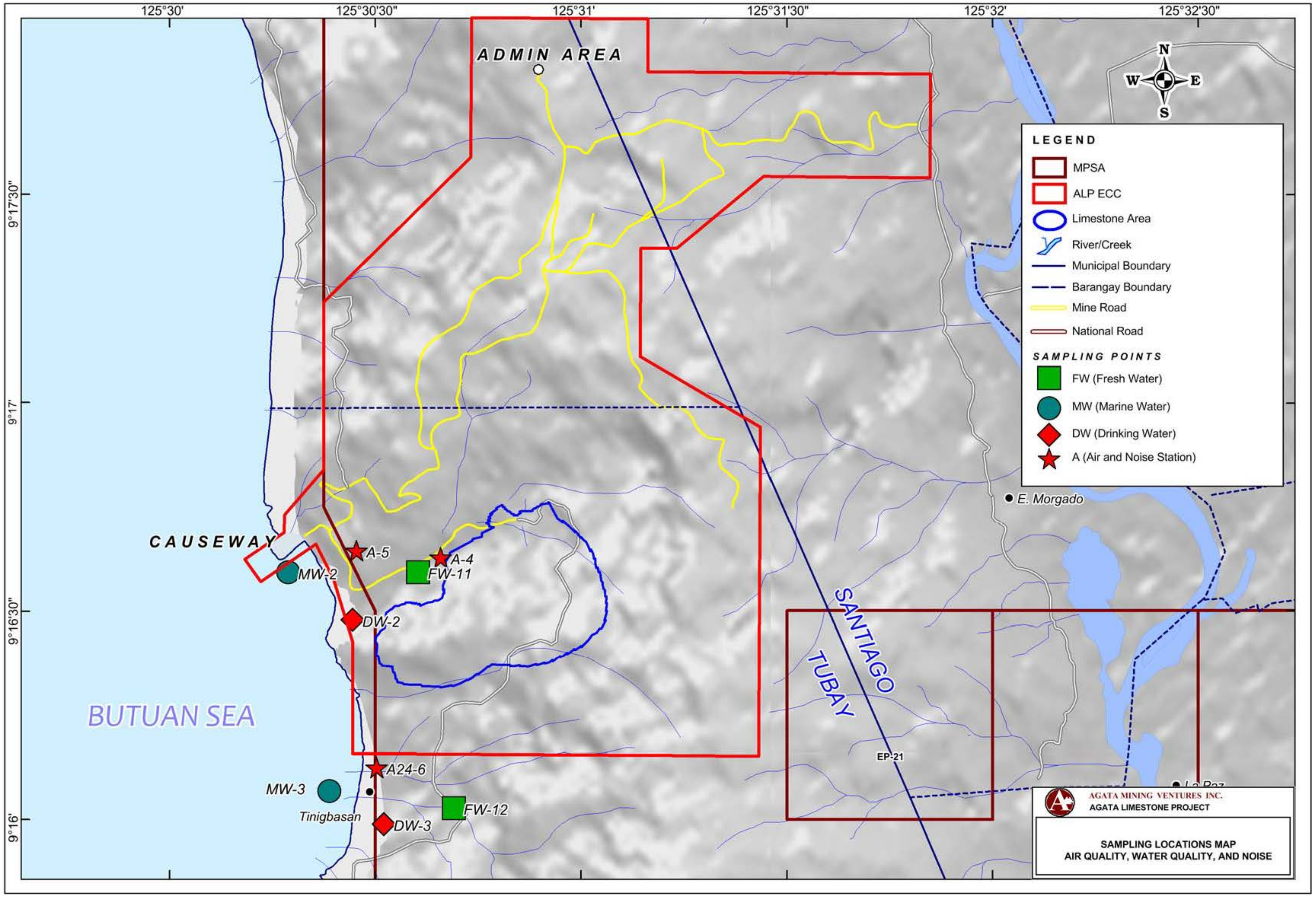


Table 2-29 Sampling Location Reference Table (Reference **Figure 2-39** and **Figure 2-40**)

River/Creek	Station No.	Description
Kalinawan River (Tubay River)	FW-1	Confluence with Bangonay River
Nangka Creek	FW-2	Downstream Road Culvert
Paiton Creek	FW-3	Upstream Road Culvert
Mantiawas Creek	FW-4	Upstream Reforestation
Duyangan Creeks	FW-5	Downstream SSM Area
Agata Creek	FW-6	Downstream Road Culvert
Guinaringan Creek	FW-7	Upstream Confluence with Kalinawan River
Kalinawan River	FW-8	Midstream Kalinawan River
Sua Creek 1	FW-9	Monitoring Station Removed
Sua Creek 2	FW-10	Downstream Reach
Payongpayong Creek	FW-11	Downstream Payongpayong Creek
Tinigbasan Creek	FW-12	Confluence of Tributaries
Tagpangahoy Creek	FW-13	Downstream Road Culvert
Binuangan Creek	FW-14	Confluence of Tributaries
Binuangan Creek	FW-15	Intertidal Zone Butuan Bay
Kalinawan River	FW-16	Downstream Confluence with Santiago River
Kalinawan River	FW-17	Near Tubay Bridge
E. Morgado, Jabonga	DW-1	Brgy. E. Morgado Water Tank
Payongpayong, Tinigbasan	DW-2	Sitio Payongpayong Water Source
Tinigbasan, Tubay	DW-3	Brgy. Tinigbasan Water Source
Tagpanghoy, Tubay	DW-4	Brgy. Tagpangahoy Water Source
Binuangan,Tubay	DW-5	Brgy. Binuangan Water Source
Lawigan Coastal Area, Tubay	MW-1	
Payongpayong Coastal Area	MW-2	Note:
Tinigbasan Coastal Area	MW-3	SW- Surface Water
Tagpanghoy Coastal Area	MW-4	MW- Marine Water
Binuangan Coastal Area	MW-5	DW- Drinking Water
La Fraternidad Coastal Area	MW-6	

Table 2-30 Surface Water Quality Data (Year 2019) (Reference:

Parameter	DENR (Class C)	Sampling Stations							
		FW-1	FW-2	FW-3	FW-4	FW-5	FW-6	FW-7	FW-8
BOD	7 mg/l	0.63	0.74	0.51	0.75	0.83	0.60	0.28	0.32
Chloride	250 mg/l	4.25	5.17	4.53	4.27	2.83	3.60	2.73	4.87
Color	75 TCU	6.67	6.67	6.67	5.00	5.00	5.00	5.00	5.00
DO	5 mg/l (min)	7.03	7.81	7.63	7.73	8.19	7.45	8.27	6.98
Fecal Coliform	200 MPN/ 100 mL	54.00	56.33	75.00	>4065.5	155.67	143.33	94.00	430.67
Nitrate (NO3-)	7 mg/L	0.07	0.05	0.07	0.09	0.09	0.08	0.07	0.08
pH	6.5-9	8.07	7.26	7.91	8.11	7.89	8.42	7.95	7.94
Phosphate	0.5 mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Temperature	25-31°C	26.17	26.53	26.21	26.66	26.72	26.06	26.23	26.89
TSS	80 mg/l	57.67	31.00	39.33	63.33	60.00	33.00	45.33	22.33
Oil and Grease	2.0 mg/l	<1	<1	<1	<1	<1	<1	<1	<1
BOD	7 mg/l	0.63	0.74	0.51	0.75	0.83	0.60	0.28	0.32
Chloride	250 mg/l	4.25	5.17	4.53	4.27	2.83	3.60	2.73	4.87
Color	75 TCU	6.67	6.67	6.67	5.00	5.00	5.00	5.00	5.00
DO	5 mg/l (min)	7.03	7.81	7.63	7.73	8.19	7.45	8.27	6.98
Manganese	0.2 mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic	0.02 mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.005 mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	0.05 mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	0.2 mg/l	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Note: TSS baseline 106 mg/L (FW1. FW2, FW3, FW4, FW5); 672 mg/L (FW8)
Source: ANLP Self-Monitoring Report (2019)

Table 2-30 Surface Water Quality Data (Year 2019)

Parameter	DENR	Sampling Stations							
	(Class C)	FW-10	FW-11	FW-12	FW-13	FW-14	FW15	FW-16	FW-17
BOD	7 mg/l	0.40	0.52	1.25	0.50	1.08	0.71	0.51	0.70
Chloride	250 mg/l	4.33	3.50	7.73	3.37	5.00	24.10	5.13	5.33
Color	75 TCU	9.33	4.67	6.00	4.67	5.3	4.85	9.21	8.4
DO	5 mg/l (min)	7.94	8.04	7.79	7.88	7.73	8.18	7.27	7.95
Fecal Coliform	200 MPN/ 100 mL	151.67	153.33	176.50	94.50	156.00	253.67	493.33	336.33
Nitrate (NO3-)	7 mg/L	0.09	0.21	0.05	0.09	0.06	0.08	0.08	0.09
pH	6.5-9	8.17	8.16	8.69	7.58	8.16	7.26	8.19	7.92
Phosphate	0.5 mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Temperature	25-31°C	26.21	26.15	26.21	27.08	26.90	26.05	26.16	26.41
TSS	80 mg/l	33.33	37.67	27.00	40.33	32.33	41.67	55.33	56.67
Oil and Grease	2.0 mg/l	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	0.2 mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic	0.02 mg/l	<0.01	<0.01	<0.011	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.005 mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	0.05 mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	1.5 mg/l	0.40	0.20						
Mercury	0.002 mg/l	<0.001	<0.001						
COD		<3	<3						
Ammonia	0.05 mg/L	0.01	0.02						
Fluoride	1 mg/L	0.09	0.21						
Surfactants	1.5 mg/L	<0.01	<0.01						

Source: ANLP Self-Monitoring Report (2019); Additional Water Quality Testing for COD, Ammonia, Flouride, Surfactants, Iron and Mercury (2020)

Table 2-31 Drinking Water Quality Data (Year 2019)

Parameter	PNSDW	Sampling Stations								
		DW-1	DW-2	DW-3	DW-4	DW-5	DW-6	DW-7	DW-9	DW-10
BOD	7 mg/l	0.99	0.70	0.72	0.69	0.77	0.72	0.87	0.91	0.75
Chloride	250 mg/l	2.25	1.81	1.49	2.48	2.40	2.79	2.99	2.50	2.89
Color	10 CU	<3	<3	<3	<3	<3	<3	<3	<3	<3
DO	5 mg/l (min)	6.64	7.03	7.39	7.34	7.26	7.54	7.53	7.36	7.21
Fecal Coliform	<1.1 MPN/ 100 mL	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	6.28
Parameter	Baseline	DW-1	DW-2	DW-3	DW-4	DW-5	DW-6	DW-7	DW-9	DW-10
Nitrate (NO_3^-)	50 mg/L	0.07	0.15	0.11	0.13	0.23	0.12	0.18	0.32	0.21
pH	6.5-8.5	7.40	6.73	7.06	7.05	7.08	7.57	7.41	7.93	7.93
Phosphate (PO_3^-)	0.5 mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Temperature	25-30°C	26.74	27.69	27.20	27.08	28.28	27.51	26.98	26.00	25.79
TSS	80 mg/l	50.50	38.00	53.75	22.25	35.25	32.50	50.50	44.50	30.67
Oil and Grease	1.0 mg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	0.4 mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Iron	1.0 mg/l	0.09	0.09	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic	0.01 mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.003 mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	0.01 mg/l	<0.00875	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	0.7 mg/l	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Parameter (added)	PNSDW	DW-1	DW-2	DW-3	DW-4	DW-5	DW-6	DW-7	DW-9	DW-10
Iron	1.0 mg/l		<0.06	<0.06						
Mercury	0.001 mg/l		<0.001	<0.001						
COD			<3	<3						
Ammonia	0.05 mg/L		0.03	0.03						
Fluoride	1.5 mg/L		0.26	0.24						
Surfactants	0.2 mg/L		<0.01	<0.01						

Source: ANLP Self-Monitoring Report (2019); Additional Water Quality Testing for COD, Ammonia, Flouride, Surfactants, Iron and Mercury (2020)

Table 2-32 Marine Water Quality Data (Year 2019)

Parameter	DENR	Sampling Stations					
	(Class SC)	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
BOD	N/A						
Chloride	N/A	17525.00	20020.00	18400.00	64550.00	17565.00	18425.00
Color	75 TCU	4.50	4.50	4.50	4.00	4.50	3.50
DO	5 mg/l (min)	7.06	6.72	6.84	6.63	6.57	7.00
Fecal Coliform	200 MPN/ 100 mL	170.25	169.75	105.25	143.00	125.75	99.50
Nitrate (NO3-)	10 mg/L	0.13	0.37	0.14	0.10	0.25	0.49
pH	6.5-8.5	7.88	7.95	7.80	7.65	7.72	8.04
Phosphate	0.5 mg/l	BDL	BDL	BDL	BDL	BDL	BDL
Temperature	25-31°C	26.58	26.90	26.70	27.32	26.71	26.95
TSS	80 mg/l	30.00	67.00	45.75	34.00	24.71	24.00
Oil and Grease	3.0 mg/l	<1	<1	<1	<1	<1	<1
Manganese	0.4 mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic	0.02 mg/l	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Cadmium	0.005 mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	0.05 mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	0.06 mg/l	0.02	0.02	0.02	0.02	0.02	0.02
Manganese	0.4 mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Parameter (added)	(Class SC)	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
Iron	1.5 mg/l		<0.06	0.20			
Mercury	0.002 mg/l		<0.001	<0.001			
COD			11	49.00			
Ammonia	0.05 mg/L		o.03	0.26			
Fluoride	1.5 mg/L		0.26	0.95			
Surfactants	1.5 mg/L		<0.01	<0.01			

Note: TSS baseline 106 mg/L (FW1. FW2, FW3, FW4, FW5); 672 mg/L (FW8)
Source: ANLP Self-Monitoring Report (2019); Additional Water Quality Testing for COD, Ammonia, Flouride, Surfactants, Iron and Mercury (2020)

Results of the water testing for surface water, drinking water, and marine water presented in **Table 2-30 Table 2-31**, **Table 2-32**, respectively, showed that all Physico-Chemical parameters are within the DENR Standard. The pH values ranged from 7.2to 8.16, which were well within the normal limits for marine or freshwater bodies, per DAO 2016-08 Class C and Class SC water quality standards.

Total suspended solids (TSS) include both inorganic and organic substances present in the water and are retained in a 0.45 um filter paper .The TSS levels in Surface Water varied from 22 to 63 mg/L., 23 to 50mg/L in Ground Water, and 24 to 67 mg/L in Marine Waters, all are within the DENR Standard.

The detectable levels of Biological Oxygen Demand (BOD5) ranged from 0.40 to 0.90 mg/L, basically this level is low compared to the DENR Class C and SC waters requirement to maintain BOD5 of up to 7 mg/L.This BOD reading is inversely proportional to the DO levels detected in all stations sampled which is above the maintaining level of 5mg/L. This result indicates good quality of water both in surface and ground water in terms of the amount of oxygen in the water system to sustain life.

On the other hand, all stations sampled gave Manganese, Iron, Arsenic, Cadmium, Mercury and Lead levels below the DENR threshold limit. High concentrations of coliforms, both total and fecal, were also recorded at most stations particularly in FW 4, FW 8, DW1, DW2, DW3, DW4, DW5, DW6, DW7, DW8, DW9 and DW10. Total and fecal coliforms are expected to be high in streams draining populated areas as these receive surface runoff that contain human and domestic animal wastes. Fecal coliform counts in FW4 and FW8 ranged from 430 to >4065 MPN/100 mL.

Station FW4 (Mantiawas Creek) is an intermittent creek where presence of domestic and wild animals is seen. Station FW8 (Midstream Kalinawan River) on the other hand is a river community where artisanal small-scale miners are inhabiting, also livestock are being raised along the river. This physical condition of FW4 and FW8 brings the water system susceptible to bacteriological contamination.

Fecal coliforms were also detected in all drinking water monitoring stations with a total count of above 8MPN/100mL compared to the normal limit of <1.1 MPN/ 100 mL for drinking water.

Root cause analysis revealed that the readings on bacteriological contamination may however be suspect for several reasons:

- Locals defecating along the stream. Employees (both from company and contractors) may fail to use comfort room
- Water source is open to environment. No protective cover installed for the concrete water tanks.
- Possible that reservoir design and piping system is inadequate
- Fecal contamination is due to animal wastes in the area. Baseline data from Yr 2007 shows high content of coliform even before mining operation has started

Several actions had been undertaken to address this problem on bacteriological contamination in partnership with the local community. These include among others;

- Conduct IEC with the local community to discuss the effects of human waste to the natural water supply used for drinking.
- Construct additional comfort rooms at strategic locations within the mine site
- Construct covers for concrete tanks that supply drinking water for the local community
- Application of Water Treatment like chlorination.
- Periodic Conduct of Water Quality Monitoring

2.7.1.1. Degradation of Water Quality

Limestone is a sedimentary rock composed mainly of calcium carbonate (CaCO3). During quarry activities, limestone materials will be exposed to natural elements, including rainwater which is weakly acidic in nature. Calcium carbonate reacts with rainwater to form the calcium bicarbonate following the chemical equation below:

$$CaCO_3(s) + H2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2(aq)$$

The soluble calcium carbonate can be carried by stormwater runoff to the nearby streams or can infiltrate to the rock fissures to reach the groundwater, causing water hardness. When heated, the soluble calcium carbonate in hardwater can decompose back to the insoluble calcium carbonate, forming limescale.

Hardwater is generally safe to drink but may cause negative impacts for domestic usage. Some synthetic detergents are less effective when used with hardwater in washing of clothes, leaving clothes stiff, rough and less bright in color Hardwater is also responsible for the scaling of bathroom fixtures and mirrors, requiring extra cleaning effort. In bathing, hair washed with hardwater may feel sticky. It also leaves soap curd film in the skin, which interferes with the removal of dirt and bacteria. Heated hardwater forms limescale, which coats the heating elements of appliances, making them less efficient.

Limescale can also clog up heated water pipes causing reduction in water flow, hence the need for replacement.

In addition, streams and rivers can be altered when mines pump excess water from a limestone quarry into downstream natural channels. This increases the danger of flooding, and any pollutants or changes in water quality affects the surface water.

Stormwater management will be the primary mitigation measure to address this water quality issue. The limestone quarry area will be installed with drainage canals to direct the stormwater runoff to the in-pit sumps and/or sediment ponds. Regular water quality monitoring of waterbodies potentially impacted by the Project operations will be continuously done. Monitoring parameters will include hardness, metals, solids, pH, and bacteriological content. Results of laboratory analysis of the samples will be reported in the quarterly Self- Monitoring Reports submitted to DENR-EMB.

2.7.1.2. Siltation of Waterbodies

In addition, exaction activities from mining and construction may lead to accelerated erosion rate and transport of sediment materials to nearby water bodies during rainfall events. This will be mitigated by the provision of safety berms and drainage canals along the roads, mine areas, and stockpile areas. The stormwater runoff will be directed to water management facilities (i.e silt impoundments, silt collector sumps, in-pit ponds, diversion banks) constructed at strategic locations based on topography. Maintenance of these structures includes embankment stabilization and regular desilting to maximize their capacity. Some erosion control materials, such as wattlings, fascines, gabion baskets, and geotextile filter, to be installed along the waterways will supplement the drainage management in mitigating the impacts of sedimentation.

2.7.1.3. Accidental Spills/ Release

Other possible sources of water contamination may come from the accidental spillage of chemical reagents, fuel oils and petrochemical products. To mitigate such emergency, storage areas will be equipped with secondary containment structures. In addition, spill management protocols will be in place. Spill drill will regularly be conducted for employees and contractors through the Safety Department. Used oils and contaminated materials will be disposed properly according to DENR guidelines.

2.7.2. Management and Monitoring Plan Relevant to Water Quality

A summary of the management and monitoring plans relative to the potential impacts to water quality is provided in **Table 2-33.**

Water quality monitoring of surface and marine waters impacted by the Project operations is and will be continuously done internally by the Environment Department. Results of laboratory analysis of the samples are reported in the quarterly Self- Monitoring Reports submitted to DENR-EMB.

Table 2-33 Summary of Management Plan- Impacts to Water Quality

Key Environmental Impact	Management Plan	Monitoring Plan
Water Hardness, Siltation, Chemical Release	Drainage Planning Installation of stormwater runoff management facilities (drainage canals, sump, in pit canals, diversion ditch, etc.) Construction of water management structures (silt impoundments, silt collector sumps, in-pit ponds, diversion banks, etc.). Regular Maintenance of water management system (repairs, desilting). Installation of erosion control materials (wattlings, fascines, gabion baskets, and geotextile filter) along waterways. Compliance to chemical storage, handling, and transport of hazardous waste and chemicals. Spill management training and protocols.	Internal and Third-Party monitoring of required water quality parameters, including: Hardness, BOD, chloride, color, DO, fecal coliform, nitrate, pH, phosphate, temperature, TSS, COD, ammonia, flouride, surfactants, oil and grease, trace metals

2.8. Freshwater Ecology

Freshwater biological sampling was conducted in July 16-17, 2020. Two stations: (1) Payongpayong and Tinigbasan creeks were subject to collection of macroinvertebrates. The methodologies used is briefly discussed below.

A. Study Period and Location

Freshwater biological sampling was conducted on July 16-17, 2020. The weather during the collection of samples was rainy to cloudy. Two stations: (1) Payong-payong and Tinigbasan creeks were utilized for the collection of macroinvertebrates. For each study stations, three subpoints, 50 m in length each, were established and sampling areas are shown in **Figure 2-41.**

B. Diversity of Aquatic Macroinvertebrates

Sampling was conducted following the Reach-wide benthos (Multihabitat) procedure of SWAMP (2007) with some modifications. Each study station covered three 50-meter reach for the collection of macroinvertebrates as replicates. 500µm D-net; 0.3 m width (-1.0 ft. frame width) was used and was placed in the water as to the mouth of the net perpendicular to face the flow of the water. 10 jabs or kicks were undertaken over the length (50 meter) of every replicate. The jabs obtained from the habitats were composited obtaining a single homogenous sample. Sampling points were alternated between the left, center and right positions along a transect (25%, 50% and 75% of wetted width, respectively. Samples collected from every jab were placed in the container or vials and were preserved in 10% formalin with its corresponding label and with sample identification.

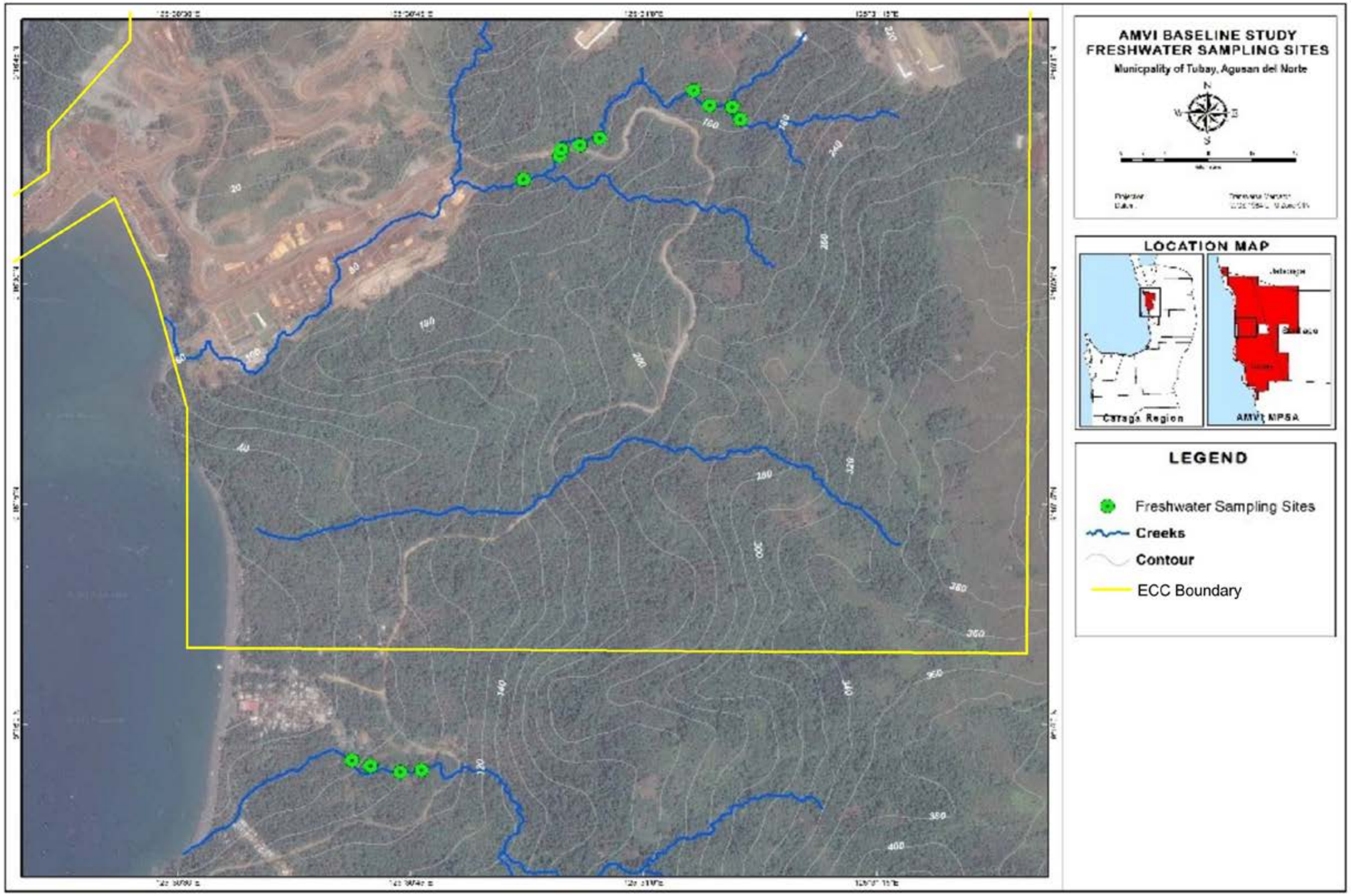
C. Sorting, Photo Documentation and Species Identification

In the laboratory, the composited samples were thoroughly rinsed with running water in a 500 µm – mesh sieve to remove fine sediments. Macroinvertebrates were then sorted and counted. The sorted organisms were placed in glass vials and were preserved using 95% ethanol. Vials were labeled with a code which stands for stream name, sampling location and taxonomic group. Collected samples were identified up to the lowest practical level, generally genus or species with the aid of LASEZ (Leica Application Suite) ver. 1.7.0. Larger organisms were documented with the use of digital camera. Macroinvertebrate guide for identification from the internet and journals were used for identification. Macroinvertebrates were classified as to their tolerance value depending on their response to specific changes in water conditions.

D. Taxa Groupings

Macroinvertebrates collected were initially grouped into 3 Taxa groups—Taxa 1, Taxa 2 and Taxa 3 based on their sensitivity or tolerance to pollution or aquatic disturbance (Barbour et al., 1999). Taxa 1 members are pollution sensitive organisms found in good water quality and include species belonging to orders *Ephemeroptera, Plecoptera, Tricoptera,* and *Coleoptera*. Taxa 2 species can exist in wide range of water quality conditions or generally moderate water quality and these would include species belonging to orders *Hemiptera, Diptera, Odonata, Decapoda*, and *Veneroida*; Taxa 3 specimens are species that can exist in a wide range of water quality conditions and highly tolerant to poor water quality. These taxa would include T*ubificida, Gastropoda, Hirudinidae, Cerithioidea,* and *Isopoda.*

Figure 2-41- Map of Collection sites in Payongpayong and Tinigbasan Creeks



E. Measuring Water Quality Using Water Quality Index (WQI)

Species were scored according to their classification using a matrix that has its corresponding points of a particular macroinvertebrate species regardless of its abundance. The sum was obtained for all scored species and divided to the total of species scored. The resulting value is the WQI.

Diversity indices, namely Abundance, Evenness, Richness and Shannon – Weiner Index of diversity as well as Principal Component Analysis (PCA) were determined using the Paleontological Statistics Software (PAST®).

2.8.1. Abundance, Frequency and Distribution of Species

A total of eighteen (18) aquatic macroinvertebrates from 10 families were identified and they are listed in **Table 2-34**. Majority (72%) of the organisms belong to Phylum Arthropoda (**Figure 2-42**) which was largely dominated by the *Gerridae* family with 5 species. No representative members of the *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), and *Trichoptera* (caddisflies) /EPT group were observed. Observation of species representing EPT indicate excellent water conditions. By taxa groupings of the specimen collected based on sensitivity or tolerance to pollution, majority (82%) of the species belong to the Taxa 2 category. Taxa 2 species can exist in wide range of water quality conditions or generally moderate water quality. No representative of the Taxa 1 group (pollution sensitive organisms found in good water quality) were observed (Figure 2 B). Location wise, more Taxa 2 representatives were observed in the Payongpayong station, than in Tinigbasan (Figure 2C). In terms of diversity, more species and accumulated number of individuals were noted in Payongpayong Creek compared to Tinigbasan, as shown in **Table 2-35**.

Comparison of the Water Quality Index (WQI) values between the two stations indicate better WQI in Payongpayong (WQI=8.55) with that of Tinigbasan (WQI=6.66), which would indicate that Payongpayong Creek belong to the "*very clean water category*", whereas Tinigbasan fall within the "rather clean- clean water range (**Table 2-36**). The WQI is based on the presence of indicator species for sensitivity/tolerance to pollution and should best be accompanied by other water quality parameters to further understand and characterize the status of water inhabited by these aquatic macroinvertebrates.

Principal Component Analysis (PCA) show that some notable species, particularly gerrids (i.e. *Limnometra* sp), were common in the stations, but were abundantly observed in Payongpayong (**Figure 2-42**). The bloodworm *Polypedilum* sp (Chironomidae)—an indicator of pollution was only observed in the lower sections of Tinigbasan, in particular near households where domesticated pig pens were established very near the creek. Aside from key species found both for the two stations, abundance of collected macroinvertebrates can be seen as an important factor in the PCA , as more individuals and species can be seen in Payongpayong.

Table 2-34 Inventory of aquatic macroinvertebrates and their corresponding Taxa groupings based on sensitivity/ tolerance to pollution

Phylum	Order	Family	Scientific name	Common names	Taxa
Arthropoda	Hemiptera	Notonectidae	Nychia sp.	Back swimmer	2
	Hemiptera	Gerridae	Lymnometra sp.	Giant Water strider	2
	Hemiptera	Gerridae	Gerris sp.1	River skater	2
	Hemiptera	Gerridae	Gerris sp. 2	Vertical stripped strider	2
	Hemiptera	Gerridae	Metrobates sp.	Short bodied strider	2
	Hemiptera	Gerridae	Metrocoris sp.	Short bodied strider	2
	Hemiptera	Veliidae	Rhagovelia obesa	Small water strider	2
	Odonata	Coenagrionidae	Ischnura sp.	Damselfly	2
	Odonata	Libellulidae	----------	Dragonfly nymph	2
	Decapoda	Palaemonidae	Macrobrachium sp 1	Large freshwater shrimp	2
	Decapoda	Palaemonidae	Macrobrachium sp 2	Freshwater shrimp	2
	Decapoda	Palaemonidae	Palaemonid sp.1	Small sized-freshwater Shrimp	2
	Diptera	Chironomidae	Polypedilum sp.	Non-biting midge/blood worm	3
Mollusca	Gastropoda	Thiaridae	Melanoides tuberculata	Red rimmed melania	3
	Gastropoda	Thiaridae	Stenomelania sp.	Black melania	3
	Gastropoda	Thiaridae	Thiara scabra	Spike tail snail	3
	Gastropoda	Ancylidae	----	Freshwater limpet	2
	Gastropoda	Neritidae	Theodoxus sp.	River nerite	2

Taxa 1- Pollution sensitive organisms found in good water quality
Taxa 2- Can exist in wide range of water quality conditions; generally moderate water quality
Taxa 3- Can exist in wide range of water quality conditions; highly tolerant to poor water quality

Figure 2-42 Percent (%) composition of major aquatic macroinvertebrate groups (A), Taxa groupings (b) and comparison of Taxa Groupings between the two study sites.

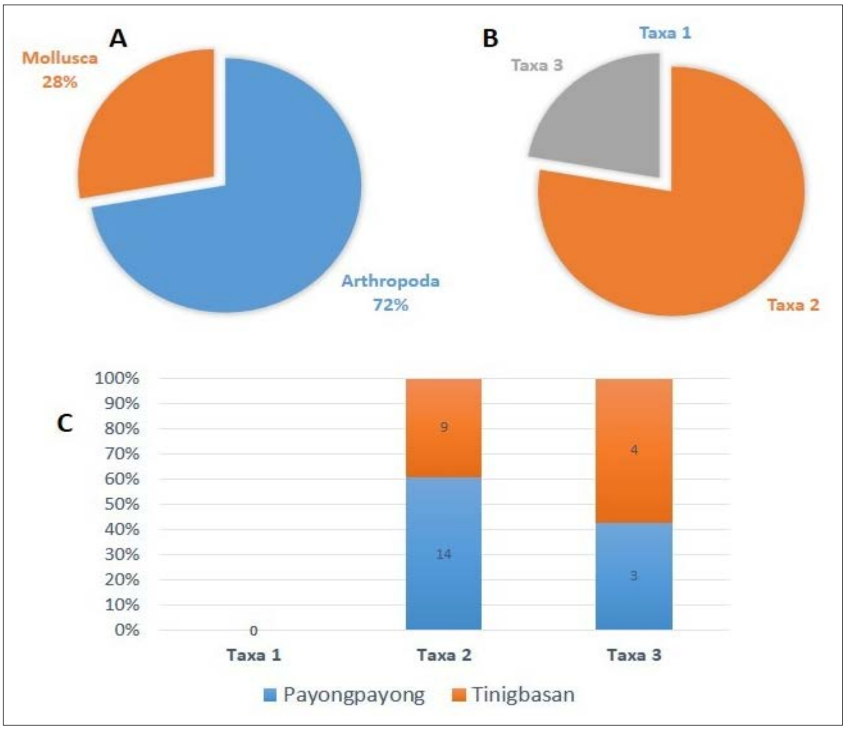


Table 2-35 Mean diversity indices of aquatic macroinvertebrates in Payongpayong and Tinigbasan Creeks

Diversity Indices	Payongpayong	Tinigbasan
Taxa_S	13.33333	10
Individuals	113.3333	100.5
Dominance_D	0.1895	0.22005
Simpson_1-D	0.8105	0.77995
Shannon_H	2.044333	1.795
Evenness_e^H/S	0.624833	0.61475

Table 2-36 Aquatic macroinvertebrates from the two study stations and their WQI score

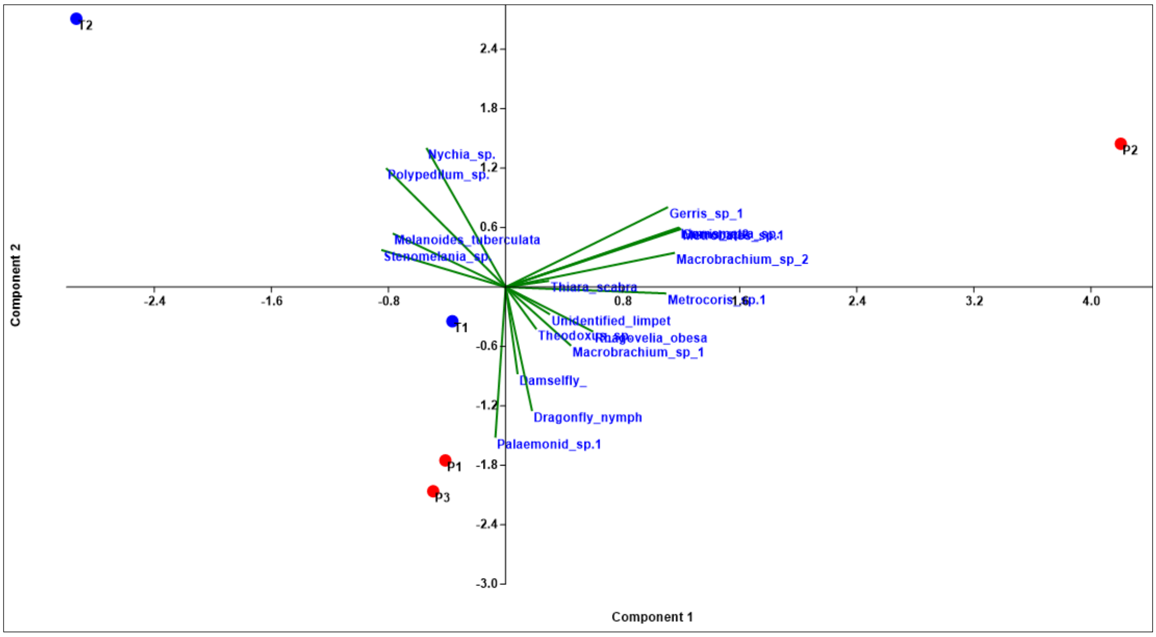
Species	Payongpayong	WQI	Tinigbasan	WQI
Nychia sp.	1	5	4	5
Limnometra sp.	125	5	20	5
Gerris sp 1	21	5	9	5
Gerris sp2	23	5	4	5

Table 2-36 Aquatic macroinvertebrates from the two study stations and their WQI score

Species	Payongpayong	WQI	Tinigbasan	WQI
Metrobates sp.1	16	5	3	5
Metrocoris sp.1	9	5	0	0
Rhagovelia obesa	5	5	2	5
Damselfly	6	6	1	6
Dragonfly nymph	6	6	0	0
Macrobrachium sp 1	3	4	0	0
Macrobrachium sp 2	4	4	0	0
Palaemonid sp.1	11	4	0	0
Polypedilum sp.	0	0	3	2
Melanoides tuberculata	21	3	41	3
Stenomelania sp.	26	3	32	3
Thiara scabra	1	3	3	3
Unidentified limpet	30	6	41	6
Theodoxus sp.	32	3	35	3
Total (individuals)	340	77	201	60
No. of Families	9		9	
No of families/WQI		8.55		6.66

WQI Legend: 7.6-10--very clean water; 5.1-7.5--rather clean- clean water; 2.6- 5.0--rather dirty water- average; 1.0- 2.5--dirty water; 0--very dirty water (no life at all)

Figure 2-43 Principal Component Analysis (PCA) of distribution and abundance of aquatic macroinvertebrates in Payongpayong (P1, P2,P3) and Tinigbasan (T1,T2).



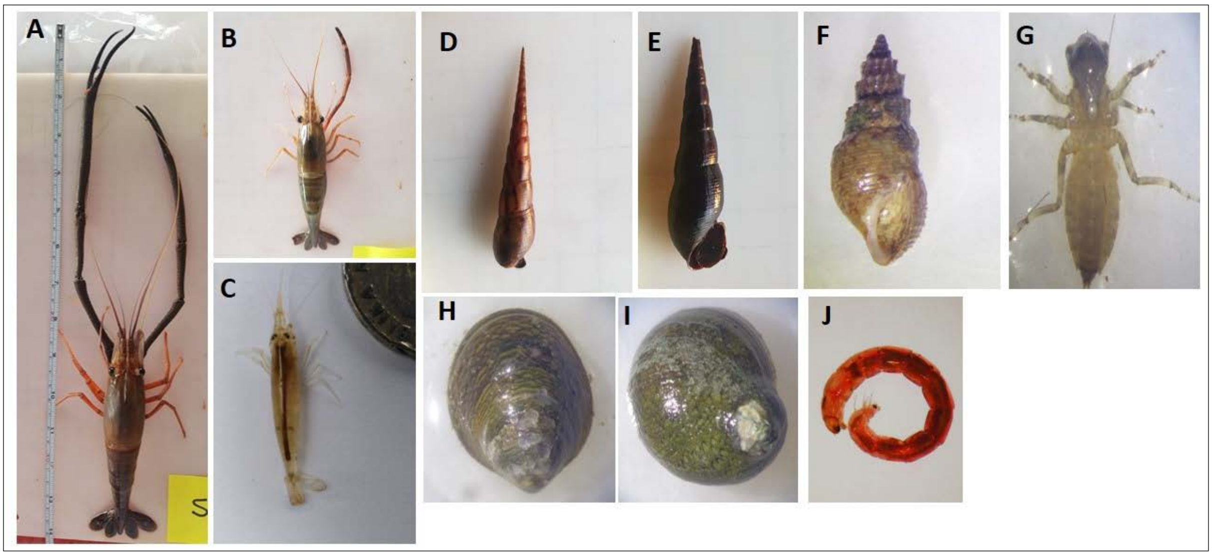


Photo 2-7 *Aquatic macroinvertebrates in Payongpayong and Tinigbasan Creeks: A- Macrobrachium sp 1, B- Macrobrachium sp 2, C-Palaemonid sp.1, D-Melanoides tuberculata, E- Stenomelania sp. F-Thiara scabra, G-Dragonfly nymph, H- Unidentified limpet, I-Theodoxus sp., J-Polypedilum sp.*

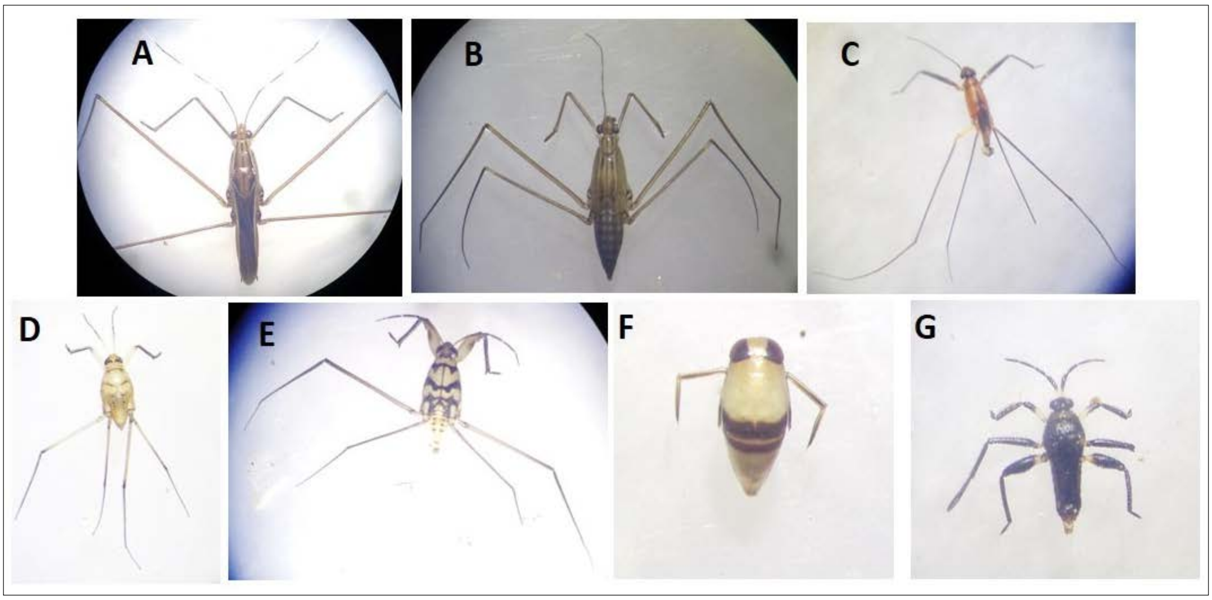


Photo 2-6 *Aquatic macroinvertebrates in Payongpayong and Tinigbasan Creeks: A-Limnometra sp., B- Gerris sp 1, C-Gerris sp2, D-Metrobates sp., E-Metrocoris sp., F-Nychia sp., G-Rhagovelia obesa*

2.8.1.1. Threat to existence and/or loss species of important local and habitat

Vegetation clearing and soil stripping activities from the Project operation may lead to increased sediment transport to the surrounding water bodies. Siltation impacts on streams is related to both suspension of silt materials on the water surface, evident as water turbidity; and sediment deposition at the bottom of the waterbed. These may likely affect the survival of aquatic organisms. Suspension of silt materials may impair the feeding mechanism of filter feeders (i.e. fish, shrimps, crabs, worms, and mollusks) which eat by straining suspended matter and food particles from water. At very high suspended sediment loads, clogging and abrasion of gills can interfere with oxygen uptake of fishes which can be fatal. Turbid waters can also reduce the light penetration which is essential for photosynthetic processes of the producers.

Base on the baseline assessment along the Payongpayong Creek, only freshwater macro invertebrates were recorded. Among the macro invertebrates, only two *Macrobrachium* species (shrimp) with limited number of individuals are edible. If the midstream portion of Payongpayong Creek will be filled with limestone materials, this shrimp will either not survive or move upstream. One unavoidable and irreversible impact due to the Project will be the loss of the midstream section 0.9 of aquatic habitat within the Payongpayong Creek watershed.

In consideration with the surrounding marine environment, the geotextile material used for arresting silt-laden run-off are only installed in discharge points and outlets which directs to the ocean. The type of material used is made of non-woven, bonded fiber geotextile which is produced by the interlocking of fibers, have higher flow rates and permittivity. And compared to its woven counterparts, non-woven geotextiles have less UV resistance which means it reacts to UV light, prone to degradation overtime and suitable for short-term applications. Because of this, geotextile used in the causeway is periodically replaced and during off-season period, some areas are not installed with silt-curtains to allow natural marine wildlife activity. Moreover, installation and monthly monitoring of these geotextiles are undertaken only by trained Coastal Resource Management (CRM) personnel and trained divers.

2.8.1.1 Threat to abundance, frequency and distribution of species

The primary potential impact anticipated is associated with threats to the abundance, frequency and distribution of the shrimp species. This will occur due to loss of habitat.

2.8.2. Management and Monitoring Plan Relevant to Freshwater Ecology

A summary of the management and monitoring plans relative to the potential impacts to freshwater ecology is provided in **Table 2-37.**

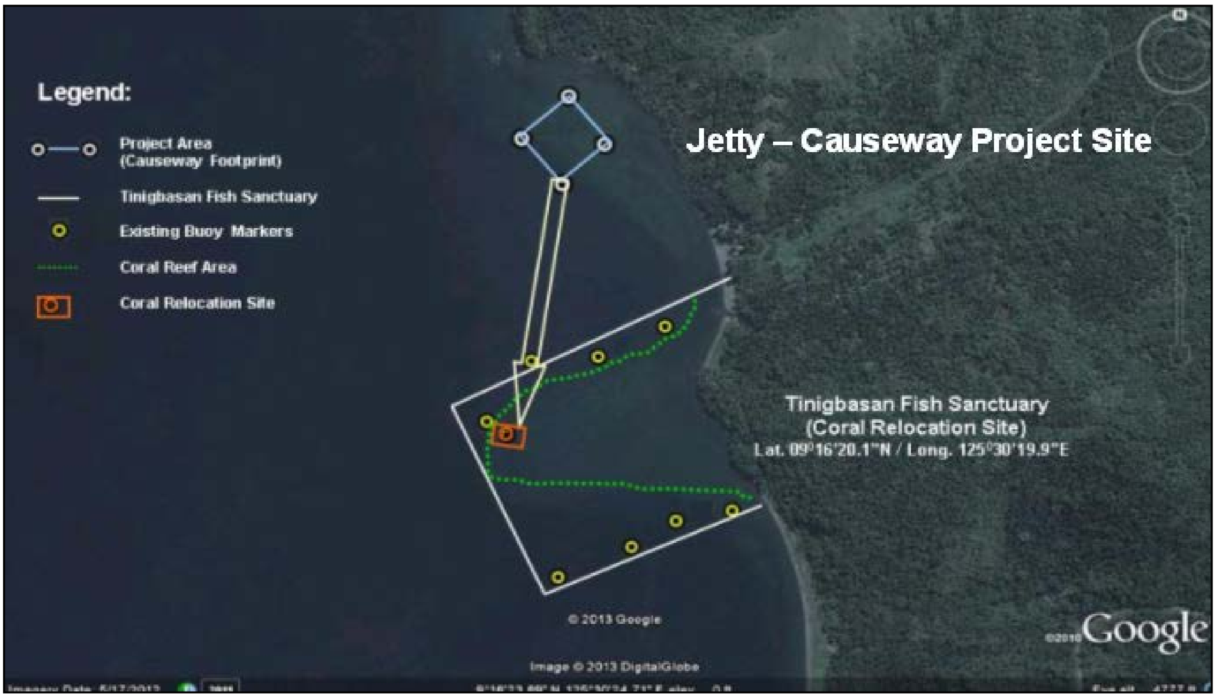
Table 2-37 Summary of Management Plan- Impacts to Freshwater Ecology

Key Environmental Impact	Management Plan	Monitoring Plan
Threat to existence and/or loss species of important local and habitat Threat to abundance, frequency and distribution of species	Erosion control measures Runoff- management system (drainage canals and water management ponds) Silt control measures (silt fence, gabions, etc.)	Water Quality Monitoring Program Freshwater Ecology Monitoring

2.9. Marine Ecology

In Year 2013, approximately 8,000 individual live hard corals from the fringing reef of Payongpayong Bay were relocated upon the recommendation of a Marine Biology expert to mitigate the potential adverse impacts on the living hard corals and the associated reef communities from the rock-filling and piling works to be done as part of the port facility construction. The relocation site identified was a coral reef area within the Tinigbasan Fish Sanctuary It is about 350 meters south of the constructed Port Facility, and about 300 meters away from the shoreline as shown on **Figure 2-44**. Since then, a coral monitoring program within the coral relocation site was established.

Figure 2-44 Marine Resource Assessment Study Area

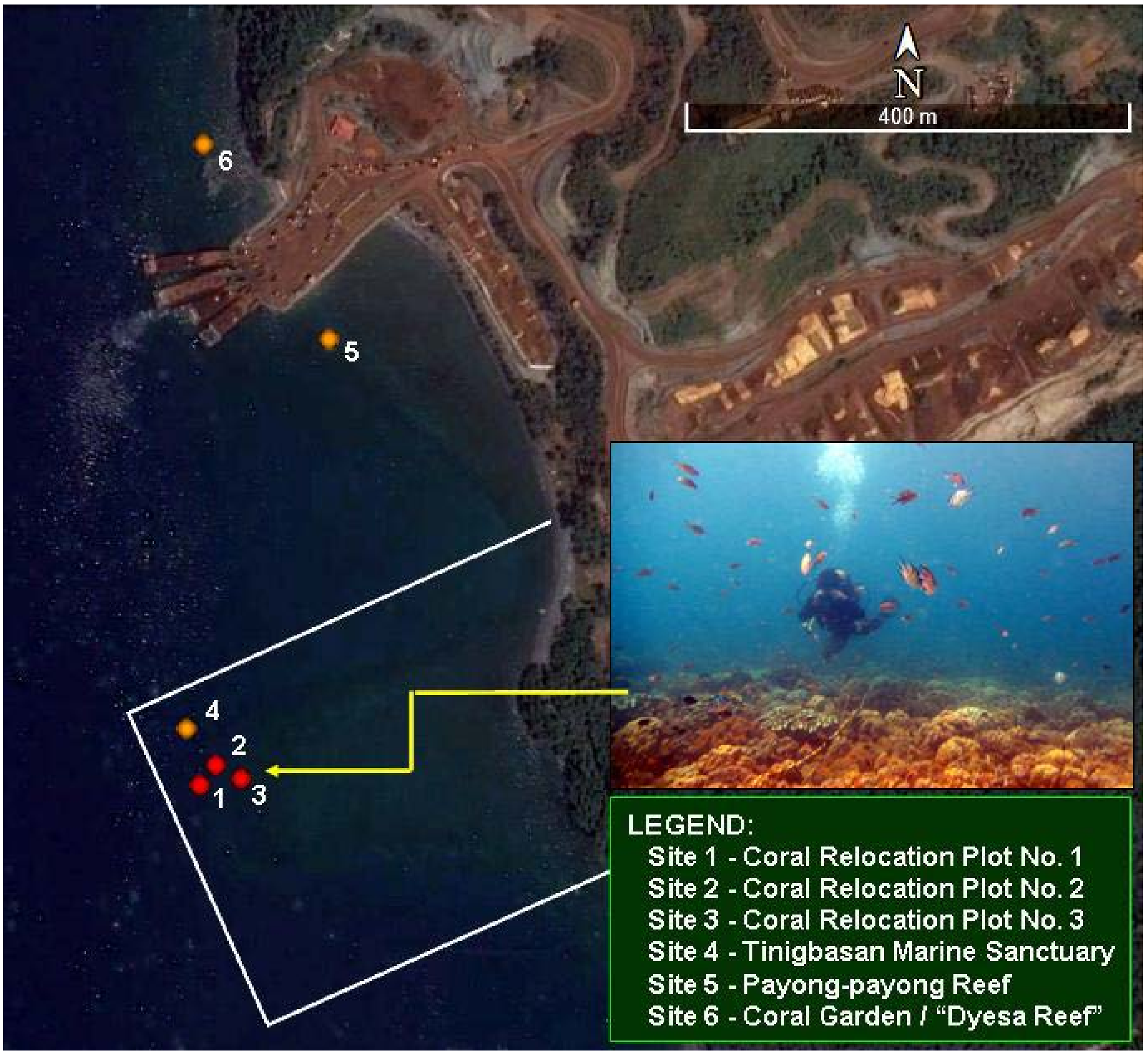


Section 2– Environmental Baseline Conditions for Critical Environmental Parameters, Impact Assessment and Mitigation

The baseline data presented in this section represents the latest coral monitoring results conducted on May 10-12, 2019. The commissioned third-party marine biology expert was Mr. E. Applied Environmental Sciences Consulting Firm (MEAESCF). Monitoring activities focused on the near shore environments within three reef stations, including the Coral Relocation Area within the Tinigbasan Marine Sanctuary (Sites 1-3), Tinigbasan Fish Sanctuary (Site 4), the Port construction site in Payongpayong reef (Site 5), and a control station within the Lawigan Marine Sanctuary (Station 6). Their relative location is shown in **Figure 2-45.**
The monitoring program includes the following activities:

- Coral and Reef Condition Assessment
- Associated Reef Fish Communities Survey
- Macrobenthic Invertebrate Communities Survey

Figure 2-45 Coral Monitoring Stations



Source: Coral Monitoring Report, MEAESCF (2019)

2.9.1. Cover Estimates of Benthic Components of the Coral Reef

Observations were made along the 10-meter permanent coral belt transects established at three (3) reef stations within the Coral Relocation Site (Sites 1, 2 and 3). Three (3) more transect stations were added in the area: the first one is situated outside the Coral Relocation Site but still inside the Tinigbasan Marine Sanctuary (Site 4), the second one is located outside of the sanctuary fronting Sitio Payong-payong Proper/near or south of the Agata Causeway-Jetty Facility (Site 5), and the third one is on a reef flat at the Coral Garden Site (Site 6) which is located north of the Agata Causeway-Jetty Facility (**Figure 2-45**).

The coral cover photo quadrat surveys were undertaken using fixed photo transects. At each reef station, one 10-m long transect line was set on the reef top using architect's fiberglass tape (**Photo 2-10**). The permanent transects were marked by insulated electrical wire (**Photo 2-9**).

These permanent markers provide positioning points for relocating the same locations during subsequent sampling periods. In this technique, small sections of the reef are photographed periodically enabling the monitoring of the fate of individual corals through time.

Photo 2-9 *Laying of a 10-m photo quadrat line transect using architect's fiberglass tape*

Photo 2-8 *The permanent transect marked by insulated electrical wire*

The percentage distribution of the major parameters or attributes of the bottom cover from the photographs of the transect were estimated by recording the identity of items lying beneath a grid of 99 points on a template over laid on each print. A summary of the bottom cover for each of the six (6) monitoring sites is presented in **Table 2-38.**

Table 2-38 Bottom Cover of the Coral Reefs Monitored

Attribute	Code No.	Reef Transect Station					
		Site 1 – % Cover	Site 2 – % Cover	Site 3 – % Cover	Site 4 – % Cover	Site 5 - % Cover	Site 6 – % Cover
Hard coral- living, normal color	100	42.2	56.5	55.5	29.9	23.4	44.9
Hard coral- living, pale or white	200	-	0.2	-	9.3	-	-
Hard coral- dead, covered/fouled by microalgae or mixture of microalgae and trapped fine sediments	300	39.3	34.5	38.8	5.0	1.0	4.9
Soft Coral	400	6.0	5.6	5.7	0.2	1.9	3.9
Algae	500	0.2	-	-	-	-	0.2
Other living	600	0.7	3.2	-	2.3	-	-
Rock (covered/fouled by microalgae, or mixture of microalgae and trapped fine sediments)	11	11.6	-	-	53.3	47.2	43.9
Sand (clean)	12	-	-	-	-	-	0.5
Silt/mud	13	-	-	-	-	26.5	1.7
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0
Total Live Coral Cover (%)	Hard /Soft Corals Combined	48.2	62.1	61.2	30.1	25.3	48.8
Coral Reef Condition		Fair	Good	Good	Fair	Fair	Fair

As shown in **Table 2-38**, the highest mean live hard coral cover for this monitoring period was observed at Site 2 -Coral Relocation Plot No. 2 (56.5%), followed by Site 3 - Coral Relocation Plot No. 3 (55.5%), Site 6 - Coral Garden/"Dyesa Reef" (44.9%), Site 1 - Coral Relocation Plot No. 1 (42.2%), and Site 4 - Tinigbasan Marine Sanctuary (29.9%). The least was observed at Site 5 - Payong-payong Reef (23.4%). A more detailed description of the bottom cover per site is presented in **Table 2-39**.

Table 2-39 Bottom Cover Description of Monitoring Sites

Survey Station	Bottom Cover Description
Site 1: Coral Relocation Plot No. 1	Live hard coral cover (normal color) during this survey period was 42.2% and soft coral cover consisting of Sarcophyton at 6.0%. Recent dead hard coral covered by microalgae was estimated at 39.3%. Rock cover (fouled/covered by microalgae) also characterized the transect location of the reef at 11.6%. Macroalgae and other living (a giant clam) components were also noted on this reef transect (0.2 and 0.7%, respectively). Normally, no silt/mud cover was observed on the reef transect as well as within the coral relocation plot.
Site 2 - Coral Relocation Plot No. 2	A dominance of live hard corals, normal color (56.5%) and recently dead hard corals covered by microalgae (34.5%) were observed on this photo transect. Soft corals consisting usually of Sarcophyton and other living component (macroinvertebrate ascidians) were also observed at 5.6 and 3.2% cover, respectively. Bleached live hard coral cover was estimated at only 0.2%. No silt/mud cover was observed on the reef transect as well as within the coral relocation plot.
Site 3 - Coral Relocation Plot No. 3	Live hard coral cover (normal color) during this survey period was the second highest at 55.5% and soft coral cover at 5.7%. A recently dead hard coral (covered by microalgae) was estimated at 38.8%, the second highest. No silt/mud cover was observed on the reef transect as well as within the coral relocation plot.

Table 2-40 Bottom Cover Description of Monitoring Sites (continued)

Survey Station	Bottom Cover Description
Site 4 - Tinigbasan Marine Sanctuary	A high cover of rock substrate fouled/covered by microalgae (53.3%) and low live hard coral cover (29.9%) characterized this photo transect quadrat. Soft coral and other living component (ascidians and sponges) also characterized the transect location of the reef (0.2 and 2.3%, respectively). Dead hard coral cover (fouled by microalgae) was also noted on this reef transect (5%). No silt/mud cover was observed on the reef transect as well as within the immediate vicinity of the station.
Site 5 - Payong-payong Reef Site	Similar to all other reef stations surveyed, an excellent underwater visibility was observed on this reef site at the time of sampling. Live hard coral cover (normal color) was estimated at 23.4%. Soft corals were also observed at 1.9% cover. A high rock cover (fouled by a mixture of microalgae and trapped fine sediments) was estimated at 47.2%. Silt/mud occupied only some portions of the reef transect at 26.5% cover.
Site 6 - Coral Garden Reef Site	a dominance of live hard coral cover, mostly normal color (44.9%). Soft coral cover was observed at 3.9%. A recently dead hard corals (covered by a mixture of microalgae and trapped sediment) was also observed on the reef (4.9%). Likewise, a high rock cover (fouled by a mixture microalgae and sediments) was also observed on this reef transect at 43.9%. An evidence of silt/mud cover was observed on this reef transect but only about 1.7%.

Lateritic soil was not observed on the rocky and sandy bottom of the nearshore shallow reef, south of the pier facility **(Photo 2-11)**. The encrusting or foliate coral Pavona decussata and the massive/ submassive Porites spp were the most predominant form in this reef area. Individual colonies of these coral species are still very much intact and in an apparent healthy condition with normal coloration and pigmentation while no mortality was evident.

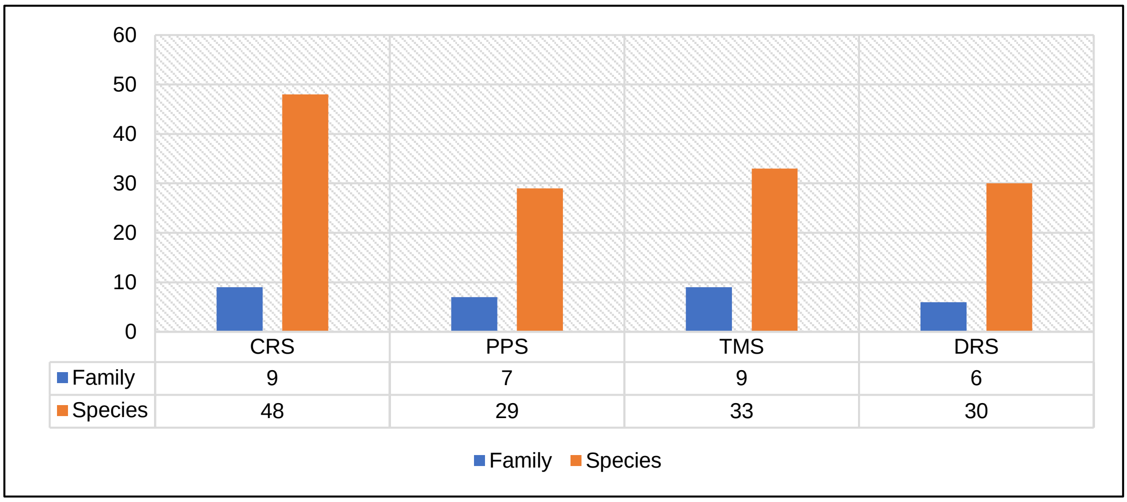
Photo 2-10 *Snapshots of the coral reef immediately south of the jetty/causeway facility showing Pavona decussata in healthy condition (May 2019)*

The healthy conditions of these hard coral species can be attributed largely to the presence of geotextile silt curtains in the area. The use of silt curtains could control siltation and reduce turbidity. Moreover, coral species (Pavona decussata and Porites spp.) are more resistant to stressful condition (high sedimentation / siltation or turbidity) than other coral types. The construction of the sedimentation ponds significantly reduced sediment input into the nearby marine environment.

2.9.2. Associated Reef Fish Communities

A total of 140 species belonging to 31 families were recorded at the four (4) established sampling stations. This result is higher when compared to the last survey done in January 2018, which has a total of 45 species belonging to 12 families of fish. A comparative data on composition between the monitored sites are shown in **Figure 2-46.**

Figure 2-46 Family composition and species richness of fish aggregation at the sampling stations (May 2019)

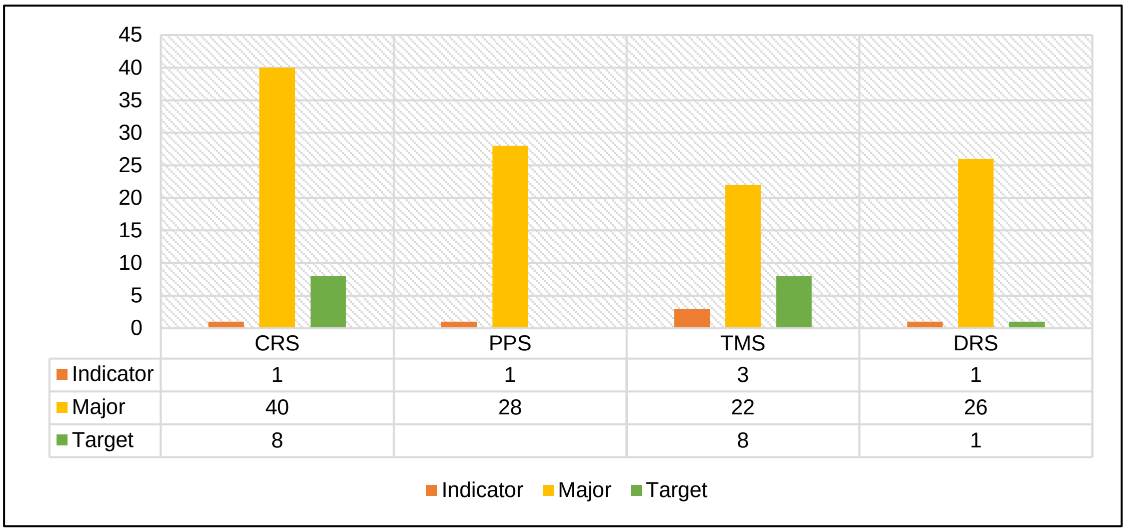


The coral reef relocation site (CRS) had higher species richness with a total of 48 species belonging to nine (9) families followed by Tinigbasan Marine Sanctuary (TMS) with 33 species and nine (9) families.

The two areas such as Payongpayong Site (PPS) and "Dyesa" Reef Site (DRS) which are located near the pier facility had recorded a total of 29 and 30 species under seven (7) and six (6) families, respectively.

Most of the fish species recorded in all sampling stations belongs to major types while few types of indicator and target species have been observed in all sampling stations, except in PPS wherein zero number of target species has been observed **(Figure 2-47).** Mixed assemblages of damselfish and wrasses were observed in all sampling stations. Their dominance could further be influenced by the exposure of the stations to strong currents and the structure of the underlying coral community and other reef attributes. These factors might also cause the variation in species richness across the sampling stations. Some of the dominant and less mobile fish species were shown in **Photo 2-12** and **Photo 2-13.**

Figure 2-47 Species richness of fish assemblages by category at the sampling stations (May 2019)



	CRS	PPS	TMS	DRS
Indicator	1	1	3	1
Major	40	28	22	26
Target	8		8	1

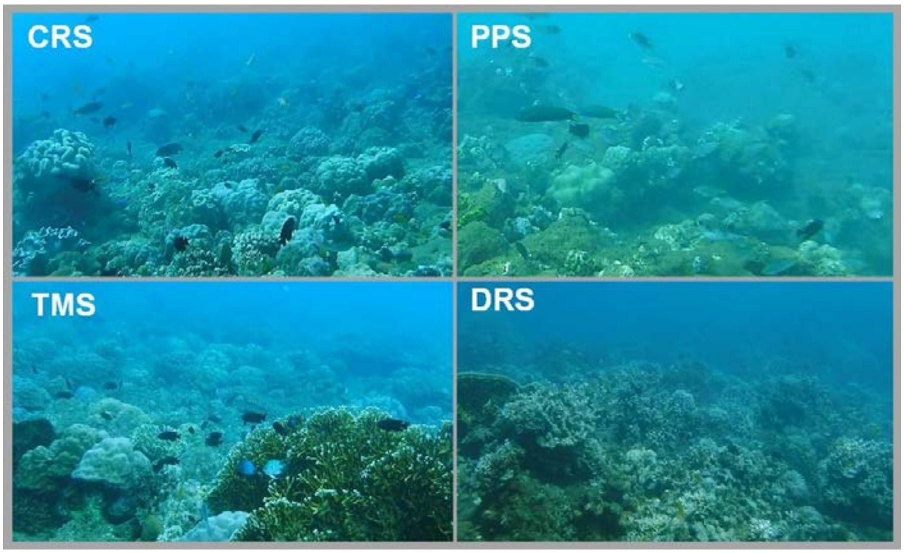


Photo 2-11 *Fish assemblages and bottom structures in the Coral Relocation Site (CRS), Tinigbasan Marine Sanctuary (TMS), Payong-payong Site (PPS), and "Dyesa" Reef Site (DRS).*

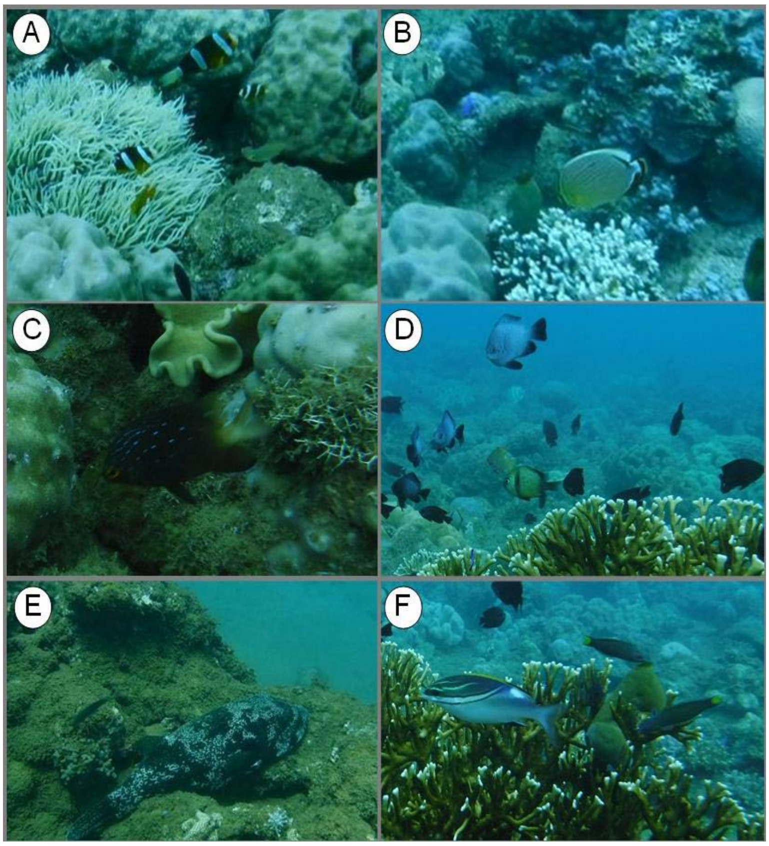
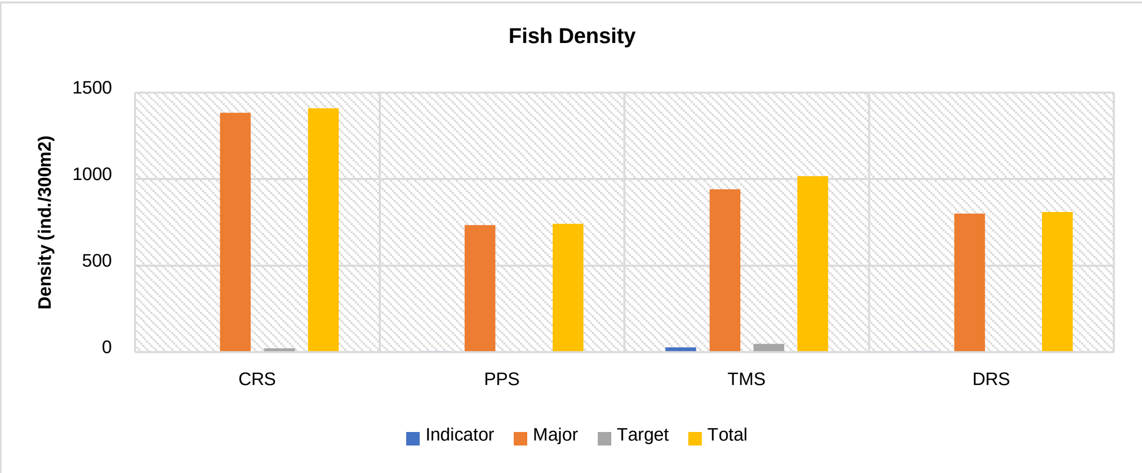


Photo 2-12 *Some of the most conspicuous species at the sampling stations: a. Amphiprion clarkii (Bennett, 1830), b. Chaetodon lunulatus (Quoy and Gaimard, 1825), c. Plectroglyphidodon lacrymatus (Quoy and Gaimard, 1824), d. Dascyllus trimaculatus (Ruppel, 1829) an*

2.9.3. Fish Density

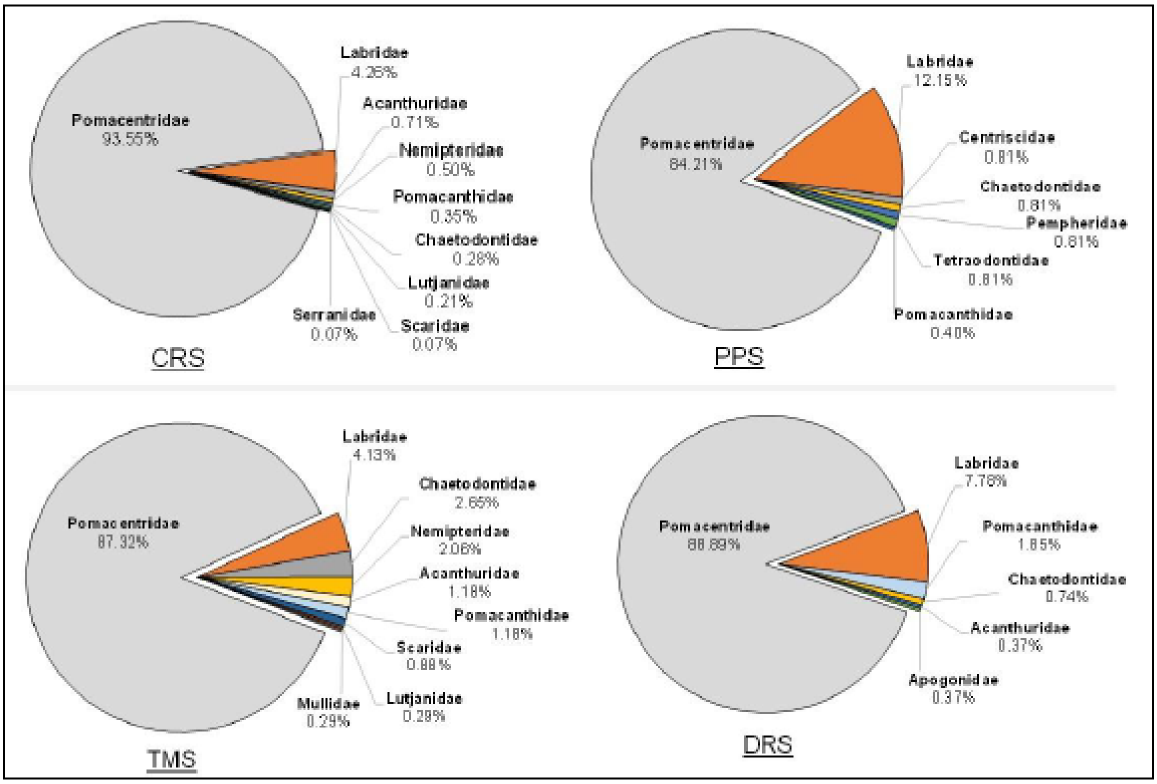
The recent survey has recorded a typical dominance of major types of species in all sampling stations with densities ranging from 735 to 1,384 individuals/300 m2. This was followed by target and indicator species with 0 – 48 individuals/300m2 and 4 – 27 individuals/300m2, respectively (**Figure 2-48**).

Figure 2-48 Density (individuals/300sqm) of fish aggregations by category at the sampling stations (May 2019)



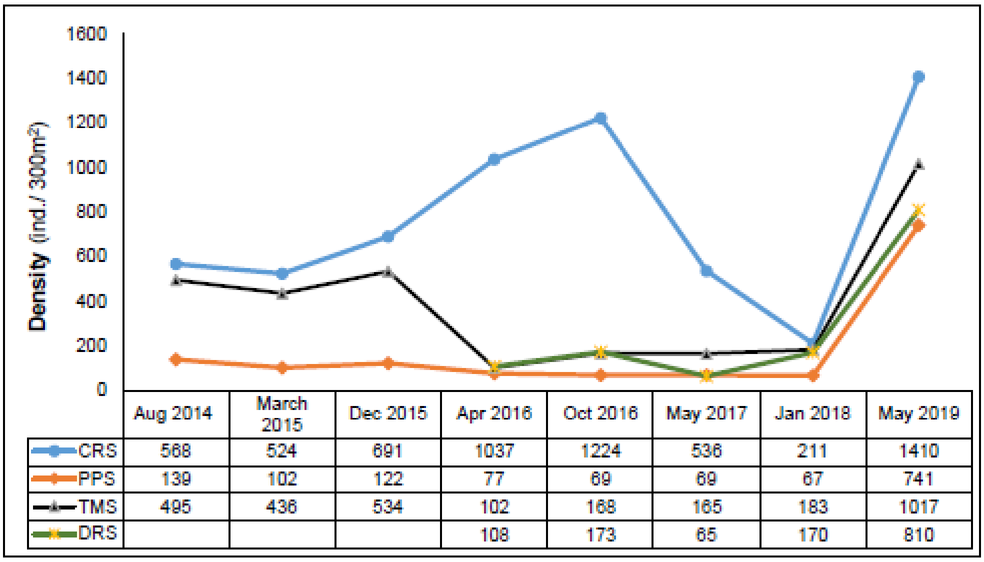
As one of the most ecologically diverse and important fish family on coral reefs (Wilson *et al*.,2008), damselfishes (Pomacentridae) contributed 84.21 to 93.85% of the total fish density at the sampling stations **(Figure 2-49**). The charcoal damsel (*Pomacentrus brachialis*), neon damsel (*Pomacentrus coelestis*), and lemon damsel (*Pomacentrus moluccensis*) were relatively higher in most of the sampling stations. The dominance of these species might be attributed to the reef features of the stations and its exposure to water current. Both damselfishes are common in areas with branching corals and prefer seaward reefs exposed to currents where there is sufficient amount of plankton to feed on (Allen, 1991; Allen, 2000). Coral demoiselle or yellow-tipped damsel (*Neopomancentrus nemurus)* was relatively higher in the reef area in Payong-payong Site (PPS). Such species form plankton-feeding aggregations on the reef slope and inshore reefs (Allen *et al*., 2003; Kuiter and Tonozuka, 2004).

Figure 2-49 Relative fish density (%) by family at the sampling stations (May 2019)



It was also observed that fish densities in all of the monitoring stations significantly increased during the latest monitoring. The temporal patter of fish densities across the 4 monitoring sites are shown on **Figure 2-50**

Figure 2-50 Temporal pattern in total fish density (individuals/300m2) at the sampling stations from August 2014 to May 2019



	Aug 2014	March 2015	Dec 2015	Apr 2016	Oct 2016	May 2017	Jan 2018	May 2019
CRS	568	524	691	1037	1224	536	211	1410
PPS	139	102	122	77	69	69	67	741
TMS	495	436	534	102	168	165	183	1017
DRS				108	173	65	170	810

2.9.4. Fish Size Distribution and Size Estimates

The length of fish individuals in all sampling stations rarely exceed in 40-cm in total length (TL) except for the species of Blue-spotted puffer (*Arothron caeruleopunctatus*) which is recorded at PPS area. Most of the sizes (total length) of fish species in the sampling stations are under 16-cm (**Figure 2-51**).

The fish biomass in the area ranges from 53.64 – 98.80 kg/300m2 **(Figure 2-52)**. Higher fish biomass was recorded in CRS with 98.80 kg/300m2, followed by TMS, PPS and DRS with the fish biomass of 86.89 kg/300m2, 53.64 kg/300m2, and 52.80 kg/300m2, respectively. An increasing fish biomass trend has been observed in the current survey when compared to the past surveys conducted from August 2014 to January 2018. This may imply a healthier and suitable environment. Seasonal migration, foraging, reproduction, recruitment, mortality, existing reef structures and other natural factors are other probable influence on the composition and fish biomass in the area.

2.9.5. Species Diversity and Cluster Analysis

The fish assemblages at CRS had the highest species diversity based on the Shannon index (H') with 2.61, followed by TMS and DRS with H' value of 2.56 and 2.55, respectively (**Figure 2-53**). Lowest species diversity was observed at PPS) with H' value of 2.00. Such area (PPS) has recorded low species richness and high dominance of single fish species. The condition may be further associated with habitat complexity and various environmental perturbation that limits the occurrence of other species. These conditions may reflect habitat perturbation (*e.g.*, sedimentation, loss of reef complexity, and low water transparency) that limits the occurrence of other species and the dominance of few species that can tolerate and adapt to a disturbed environment.

Figure 2-51 Size-density distribution of fish assemblages at the sampling stations (May 2019)

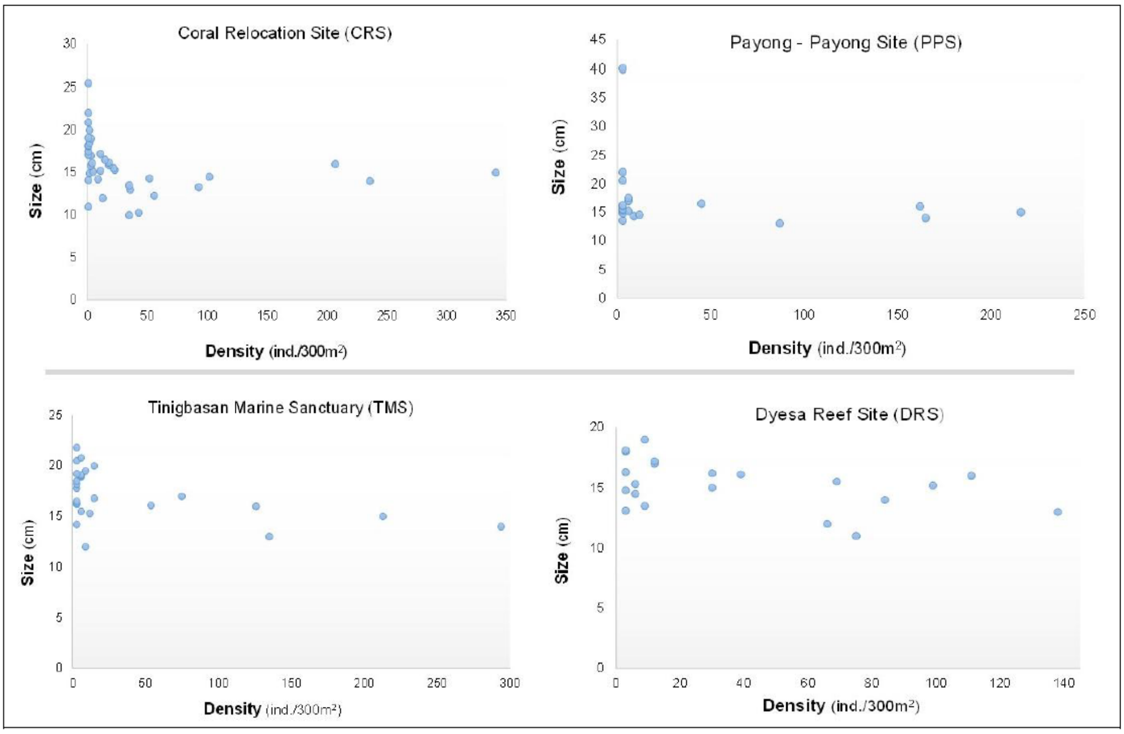
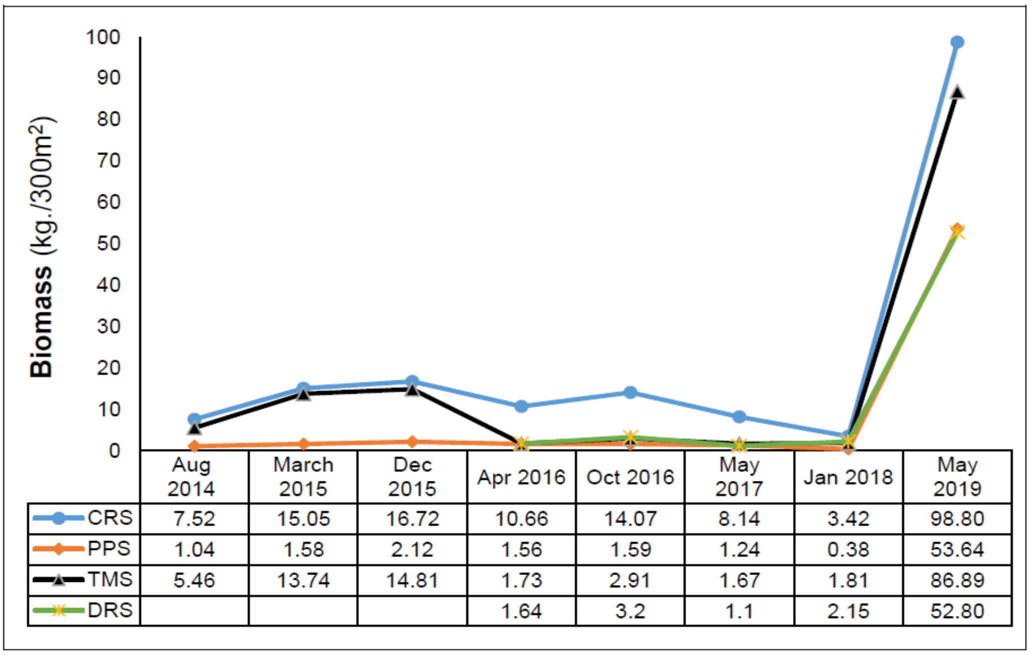
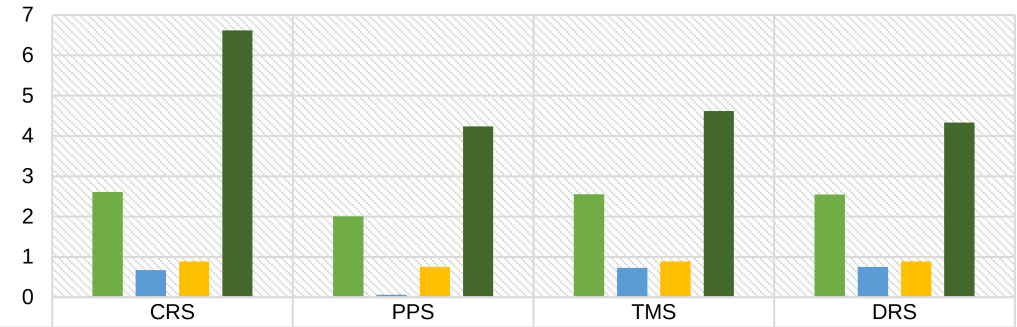


Figure 2-52 Temporal pattern in fish biomass (kg/300m2) at the sampling stations from Aug 204 to May 2019



	Aug 2014	March 2015	Dec 2015	Apr 2016	Oct 2016	May 2017	Jan 2018	May 2019
CRS	7.52	15.05	16.72	10.66	14.07	8.14	3.42	98.80
PPS	1.04	1.58	2.12	1.56	1.59	1.24	0.38	53.64
TMS	5.46	13.74	14.81	1.73	2.91	1.67	1.81	86.89
DRS				1.64	3.2	1.1	2.15	52.80

Figure 2-53 Diversity of fish aggregations at the sampling stations during May 2019



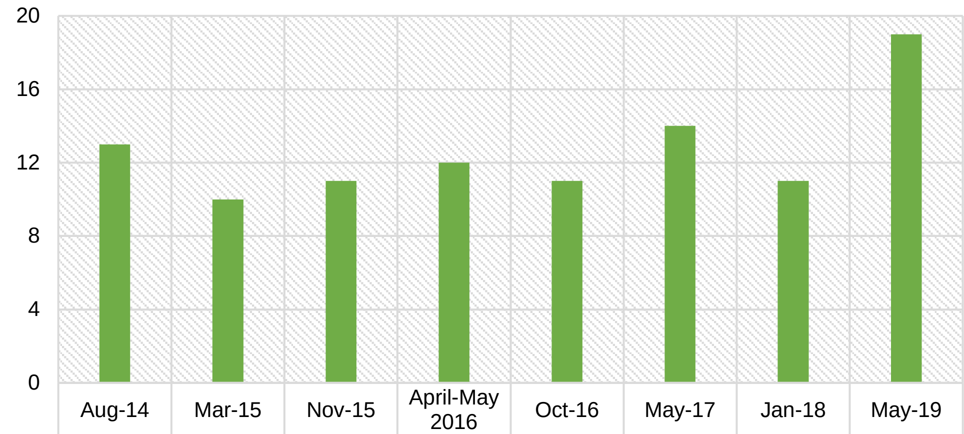
	CRS	PPS	TMS	DRS
Shannon	2.6081	2.0027	2.5554	2.5491
Eveness	0.67015	0.059476	0.73085	0.74946
Simpson	0.88934	0.75474	0.88536	0.88861
Margalef	6.6195	4.2373	4.6212	4.3303

2.9.6. Macrobenthic Invertebrate Communities

A visual census of macroinvertebrates was conducted while scuba diving along the 10-m long transect lines attached to reefs. All macroinvertebrates within a two-meter wide swath covered by the transect length (an area of 20m2) were identified, enumerated and counted. The sizes of censused macroinvertebrates exceeded one (1) cm. Photo and video documentation at each reef transect was also done to supplement and support data from the visual census survey.

A total of 19 macroinvertebrate species/taxa that are classified under seven (7) major faunal groups were recorded in the present sampling period in May 2019, which was higher compared to the last sampling period in January 2018 with 11 species, as well as in all the previous sampling periods.

Figure 2-54 Total number of macroinvertebrate species by sampling period



	Aug-14	Mar-15	Nov-15	April-May 2016	Oct-16	May-17	Jan-18	May-19
Total Number	13	10	11	12	11	14	11	19

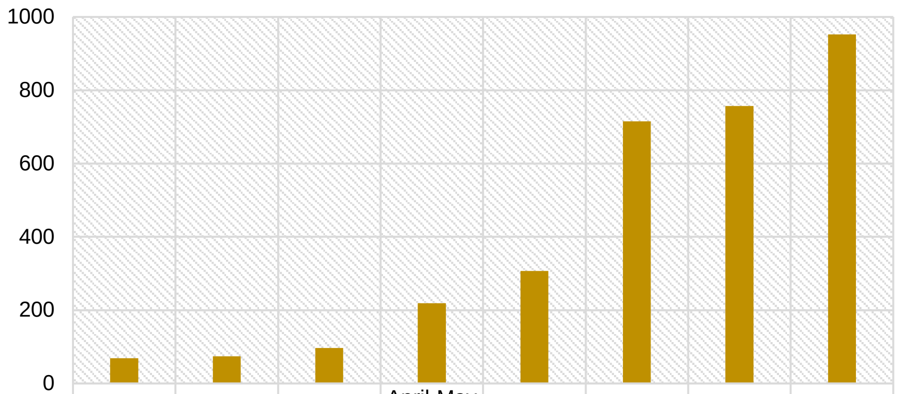
As shown on **Figure 2-54**, there was an increase in the total number of macroinvertebrate species in all transect stations except at Station CRS2 - Coral Relocation Plot No. 2 wherein the total number of species recorded has decreased from the last sampling period in January 2018. The highest number of species was observed at Station TMS- Tinigbasan Marine Sanctuary with twelve (12) species, followed by Stations PRS-Payong-payong Reef with ten (10) species, CRS1- Coral Relocation Plot

No.1 with nine (9) species, CRS3 – Coral Relocation Plot No. 3 with eight (8) species, and CGS- Coral Garden/"Dyesa Reef" with seven (7) species. The least was observed at Station CRS-2 – Coral Relocation Plot No.2 with four (4) species.

The tiny reef ascidian *Clavelina* sp. and the green ascidian/sea squirt *Didemnum* sp. were the most common and abundant macroinvertebrates found in the study area. This was followed by the blue starfish *Linckia laevigata,* and the ink-spot sea squirt/ascidian *Polycarpa aurata*. There were also bivalve scallops *Pedum spondyloideum* found most abundant at Stations CRS1, CRS3 and TMS. The crown-of-thorns starfish (*Acanthaster planci),* which is causing coral bleaching, *was* only observed along the reef transect at Stations CRS3 and TMS. A complete inventory of the macroinvertebrates observed is included in the **Appendices.**

In terms of density, a total of 952 macroinvertebrate counts/20m2 were recorded during the monitoring in May 2019. There was a consistent increase in the total density of macroinvertebrates from the beginning of the study up to the present sampling period as shown in **Figure 2-55.**

Figure 2-55 Macroinvertebrate Density by Sampling Period



	Aug-14	Mar-15	Nov-15	April-May 2016	Oct-16	May-17	Jan-18	May-19
Density (count/20sqm)	69	74	97	219	307	715	757	952

2.9.7. Threat to Marine Biodiversity

2.9.7.1. Threat to Existence and/or Degradation of Important Local Species and Habitat

The corals within the study area are being threatened by both natural and human-induced disturbances. Disturbance can be defined as “any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment” (Pickett and White, 1985 as cited by Rogers, 1993). The nature of the disturbance, and hence the resulting biota, varies according to reef site.

Typically, among the possible external stresses and / or disturbances that were identified during last monitoring period were:

a) Turbidity and siltation/sedimentation,
b) Accidental bumping of corals by tugboats and / or barges;
c) Infestation of crown-of-thorns starfish *Acanthaster planci*;
d) Storm damage; and
e) Low salinity.

A. Increased turbidity and sedimentation.

The most important single cause of reef degradation is sedimentation resulting from human terrestrial activities (Yap and Gomez, 1985). Turbidity (resuspended solids) and sedimentation/siltation above normal levels can adversely affect marine organisms and habitats, particularly coral reefs and seagrass beds and the communities they support (Griffen, 1975 as cited by Williams, 1983). Experimental application of sediments onto living coralline tissues has demonstrated detrimental effects including expulsion of zooxanthellae, cellular damage and, after complete burial, death (Rogers, 1983). Siltation effects are clearly manifested in the coral reefs surveyed (such as in Payong-payong Reef Site, along the causeway-jetty area and on the adjacent reef immediately north of the causeway-jetty facility) where blankets of fine sediment are typical. Turbidity increases light attenuation and consequently decreases photosynthetic activities. Settling sediment tend to cover, smother and foul surfaces of coral colonies.

B. Accidental bumping of corals by tugboats and barges

Accidental bumping of the nearby coral formations at Tinigbasan Marine Sanctuary (TMS) and Coral Relocation Site (CRS) by tugboats and barges may occur during bad weather since the occurrence of storm waves and monsoon surges is typical in the area. In addition, the close proximity of the TMS to the port/loading area poses the threat of major ship groundings. This is likely to happen since the distance of the existing causeway-jetty facility from the sanctuary is only about 300-m.

C. Predation by the crown-of-thorns starfish *Acanthaster planci.*

Acanthaster planci is may be the only venomous starfish in the world. The crown-of-thorns (COT) is a predator of corals. It feeds by everting its stomach out of its mouth in a thin sheet that covers all or part of a coral colony and digesting the coral tissue from the skeleton. After several hours, the starfish moves away leaving as a portion of dead coral that is starkly white. This feeding site soon becomes darkened with algae (Colin and Arneson, 1995). This echinoderm species was found to be present along the reef transect at Stations CRS3 and TMS.

Adapting the ANLP's Coastal Resource Management Program, the CRM activities for the ALP will include collection of COTs. Trained and employed local divers schedule the collection based on actual sightings during monthly monitoring activities and identified seasonal changes in the area. The collected COTs are weighed before being disposed by means of deep ground burying. Furthermore, coastal communities of Brgy. Lawigan and Tinigbasan is tapped in monitoring the proliferation of COTs and to assist the Company's Environmental Fish Warden in employing appropriate management response to address the issue on the outbreak of starfish predators.

D. Storm Damage

The reef-building corals are strong and often dense structures that can resist the physical forces generated by normal waves in the study area. It is presumed, however, that turbulences caused by wind-driven waves during a very strong typhoon can overturn large coral heads and tear loose epifauna from their substrata. Powerful storms can affect reefs down to 20-35 m and deep reef zones generally experience less disturbance than shallow zones (Rogers, 1993).

Last year, several typhoons (*e.g*., Typhoon Ompong in September 2018) passed through the area. This might have caused some damages at Site 6 – Coral Garden/"Dyesa Reef" as a result of the mechanical force exerted by the pounding surf associated with the typhoon. The typhoon caused significant decrease in total live hard coral cover along the reef transect (from 79.0% in January to 44.9% in May 2019). Another noticeable difference during the last sampling period in January 2018 and the present sampling period in May 2019 was the significant increase in rock substratum (from 20.0% up to 43.9% cover) covered by microalgae with trapped fine sediments. This remarkable may be associated with the strong storm wind-generated waves that presumably can stir up deposited sediments which settle on reef organisms such as microalgae.

E. Low salinity

Coral reefs occur under natural conditions at salinities ranging from 25 to 42 ppt (Coles and Jokiel, 1992). Most species of corals show very little tolerance to low salinity waters such that they are generally absent near mouths of rivers or creeks. Example of this is the shore area close to the mouth of Payong-payong Creek. The presence of this creek often results in local influx of large volumes of freshwater that may cause extensive damage to both branching and massive corals in shallow water habitats close to creek mouth especially during the rainy months, or passage of typhoon events.

The latest monitoring data indicated a decreased coral cover substantially from 47.6% in January 2018 down to 29.9% in May 2019. This can be attributed principally to reduced salinity that led to mortality of coral organisms in shallow water. A survey of literature suggests that most species of reef corals are killed when salinity is reduced to 15 to 20 ppt for 24 hour or more (Coles and Jokiel, 1992; Jockiel et al., 1993).

2.9.7.2. Threat to Abundance, Frequency, and Distribution

The impacts on marine organisms are effects of changes in water quality and bottom contamination. Siltation of the near shore water due to runoff or discharge of silted water from the open or disturbed areas is a primary concern for the ALP operation. Fine soil particles, when discharged in the ocean, settle at the bottom and cover the biota and the physical habitat at the ocean floor. Exposure to these fine materials may impede the natural biological processes of the marine organisms, such as their feeding and reproduction, and can be detrimental to their health. Furthermore, the presence of the Port may accelerate sediment deposition in the stagnant water behind the structure.

The transport of silt and sediment materials to the marine environment is controlled by the establishment of drainage system consists of interceptor canals, designed to direct the surface run-off to the water management structures (settling ponds, silt collector sumps, in-pit ponds). This allows for the removal of suspended solids in water, prior to its discharge into the receiving water bodies. Catchment rafts stationed under barge ramps are also used during barge loading to manage ore spillage. As a final line of defense in case of drainage system failure and heavy rainfall events, the silt curtain installed around the causeway helps contain the silt materials and minimize the potential sedimentation impact to marine habitat.

The silt curtain is usually made with geotextile material, which is a geosynthetic, permeable fabric; the same material currently used for embankment stabilization in the sediment ponds.This type of polyester fabric is not water soluble and reacts only to UV, hence is eco-friendly. Alternatively, jute sacks made with natural abaca fibres, are also used in the production of the silt curtain. Either way, the women from the local community are involved in manually putting together the fabric to produce the silt curtain.

Effluents from barges, including bilge water and domestic wastes, when mixed with marine water can lead to eutrophication and reduced oxygen levels of water due to insufficient mixing. This is also a threat to the survival of marine organisms. This impact is prevented through the conduct of IEC for barge operators on the proper wastewater disposal. Regular barge inspection by the PCO enables checking of the compliance to the disposal protocols.

The hard corals with respect to the near shore marine environment, which is adjacent to the Project area, potentially impacted coral community found within the Port construction site is already relocated in a nearby marine sanctuary. Marine vessels, if not properly maneuvered, can damage the coral reef in the sanctuary. Mitigating measures include installation of buoy markers within the coral reef area to prevent barges from entering, and installation of solar powered blinkers as guide for the navigation of marine vessels. A lookout tower is also established for monitoring by the deputized coast guards.

The Company's management protocols relative to the marine resources are embodied in the Coastal Resource Management Program (CRMP) developed to strengthen marine conservation measures and protect the nearby marine sanctuaries. This is adopted from the established Integrated Coastal Resource Management Program (ICRMP) of Tubay, which has long been implemented by its LGU, through the Community Based Resource Management Project (CBRMP) of the Department of Environment and Natural Resources (DENR) and Department of Agriculture (DA).

Through their ICRMP, Tubay was able to establish a Municipal Coastal Resource Management Framework which serves as a guide in conducting the following: a) Delineation of boundaries of Municipal waters (in coordination with the Municipal Government of Jabonga and Cabadbaran), b) Preparation of zoning and management plans covering the Municipal water of Tubay, c) Strengthening the fisherfolk organizations and the Fisheries and Aquatic Resources Management Council (FARMC), d) Formulation of organizational and institutional mechanisms, e) Identification of procedures for dealing with pollution (form liquid and solid waste) recreational, and educational.

In 2007, this ICRMP was adopted by the Company in partnership with the LGU of Brgy. Lawigan and Tinigbasan of Tubay, the Tinigbasan and Fisherfolks Association (TIFFA), Lawigan Farmers and Fisherfolks Association (LAFFA) and the Municipality of Tubay. In coordination with the Municipal CBRMP Coordinator of Tubay and the active participation of the local fisherfolks, the ICRMP for Barangay Lawigan and Tinigbasan was continually improved under the implementation of the Annual Environmental Protection and Enhancement Program (AEPEP) of the Company.

2.9.8. Management and Monitoring Plan Relevant to Marine Ecology

A summary of the management and monitoring plans relative to the potential impacts to marine resources is provided in **Table 2-40.**

Table 2-41 Summary of Management Plan- Impacts to Marine Ecology

Key Environmental Impact	Management Plan	Monitoring Plan
Siltation of near shore marine water due to erosion and ore spillage during loading activities. Marine habitat degradation from siltation Health effects on marine animals Discharge of contaminated bilge water from barges. Domestic solid waste and wastewater discharge from ship crew. Coral reef damage from marine vessels	• Installation of erosion control materials along slopes (coconets, gabion basket, stop logs, wattlings, and fascines). • Establishment of drainage system (road berms, interceptor canals) around active disturbed areas for runoff management. • Installation of silt fences, silt curtain along waterways to capture silt/ sediment materials discharged in the waterways. • Installation of raft under the loading ramp to catch ore spill. • Geotextile silt curtain installed around the causeway as last line of defense to contain the silt materials in water. • Orientation to barge crew members on proper housekeeping and waste management practices. • Regular inspection of the barge and ship by the PCO. • Buoy demarcation and blinkers for navigational guide of marine vessels • Construction of a look-out tower and deployment of local fish wardens for easy monitoring of activities.	Coral and Marine Habitat monitoring Regular Marine Water Quality Monitoring and Assessment

2.9.9. Meteorology and Climatology

2.9.9.1. Local Microclimate

The Project area is located within a Type II climate zone as defined by the Modified Coronas Climate Classification developed by the Philippines Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). This particular climate type is characterized by an absence of a dry season. Rainfall occurs throughout the year with the heaviest rainfall occurring during the months of December and January. A climate classification map showing the project area is shown on **Figure 2-56.**

The northeast monsoon blows from November to April and is responsible for the high amount of rain that falls during this period. The southwest monsoon prevails during the rest of the year but since it approaches the country from the southwest, Agusan del Norte is partly shielded from its full effect.

The Philippine Area of Responsibility (PAR) is visited by an average of 20 typhoons every year, with about 8 or 9 of them crossing the Philippines. The peak of the typhoon season is July through October, when nearly 70% of all typhoon develop. Most disturbances traverse Luzon and Visayas while typhoons rarely cross Mindanao. The site of the proposed limestone project is within the area visited by approximately two to three typhoons per year.

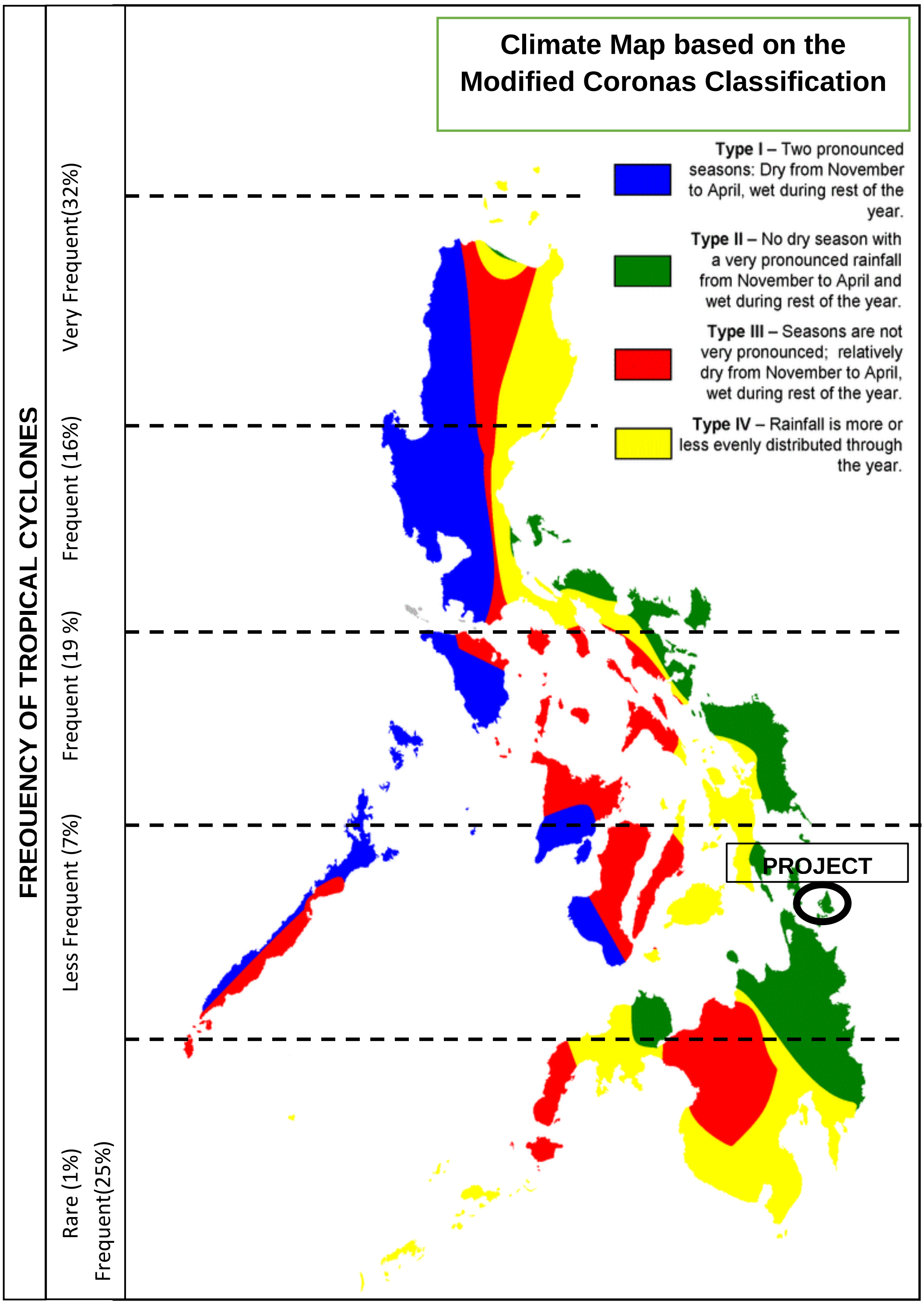
The mean annual rainfall (1981-2010) at the PAGASA-Butuan Station is 2,058 mm with the period of October to February being the wettest months. Other meteorology and climate data available for the Butuan station include temperature and evaporation. Temperature data and Monthly mean rainfall values for the period Years 1981 to 2010 are shown in **Table 2-41.**

Table 2-42 Climate Data Mean Monthly Values, Butuan City, Agusan del Norte

Month	Rainfall	Temperature (max)	Temperature (min)	Temperature (Mean)	Monsoon Season
	(mm)	(C)	(C)	(C)	
January	318	30.2	22.5	26.3	Northeast
February	225	30.8	22.5	26.6	Northeast
March	145.4	31.8	22.8	27.3	Northeast
April	109.7	33.1	23.5	28.3	Northeast
May	115.5	33.7	24.2	28.9	Southwest
June	154	33.1	24	28.5	Southwest
July	143.9	32.6	23.7	28.2	Southwest
August	105.6	32.9	23.9	28.4	Southwest
September	126.3	32.9	23.7	28.3	Southwest
October	178.4	32.4	23.6	28	Southwest
November	197.9	31.7	23.4	27.5	Northeast
December	238.2	30.8	22.9	26.9	Northeast
Annual	2,058	32.2	23.4	27.8	-

Source: Rainfall Data and Temperature, PAGASA Butuan City; PAGASA Climatological Normal Values.

Figure 2-56 Climatological Map of the Philippines

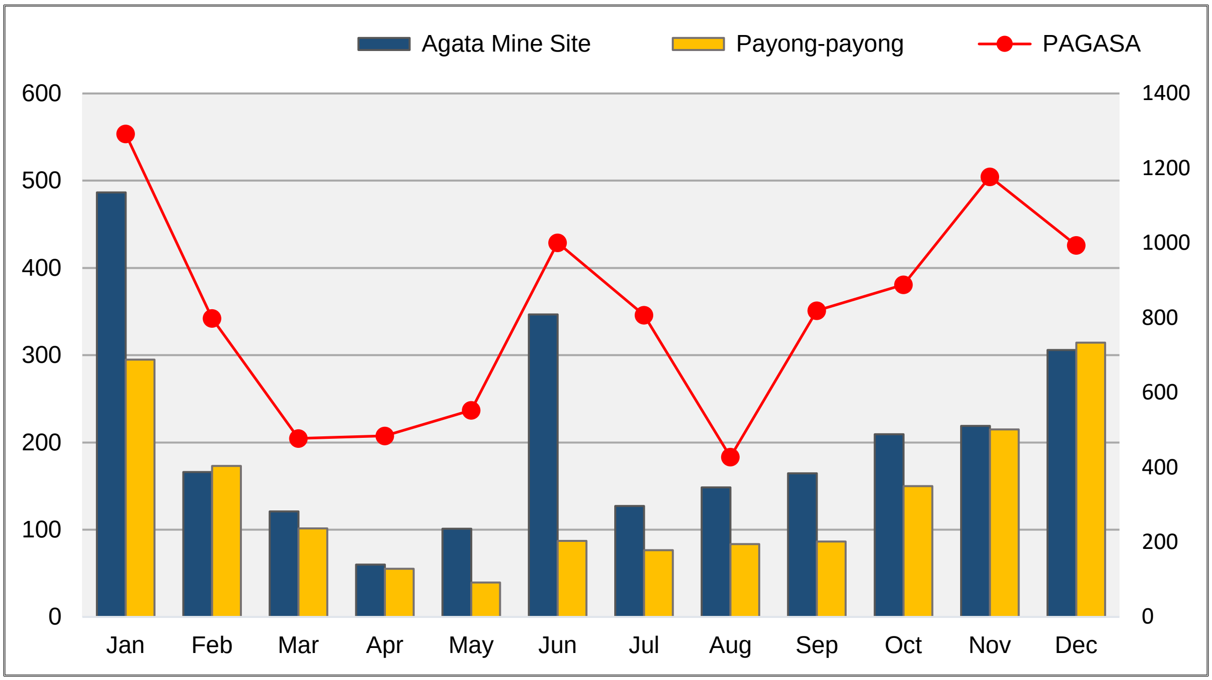


Source: PAGASA

The temperature records of the PAGASA Butuan City Station indicate a relatively warm annual average temperature of 32.2°C(max), 23.4°C(min) and an annual mean of 27.8°C. May, June and August are the hottest months based in the mean temperature rising to an average of 28.6°C. The coldest month is January, which has an average temperature of 26.3°C.

Daily meteorological monitoring is also done in-house by the Environment Department to record the local precipitation trends that may not be reflected in the regional data. Two rainfall monitoring stations are established in the Project area; one rain gauge is stationed near the surface mine and another is installed at the causeway/ port area in Payong-payong. Meteorology data for the period Year 2019, for Agata Mine Site and Payong-payong monitoring stations are shown in **Figure 2-57**

Figure 2-57 Total Monthly and Cumulative Rainfall for Year 2019 – Agata Mine Area Station



The mean annual rainfall recorded at the surface mine site for the five year period record is 204.66 mm. January was the wettest month, with a mean rainfall depth of 486.55 mm; while April was the driest month with a mean rainfall depth of 0.8 mm and a total rainfall depth of 60.11 mm.

A different precipitation trend was observed at the Payong-payong Port area with annual mean rainfall of 139.79 mm. January had the highest mean rainfall depth of 295.12 mm. May was the driest month with a mean rainfall depth of 39.58 mm.

2.9.9.2. Seasonal Changes from Climate Change

In Year 2019, PAGASA updated their climate projections for the Philippines in their report entitled Observed Climate Trends and Projected Climate Change in the Philippines. Using climate models, the average climate information collected over the period of Year 1971-2000 was used to derive the projected changes in temperature and rainfall for the mid-20th century (Year 2036 to Year 2065), over 73 major provinces of the Philippines.

Three projected patterns of changed were included in the report. They include the lower driest possible (lower bound), the wettest possible (upper bound), and the most likely change to be observed (median). Two scenarios were considered in this modelling: the moderate level GHG emissions (RCP 4.5) and the high level GHG emission (RCP 8.5).

The PAGASA climate change projections for the Province of Agusan del Norte is shown in **Table 2-42.** The modeling results shown is the median changes based on moderate emission scenario. As seen in the projected values, the province is predicted to have a net decrease in rainfall and net increase in temperature throughout the year.

Table 2-43 Projected Seasonal Changes in Rainfall and Temperature for Agusan del Norte

DJF		MAN		JJA		SON	
Projected Rainfall Changes							
% change	mm	% change	mm	% change	mm	% change	mm
-9.8	790.2	-14.2	379.4	-11.4	407.3	-21.2	495.5
Projected Temperature Changes							
% change	ºC	% change	ºC	% change	ºC	% change	ºC
1.2	27.4	1.3	28.9	1.2	29	1.2	28.6

Note: Median Values for Moderate Emission Scenario; Source: PAGASA, 2018

Using the baseline rainfall values in Year 2019 and applying the projected rainfall changes, the projected rainfall values in the limestone project area and Payong-payong Port is shown in **Figure 2-58** and **Figure 2-59**, respectively.

Figure 2-58 Seasonal Change in Rainfall (mm) at Nickel Mine Site (2036-2065)

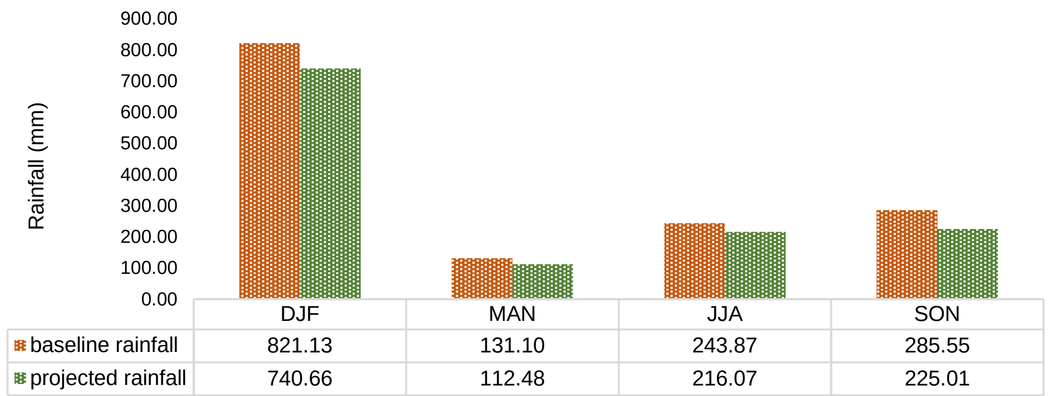
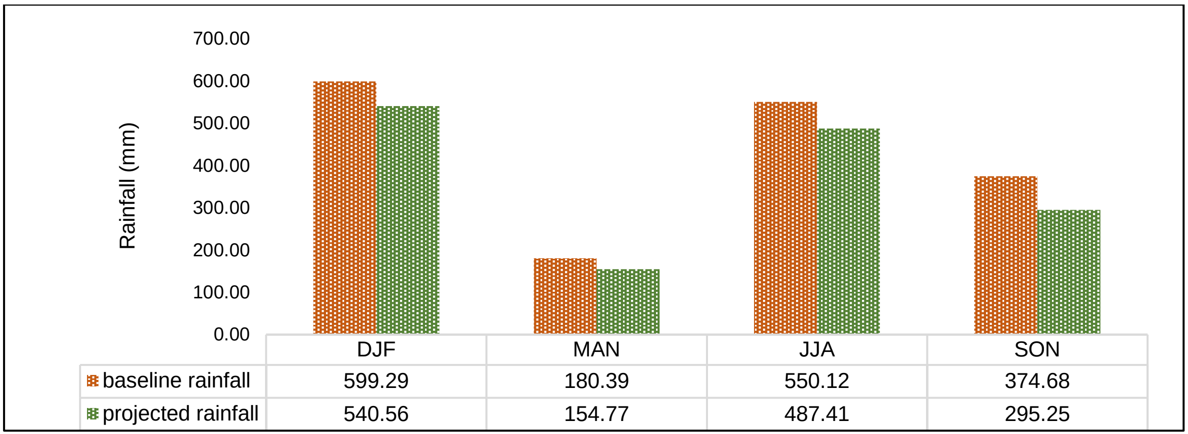


Figure 2-59 Seasonal Change in Rainfall (mm) at Payongpayong Port (2036-2065)



The most significant decrease in rainfall is predicted towards the end of the year, with a net decrease of 21% or equivalent to 60.5mm less rain at the nickel mine area and around 80mm less rain at Payong-payong Port.

In mining where activities are contingent to weather condition, drier season is more preferred because it will allow continuous mining, processing, and loading activities. With the heavy land disturbance from mining activities and the stockpiling of loose ore materials, siltation from stormwater run-off is usually common. However, the overall decrease in rainfall and higher temperature may somehow slow down the erosion rate but may contribute to dust generation. Water management facilities will be in place to manage stormwater run-off during rainfall events. Capacities of structures will be computed based on the maximum expected rainfall in record. In drier days, dust control will be employed by spraying through water trucks.

2.10. Air and Noise

2.10.1. Air and Noise Quality

The ambient air and noise quality monitoring is done at seven (7) sites listed in **Table 2-43** and is shown on the sampling map in **Figure 2-60** and **Figure 2-61.**

Among all sampling stations, only A-4, A-5, and A24-6 are within the vicinity of the project **(Figure 2-61**). The 4 others are not likely to be affected by the limestone project activities but will also be included to serve as control stations for future monitoring during the operations and post operations periods.

Table 2-44 Ambient Air and Noise Quality Monitoring Stations

Station Designation	Air Monitoring Station
A-1	Admin building compound
A-2	Between Pit 1 and Pit 2 of ANLP
A-4	**Pier yard**
A-5	**Pier yard near Causeway**
A24-6	**Brgy. Tinigbasan, Tubay - Near Brgy. Hall**
A24-7	Brgy. Lawigan, Tubay - Near Brgy. Hall
A24-3	Brgy. E. Morgado, Santiago- Near Kalinawan

Section 2– Environmental Baseline Conditions for Critical Environmental Parameters, Impact Assessment and Mitigation

Parameters monitored include Total Suspended Particulates (TSP), Particulate Matter less than 10 micros (PM10) and Noise Level. Air and noise monitoring all falls within the NPCC standard for both Class D (Industrial) and Class A (Residential) categories.

Air and noise quality data presented in **Table 2-44** is the average of the quarterly monitoring conducted in Year 2019.

Table 2-45 Ambient Air and Noise Quality Monitoring Data

Parameter	NPCC Class D	A-1	A-2	A-4	A-5
Noise Level (dB)	75.00	55.00	52.50	45.50	47.50
TSP (ug/Ncm)	300.00	12.70	13.88	1.60	1.60
PM10 (ug/Ncm)	200.00	<1.675	6.00	1.60	1.60

Parameter	NPCC Class A	A24-3	A24-7	A24-6
Noise Level Morning (dB)	50.00	47.75	47.50	54.67
Noise Level Daytime (dB)	55.00	57.00	50.50	55.67
Noise Level Evening (dB)	50.00	47.75	45.75	54.00
Noise Level Nightime (dB)	45.00	45.00	44.75	53.00
TSP (ug/Ncm)	230.00	12.07	18.71	16.00
PM10 (ug/Ncm)	150.00	0.94	0.71	1.29

Source: ANLP SMR, 2019

Results indicated that the TSP and PM-10 levels detected, both within the project site and in the community, are complying to the applicable ambient air standards. Morning noise level at Station A24-6 slightly exceeded the noise standard which can be attributed to its location being near a population center.

Figure 2-60 - Air and Noise Quality Monitoring Location Map (ANLP)

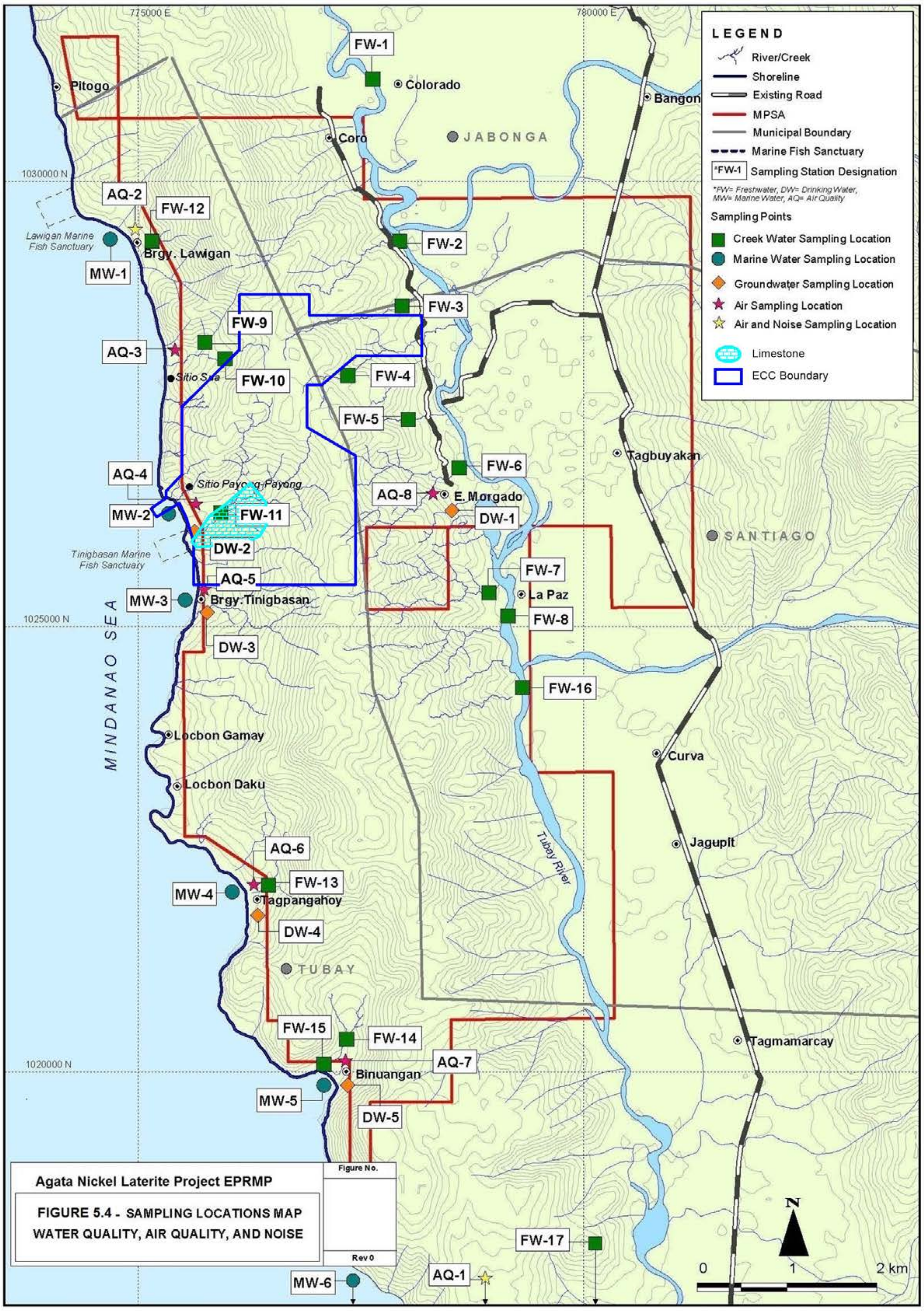
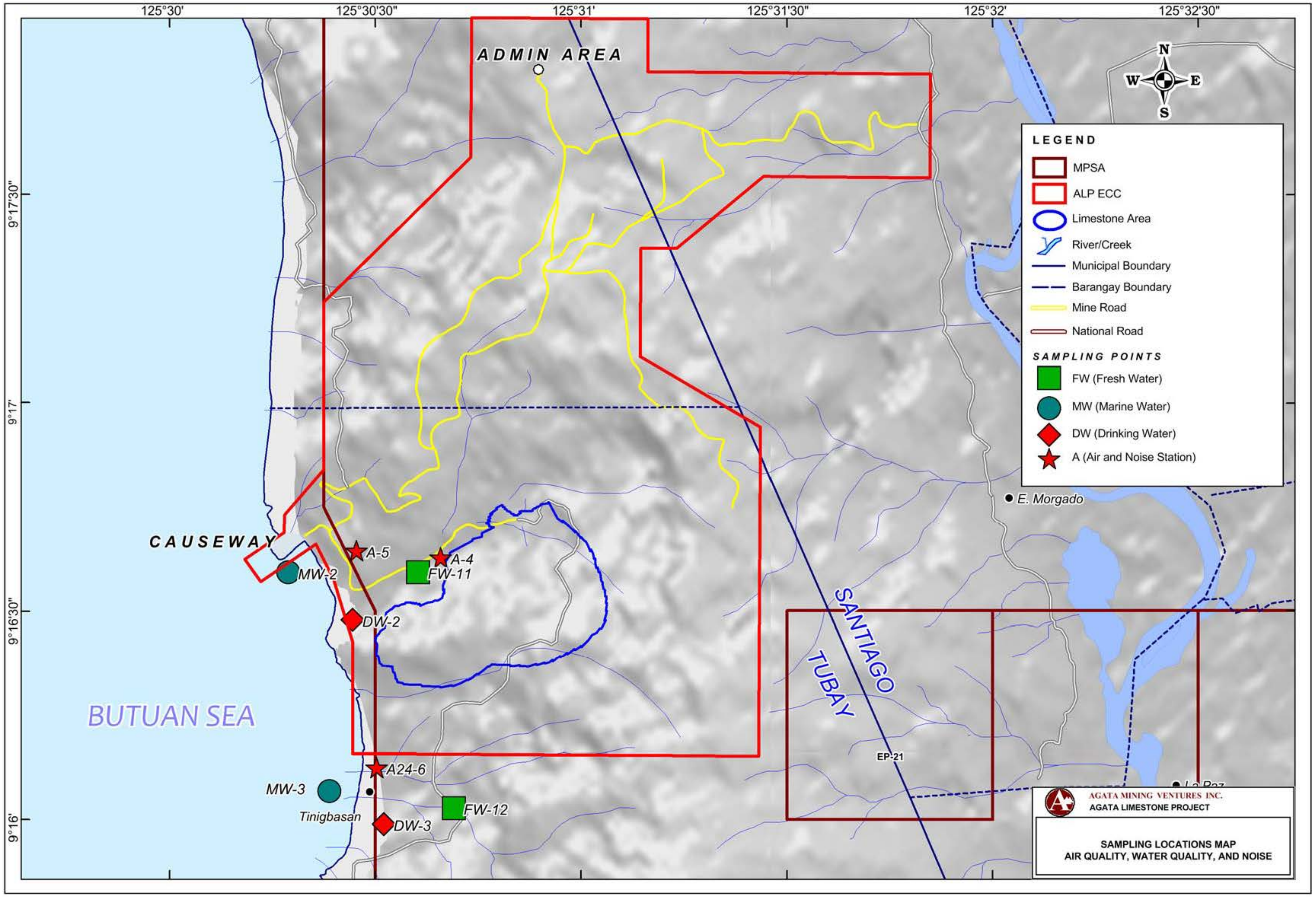


Figure 2-61- Air and Noise Sampling Location Near the Project Area



2.10.1.1. Fugitive Dust and Noise Generation

Dust suppression is through direct water spraying using water trucks. Areas to be cleared and disturbed are limited to those identified in the mine plan to minimize footprint. Establishment of vegetation curtain along the roads, and the periphery of the disturbed areas activities is done to reduce wind velocity and to minimize dust dispersion. Another measure is the regular maintenance, such as grading and compacting, for all access and haul roads. Speed regulation protocols for moving vehicles; especially those involve in hauling, transporting, stockpiling and loading are also in place. Regular preventive maintenance of all heavy equipment and light vehicles, and tree plantations around the mining area which serves as buffer for airborne dust.

Potential sources of noise around the mine site are on and off-road vehicles, blasting operations by the use of explosives, heavy equipment and crusher plant, and power station. Noise and vibration from equipment operation can be nuisance to the surrounding community. It can also drive away faunal species sensitive to noise.

Noise Management to have a quarterly noise monitoring at identified monitoring stations, construction of noise barriers to the main noise source to minimize the impact to the community, provision of PPE's to workers such as mufflers or ear plugs and use of PPE's in heavy machinery, large vehicles, and controlled blasting will be strictly implemented, restriction of hours of activity (heavy vehicle mobilization is minimal during night time, light vehicles are restricted from travelling during night time).,blasting will be done at a fixed schedule and employees and concerned community will be notified through siren before and after the activity. Equipment maintenance and installation of mufflers can minimize noise generation. Establishment of buffer zones in the periphery of the mining areas can control both dust and noise impacts to the nearby community.

2.10.1.2. Contribution to Air Emissions

A. Stationary GHG Sources

Carbon dioxide, Methane, and Nitrous oxide were estimated from the fuel usage of Generator Sets and Tower light that represents stationary sources for Greenhouse Gases (GHGs) in the ANLP Operations. **Table 2-45** and **Table 2-46** shows the predicted annual GHG from stationary sources identified from 2018 – 2019.

Results revealed that the total GHG emissions from stationary source will be approximately 100 tonnes of CO_2. It was worth noting however, that these values were relatively low compared to several records on GHG emission from stationary sources in other mining projects. This can be attributed to the stationary sources limited to Generator sets and Tower lights, whereas other operations utilize high intensity heating equipment such as Furnace, Boiler, Over and LPG. For the ALP operations, additional sources of emission will be the crushing plant.

Table 2-46 Predicted Annual Greenhouse Gas Emissions from Stationary Sources (2019)

Carbon Sources	Fuel Type	Fuel Quantity Used	CO_2		CH_4		N_2O	
			Emission Factor	tons	Emission Factor	tons	Emission Factor	tons
Generator Sets and Tower light	Diesel	38143.07	2.71	103.47	0.00014	0.1121	0.00014	1.66
Generator Sets and Tower light	BioDiesel	778.43	-	-	0.00038	0.0062	0.00087	0.21
GWP		-	1.00		21.00		310.00	-
Total Emission		-	-	103.4707	-	0.1184	-	1.86
Total GHG Emission (tons CO2)= 105.45								

Table 2-47 Predicted Annual Greenhouse Gas Emissions from Stationary Sources (2018)

Carbon Sources	Fuel Type	Fuel Quantity Used	CO_2		CH_4		N_2O	
			Emission Factor	tons	Emission Factor	tons	Emission Factor	tons
Generator Sets and Tower light	Diesel	34130.46	2.71	92.58	0.00014	0.1003	0.00014	1.48
Generator Sets and Tower light	BioDiesel	696.54	0	0.0000	0.00038	0.0056	0.00087	0.19
GWP			1		21.00		310	
Total Emission				92.59		0.1059		1.67
Total GHG Emission (tons CO2)= 94.3607								

B. Mobile GHG Sources

Similar with Stationary sources, the GHG emission from mobile sources were also estimated from the total fuel usage during the nickel operation. Shown on **Table 2-47, Table 2-48,** and **Table 2-49** are the estimated GHG emission for the different mining activities from construction, development, and abandonment phases.

The ore extraction activity, including the loading and hauling of mined materials to the stockpile area, accounts for the greatest emission of 338.2 tonnes of CO2 equivalent. The stationary sources identified for the ALP Operations include mining equipment, haul trucks, and light vehicles. These are the same with that of ANLP operations, so emissions of similar magnitude are anticipated.

Table 2-48- Estimated Annual Greenhouse Gas Emissions from Construction and Development Activities

Activity	GHG Emissions (t CO_2e)			
	Diesel Use	CO_2	CH_4	N_2O
Construction and Development	16,500	43.86	0.05	0.80
Site Preparation Clearing, and Earthwork	12,000	31.90	0.04	0.59
Pre stripping activities at the quarry site	42,000	111.65	0.13	2.05
Construction of Additional Roads	15,000	39.88	0.05	0.73
Water management Ponds and Canals	6,000	15.95	0.02	0.29
Total	91,500	243.25	0.28	4.46

Source: API

Table 2-49- Estimated Annual Greenhouse Gas Emissions from Mining Activities

Activity	GHG Emissions (t CO_2e)			
	Diesel Use	CO_2	CH_4	N_2O
Clearing and Grubbing	52,000	138.24	0.16	2.54
Stripping	18,200	48.38	0.06	0.89
Ore Extraction (Loading Hauling)	124,800	331.77	0.39	6.09
Waste generation from daily operational activities	3,900	10.37	0.01	0.19
Water management Ponds and Canals	5,200	13.82	0.02	0.25
TOTAL	204,100	542.59	0.63	9.95

Source: API

Table 2-50- Estimated Annual Greenhouse Gas Emissions from Abandonment Activities

Activity	GHG Emissions (t CO_2e)			
	Diesel Use	CO_2	CH_4	N_2O
Benching, grading and earthwork for the closure of the disturbed areas (surface mine, water management structures, etc)	28,600	76.03	0.09	1.39
Decommissioning or Rehabilitation of Mine Facilities (Office and Housing Buildings, Motorpool, Storage Areas, Nursery, and Pier	5,200	13.82	0.02	0.25
Rehabilitation of Mine Disturbed areas	5,200	13.82	0.02	0.25

Source: API

Table 2-51- Total Greenhouse Gas Emissions from All Mining Phases

Activity	Total GHG Emission (t CO2e)
Construction and Development	44.72
Site Preparation Clearing, and Earthwork	32.52
Pre stripping activities at the quarry site	113.83
Construction of Additional Roads	40.65
Water management Ponds and Canals	16.26
Clearing and Grubbing	140.94
Stripping	49.33
Ore Extraction (Loading Hauling)	338.24
Waste generation from daily operational activities	10.57
Water management Ponds and Canals	14.09
Benching, grading and earthwork for the closure of the disturbed areas	77.51
Decommissioning or Rehabilitation of Mine Facilities	14.09
Rehabilitation of Mine Disturbed areas	14.09
TOTAL	906.9

C. Carbon Loss from waste Decomposition

The type of carbon loss via decomposition of waste materials especially in semi-saturated condition is methane. This was estimated by segregating waste materials and determining its weight or volume against the total waste generated.

Four type of solid waste most commonly generated by the project were identified for calculation of methane emission. Among them, the biodegradable waste, particularly the food waste had the highest volume generated and translated into the highest methane emission source. Methane emission from 2018 – 2020 ranges from 140 – 230 tons per year. The highest methane generated was recorded last 2018 as shown in **Table 2-51, Table 2-52,** and **Table 2-53**.

Table 2-52 Estimated Methane emission from waste generated in (2020)

Factor	Waste Type	Waste (kg/year)	% DOC by Volume	DOC	Total Methane Emitted (tons/year)
A	Paper and Textiles	6433.44	21.54	15.45	141.75
B	Garden and Park Waste, Non-Food	255.47	0.86		
C	Food Waste	11268.52	37.72		
D	Wood, Straw Waste	1022.75	3.42		
Total Waste (2020)		18980.18			

Table 2-53 Estimated Methane emission from waste generated in (2019)

Factor	Waste Type	Waste (kg/year)	% DOC by Volume	DOC	Total Methane Emitted (tons/year)
A	Paper and Textiles	11200.48	37.50	25.18	231.07
B	Garden and Park Waste, Non-Food	202.07	0.68		
C	Food Waste	16893.58	56.56		
D	Wood, Straw Waste	1574.86	5.27		
Total Waste (2019)		29870.98			

Table 2-54 Estimated Methane emission from waste generated in (2018)

Factor	Waste Type	Waste (kg/year)	% DOC by Volume	DOC	Total Methane Emitted (tons/year)
A	Paper and Textiles	11043.56	36.97	25.39	232.99
B	Garden and Park Waste, Non-Food	653.38	2.19		
C	Food Waste	14805.29	49.56		
D	Wood, Straw Waste	2781.67	9.31		
Total Waste (2018)		29283.89			

D. Land Use Change

Specific land use change will be from grassland and mixed perennial to open area which brought about vegetation clearing during construction and pre development phase. Vegetation hold the active component of carbon in the system and removing them also removes carbon in the area. The estimated loss of carbon is greater than 2000 ton corresponding to the planned area to be converted which is approximately 50 ha. This is shown on **Table 2-54**.

Table 2-55 Estimated Carbon loss via Land Use Change

Land Use to be Change	Area (ha)	Estimated Carbon Storage (ton C/ha)	Carbon Estimated be loss	Total Carbon loss (tons C/ Total Area)
Grassland	2.14	12.1	25.894	2199.65
Mixed (Agroforestry)	47.88	45.4	2173.752	
Total Area	50.02			

Summarizing the emissions from various sources, it is shown on **Table 2-55** that mobile sources are the most significant sources of GHG emissions in the quarry operations. These sources include the heavy equipment and light vehicles to operate in the mine site.

Table 2-56 Summary of estimated GHG emission (tons) from the prospective project area

Carbon Souces	2018	2019	2020	Total GHG Emission
Stationary Sources	94.368	105.45	0	199.82
Mobile Sources	10067.48	368.83	0	10436.31
Waste	233.00	231.07	141.75	605.82
Land Use Change	0	0	2199.65	2199.65
			TOTAL GHG EMISSION	13441.59

To mitigate the potential impacts from the harmful GHG emissions, mine development plan will be strictly followed to maximize the equipment use. Equipment and plant maintenance will also be done regularly for better fuel burning efficiency. Blasting activities at the quarry site will be controlled and will only be done as necessary. Hauling roads and routes will be planned in such a way that hauling distance is minimized. Ecological/ vegetation curtain and buffer will be established within the periphery of the active mining and stockpile areas to minimize dispersion of particulates. The reforestation activities during progressive rehabilitation can also help in carbon sequestration.

2.10.2. Management and Monitoring Plan Relevant to Air and Noise

A summary of the management and monitoring plans relative to the potential impacts to air and noise is provided in **Table 2-56.**

Table 2-57 Summary of Management Plan- Impacts to Air and Noise

Key Environmental Impact	Management Plan	Monitoring Plan
Particulates and chemical emissions from mining activities and vehicle use. Chemical emission from wastes and land use change	Mine Planning Controlled blasting Carbon sequestration from reforestation activities. Plant and equipment maintenance. Planned hauling routes Buffer zones and vegetation curtains. Waste management.	Regular Ambient Air and Noise Monitoring for TSP, PM10, SOx, NOx and CO. Source Emission Monitoring for mobile vehicles, heavy equipment and generator set exhaust.
Dust generation from equipment operation (construction and operation)	Water truck deployment and speed limit regulation. Regular road maintenance Maintenance of buffer zone in Project area periphery	

Table 2-56 Summary of Management Plan- Impacts to Air and Noise

Key Environmental Impact	Management Plan	Monitoring Plan
Noise generation from plant operation and equipment use. (Community nuisance and faunal migration)	Establishment of vegetation along roads as ecological curtain. Equipment maintenance and muffler installation.	Regular Ambient Air and Noise Monitoring for TSP, PM10, SOx, NOx and CO. Source Emission Monitoring for mobile vehicles, heavy equipment and generator set exhaust.

2.11. The People

2.11.1. Demographics

A. Population

The impact area where Project activities will be implemented is in Barangay Tinigbasan, Municipality of Tubay. The neighboring community that hosts the Administrative building, Assay laboratory and facilities to include the accommodation quarters of staff and mess hall is Barangay of Lawigan, also within the municipal jurisdiction of Tubay.

Total land area of the municipality is 13,809 hectares comprising 5.1% of the total land area of the province of Agusan del Norte.

Summary of the size and population of the two barangays is shown in **Table 2-57.**

Table 2-58 Population Data of Impact Communities

Municipality	Municipal Land Area (ha)	Impact Barangay	Population (2016)	Population (2019)	Increase or Decrease from 2016	Class
Tubay	13,809	Lawigan	814	724	11.1%	5th Class Municipality
		Tinigbasan	1,003	1,026	2.29%	

Source: PSA, CSU-SIA, 2017

In Brgy. Tinigbasan, the working age group of 18-49 forms the 42.5% of their population, while the senior citizens aged 65 and above has the lowest count. This relatively the same with Brgy. Lawigan with 49% of their population are the work group (18-49), and the old dependents aged 65 above is only 4% of the total residents. The comparative population distribution in the two barangays, per age group and sex is presented in **Table 2-58**.

Barangay Tinigbasan registered 216 household and barangay Lawigan has 169 as reflected in their Barangay Development Plans for 2018 - 2022.

The majority of the local inhabitants within and surrounding the Project area are of Visayan heritage. The area is also the home of the Mamanwa-Manobo indigenous peoples. In most recent times migrants from the Visayas and Luzon Provinces have settled in the area. Most residents speak the Cebuano dialect; Tagalog is reasonably understood and spoken when necessary.

Table 2-59 Population by Age and Sex

Age Group	Brgy. Tinigbasan		Brgy. Lawigan	
	Male	Female	Male	Female
0-6	128	58	45	42
7-17	154	76	78	86
18-49	272	164	187	166
50-64	76	41	46	44
65 above	35	22	10	20
Total	1,026		724	

Source: Actual Interview, 2019

B. Indigenous Peoples

Mamanwas are ancestral people of several indigenous people in the Northern area of Surigao, Philippines dating back to the earlier centuries. The Mamanwas inhabit the mountains in Northeast Mindanao. They are less in number and more scattered and nomadic. The Mamanwas are a different in their looks and physical features compared to the lowlanders. They generally did not adopt the lowlanders' way of living even if they were already Christianized. They had been rooted for centuries in the indigenous culture which is very difficult to understand. They speak their own dialect which noticeably has some phonetic similarities with that of Surigaonon.

The Agusan Manobo is one of eight (8) tribal groups that comprise a cluster of tribes known generally as Manobo and inhabits the island of Mindanao. The Agusan Manobos number about 60,000 and live in the flood plains along the Agusan River and adjacent foothills of North Central Mindanao. Unlike other tribes of Mindanao who live in rugged, remote mountains, the Agusan River Manobos live in an area that annually becomes a vast inland lake due to flooding.

On July 14, 1999, with guidance of the NCIP, MRL Gold Philippines, Inc., previous operator of the Agata MPSA and now known as MRL Nickel Philippines, Inc., executed a Memorandum of Understanding (MOU) with its host Mamanwa and Manobo Tribes that led to the execution of a Memorandum of Agreement (MOA) for its Agata Nickel Laterite Project. This then led to the eventual compliance of the Free and Prior Informed Consent (FPIC) and the issuance of a Certificate of Precondition by the NCIP on February 6, 2008. A copy of the MOA and the Certificate of Precondition is included in the **Appendices.**

C. Education

In terms of educational attainment, close to 1/3 of the population of Brgy. Tinigbasan were able to attend primary school, while only 5% were able to finish college. Higher educational attainment was completed by the residents of Brgy. Lawigan with 21% are high school graduate. Nearly 6% graduated from college. These are shown in **Table 2-59**.

Table 2-60 Population by Educational Attainment

Brgy.	Pre School level	Elementary level	Elementary Graduate	High School Level	High School Graduate	College level	College Graduate	No Schooling
Tinigbasan	-	330	103	132	176	155	46	84
Lawigan	25	167	92	139	152	54	43	52

2.11.1.1. Displacement of Settlers and Property

The area is classified as a mineral land and will undergo development and eventual operations if statutory and regulatory requirements are fulfilled. The implementation of the Project will result in actual physical disturbances of the land, which are inherent in mining projects. These disturbances will be mitigated through progressive rehabilitation and mine decommissioning strategies, which are integral part of the overall mine plan. A Final Mine Rehabilitation & Decommissioning Plan for the Project has been developed consistent with existing rules and regulations

The ALP area will not entail any displacement of people and their personal properties since these were already negotiated and relocated during the construction of Agata Nickel Laterite Project's causeway. The residents who are mostly informal settlers along the shore of sitio Payongpayong signed a Memorandum of Aggreement with API on December 19, 2012. The Municipal Local Government of Tubay facilitated the MOA.

There are still land properties that need to be acquired for the quarrying operations. However, there are no people living in these properties nor any significant structure built in them. Resettlement of settlers will not be necessary.

There will be an increased equipment and vehicle movement when the ALP becomes operational. This, however, will be along the hauling roads near the quarry and pier facilities. Increased mobility of people and equipment will also be mostly within the immediate area of the Project.

2.11.1.2. Conflict in Land Ownership

The Project is located in a land classified as mineral land by the Philippine Government and covered by an MPSA approved on May 26, 1999 and denominated as MPSA No. 134-99-XIII.

A portion of the Project area is covered by the Community-Based Forest Management Agreement (CBFMA) of Tinigbasan Farmers & Fisherfolks Association (TIFFA), which was issued years after the MPSA was granted. It is worth mentioning that the Proponent did not insist over its legal rights to displace CBFMA and Community-Based Resource Management Plan (CBRMP) holders particularly TIFFA, Lawigan Farmers & Fisherfolks Association (LAFFA), and E. Morgado Integrated Forest Developers & Multipurpose Cooperative (EMIFDMC) when it operated the ANLP despite the Proponent's prior rights, instead, it finalized deals with these POs through MOAs. This way, the Proponent showed that it can work in harmony, and in accord, with the community.

A portion of the Project area was also erroneously covered by Certificates of Land Ownership (CLOAs), inadvertently granted by the Department of Agrarian Reform in March 2013, fourteen (14) years after the granting of the Agata MPSA. Within the proposed quarry area, majority of the area covered by these

CLOAs have been cancelled by the DAR, pursuant to its Decision of 23 October 2014, which Decision had long attained finality.

Land properties covered by TCTs and Tax Declarations are also present in the Project area. Some of these had already been acquired by the Proponent. It will endeavor to acquire the remaining land properties it may need, for safe and effective operations of the Project, through just and reasonable arrangements, to avert conflicts which may arise with those landowners.

2.11.1.3. Change/Conflict Right of Way

The northeastern and northern areas of the limestone deposit are currently used by the ANLP as stockpile areas of its nickel laterite DSO. Ingress and egress through these areas will not be a problem concerning rights of way from private landowners.

Just and reasonable acquisition of the land properties located in the immediate surrounding areas will ensure no conflict will arise pertaining to rights of way.

2.11.1.4. Impact on Public Access

There are plans to connect the provinces of Agusan del Norte and Surigao del Norte through a coastal road that will pass through the coastal barangays of Tubay and Jabonga. In Tubay, a pilot road had been constructed many years back and little progress has been made so far along the Binuangan-Tinigbasan stretch. Once completed, this will become a major access from La Fraternidad down south to Lawigan and thence to Jabonga to the north passing through the northern section of the Project area.

Safety of the local population with regards to vehicle movements will be prioritized. When the Tubay-Jabonga coastal road becomes operational, a traffic management plan will be implemented in close coordination with the Tinigbasan and Lawigan BLGUs and the Tubay MLGU.

At this point, vehicular movements along that portion of the coastal road that will pass through the Project are contemplated to include but not be limited to the following:

- The company or trucking contractor will be required to hire local drivers and train drivers and helpers to ensure a safe operation.
- The company or the trucking contractor will deploy trained local traffic spotters with radios in strategic portions along the road.
- Traffic management will be coordinated with the LGUs.
- Sections of roads that will incur traffic build up and will be managed by traffic spotters and using passing bays so that the trucks do not contribute to traffic bottlenecks especially where the road narrows. This will help to harmonize and enhance experience for casual driving residents or visitors.

2.11.1.5. In migration

In-migration will be inevitable to the area where livelihood and commerce is available. Qualified residents of Barangays Tinigbasan and Lawigan will be given priority employment in the ALP but it is expected that non-residents of these two (2) barangays will have a significant share in the employment during the quarrying operations.

Non-Tinigbasan and non-Lawigan residents who cannot be accommodated by the Company's housing facilities may opt to transfer their residences to these barangays during the term of their employment. This means room and house rentals will be brisk during the duration of the ALP. Some may opt to acquire or rent land properties within these impact barangays and their peripheries. Areas like Sua in Lawigan or Lucbon in Tinigbasan may see in-migration including construction of houses.

The proponent will prioritize the engagement of qualified local manpower. However, if no qualified local applicant is available, outsiders will also be considered. Employees who are not residents of the host and neighboring barangays will be accommodated using the proponent's housing facilities.

Furthermore, the economy of barangays Tinigbasan and Lawigan is expected to rise during the life of the ALP. This will result in business entrepreneurs setting up businesses in these two (2) barangays.

However, security protocols will be in place to regulate entry to the project area. Coordination with the LGU and local authorities will also be done.

2.11.1.6. Cultural and Lifestyle Change

The quarrying operations of the Agata Limestone Project (ALP) will not bring about significant cultural changes to the Indigenous Cultural Communities who own CADT 237 nor to the non-IP residents of the host and neighboring barangays. The Manobo-Mamanwa IP are settled in the barangays far away from the quarrying operations.

There are no archaeologic, paleontologic, historical, religious, aesthetic or major cultural structures present in the Project area and its immediate surroundings that will be physically impacted by the operations. During the Field -Based Investigation of the NCIP, which was part of the Free and Prior Informed Consent (FPIC) process, it was established that there is no historical or archaeological landmarks within the host IPs' ancestral domain, nor information relating to the presence of historical sites in the host and neighboring barangays.

The operations of ANLP since 2014 and the community preparations prior to this ensure that cultural and lifestyle impacts will be insignificant. Majority of the local inhabitants in the general project area are of Visayan heritage and the Mamanwa-Manobo IPs have been living with them too long and have already influenced their culture.

The Mamanwa-Manobo community structures, religious practices, and other cultural practices will not be affected by the operations of the Agata Limestone Project.

The Community Relations Office of API, established by virtue of DAO 2010-12 to ensure and facilitate the community extension program of the company to the communities, will continue to support the local cultural activities through its support to Socio – Cultural Program component of the SDMP.

2.11.2. Public Services

A. Water Supply

As of Year 2016, all of the 385 households registered within Barangay Tinigbasan and Barangay Lawigan have already access to safe drinking water. Most of the water are distributed via a Level II water system of communal source for 2-3 household units. This indicates an improvement relative to Year 2012 condition wherein only 90% of the total households were serviced with safe drinking water supply. Several water supply facilities, both provisions of new sources and improvement of the existing ones, were provided by the Company through the implementation of its SDMP Program in the Nickel Laterite project.

B. Power

Service for electricity in Agusan del Norte is mainly provided by ANECO or Agusan del Norte Electric Cooperative, Inc. Data shows that since 2016, all barangays of Municipality of Tubay are adequately served with power supply.

The Project will use electric power from ANECO. The projected daily power consumption for the ALP is approximately 5,000 kWh. Diesel powered generator sets will be on standby power and will be used to augment the daily power supply requirement.

C. Communication

Cities and Municipalities of Agusan del Norte have access to mobile communication and landline telephone services. The telcos serving the area are: Bayantel Telecommunications, PhilCom, Cruz Telephone Company, PLDT, and Globe Telecom. Internet usage in the province has also increased mostly for business use. The municipality of Tubay has landline and mobile phone services. In 2016, six (6) cellular sites were established in the area include the following: Globe (3), Smart (2), and Sun (1). Data from the impact barangays indicate approximately 11,000 mobile phone subscribers.

D. Tourism and Recreation Centers

The impact communities offer eco-tourism and their natural beauty for tourists to enjoy. The latter consists of natural caves, marine sanctuary, rivers, and white sand beaches. The natural topography and marine resources found in the area attract tourists with interests in swimming and snorkeling.

E. Waste Management Facilities

With regards to the solid waste management, the latest data on facilities and practices show improving solid waste management.Presently, Tubay has an existing Material Recovery Facility and a dumpsite. Barangays Tinigbasan and Lawigan have their own material Recovery Facilities and a system of collecting their solid wastes. Solid Waste Management is implemented in the community; proper waste segregation is observed in every household.

F. Social Infrastructure and Protective Services

In terms of social assistance facilities, each barangay is equipped a Day Care Center, a Women's Center, a Senior Citizen's Office, a KALAHI Office, and a help desk to address concerns related to Violence Against Women and Children (VAWC). The presence of the different social assistance facilities shows that the municipality is actively supporting the needs of its barangay constituents.

Municipality of Tubay has one (1) municipal police station manned by PNP and non- uniformed personnel, one (1) Fire Station with one (1) Fire Truck and manned by BFP personnel.

Table 2-60 below provide information on the impact barangays' public services and other social data. Data are from the Brgy. Development Plan.

Table 2-61 Public Services and other Social Data for Tubay Municipality

Service	Tubay	
	Year 2016	Year 2019
Education	Brgy. Tinigbasan Elementary Schools- 1 High Schools - 1 Day Care Centers-1 Brgy. Lawigan Elementary Schools- 1 High Schools - 1 Day Care Centers-0	Brgy. Tinigbasan Elementary Schools- 1 High Schools - 1 Day Care Centers-1 Brgy. Lawigan Elementary Schools- 1 High Schools - 1 Day Care Centers-1
Housing	Brgy. Tinigbasan – No. of Household – 212 Brgy. Lawigan No. of Household - 125	Brgy. Tinigbasan No. of Households- 216 Brgy. Lawigan No. of Households- 169
Social Assistance Facilities	Brgy. Tinigbasan Day Care Centers- 1 Women Center- 1 Senior Citizen Office- 1 KALAHI Office- 1 VAWC Desk- 1 Brgy. Lawigan Day Care Centers- 1 Women Center- 1 Senior Citizen Office- 1 KALAHI Office- 1 VAWC Desk- 1	Brgy. Tinigbasan Day Care Centers- 1 Women Center-1 Senior Citizen Office- 1 KALAHI Office-1 VAWC Desk-1 Brgy. Lawigan Day Care Centers- 1 Women Center-1 Senior Citizen Office- 1 KALAHI Office-1 VAWC Desk-1
Protective Services	Brgy. Tinigbasan Brgy. Tanod-21 Brgy. Lawigan Brgy. Tanod-14 1 Municipal Police Station Police Personnel – 31 PNP 1 Municipal Police Station	Brgy. Tinigbasan Brgy. Tanod - 30 Brgy. Lawigan Brgy. Tanod - 20 Police Personnel - 35 PNP 1 Municipal Police Station
Fire Protection Services	1 Municipal Fire Station 1 Fire Truck Brgy. Tinigbasan No fire station/ fire truck Brgy. Lawigan No fire station/ fire truck	1 Municipal Fire Station 1 Fire Truck BFP Personnel - 15 Brgy. Tinigbasan No fire station/ fire truck Brgy. Lawigan No fire station/ fire truck

Table 2-60 Public Services and other Social Data for Tubay Municipality (continued)

Service	Tubay	
	Year 2016	Year 2019
Solid Waste Management	Brgy. Tinigbasan, Lawigan Solid Waste Management is implemented in the community. Proper waste segregation is observed in every households.	Brgy. Tinigbasan: Brgy. MRF Faciity installed Brgy. Lawigan: Brgy. MRF Facility installed
Infrastructure	Brgy. Tinigbasan Bridge-0 Brgy. Lawigan Bridge-0	Brgy. Tinigbasan Bridge-0 Brgy. Lawigan Bridge-0
Communication	Brgy. Tinigbasan 1,007 Mobile Phone subscriber Brgy. Lawigan 960 Mobile Phone subscriber	Brgy. Tinigbasan mobile phone subscriber – 1, 421 Brgy. Lawigan Mobile phone subscriber – 1,236
Tourism and Recreation	Brgy. Tinigbasan White Beach Brgy. Lawigan White Beach And Fish Sanctuary	Brgy. Tinigbasan White Beach Fish Sanctuary Brgy. Lawigan White Beach And Fish Sanctuary
Agricultural Crop Area and Production	Brgy. Tinigbasan Corn- 2.7 t/ ha Banana- 2.9 t/ ha Coconut- 2.7 t/ ha Brgy. Lawigan Corn- 2.7 t/ ha Banana- 2.9 t/ ha Coconut- 2.7 t/ ha	Brgy. Tinigbasan Corn – 27.35 ha Banana – 273 ha Coconut – 342 ha Brgy. Lawigan Corn 0 Banana – 1000 ha Coconut – 2000 ha
Livestock Production	Brgy. Tinigbasan Carabao- 12 heads Cattle- 5 heads Goat- 22 heads Swine- 34 heads Poultry- 380 heads Brgy. Lawigan Carabao- 18 heads Cattle- 18 heads Goat- 28 heads Swine- 105 heads Poultry- 220 heads	Brgy. Tinigbasan Carabao- 12 heads Cattle- 5 heads Goat- 22 heads Swine- 34 heads Poultry- 380 heads Brgy. Lawigan Carabao- 18 heads Cattle- 18 heads Goat- 28 heads Swine- 200 heads Poultry- 250 heads
Fisheries Production	Brgy. Tinigbasan 15 tonnes Brgy. Lawigan 16.2 tonnes	Brgy. Tinigbasan – 17.1 Brgy. Lawigan – 19.4

Source: Brgy. Development Plan

2.11.2.1. Threat to Delivery of Basic Services

Generally, the Project will not compete with the host and neighboring barangays in terms of social services. On the contrary, the Project will help augment the existing social services offered by BLGUs to its constituents in the areas of health and safety, public infrastructures, and other social services through the Project's Social development and Management Program (SDMP).

The two coastal barangays of Tinigbasan and Lawigan tap their electricity from ANECO, a local distributor. ANECO has ample power supply for the immediate future especially when Agusan Power Corporation's Lake Mainit hydroelectric project will be operational by 2021. Thus, the Project will not compete with the residents in terms of electric power supply. It also has standby generating sets should power source become problematic.

On water resources, API has existing three (3) Conditional Water Permits granted by the National Water Resource Board (NWRB) that will be directly utilized by the Project during the quarrying operations. These are in: Solana Creek, Payong-payong; Payong-payong Creek in Payong-payong; and Agroland Spring in the main nursery pertaining to water resources. The Company, through its ANLP SDMP, is helping to upgrade the water distribution system of its host and neighboring communities.

The implementation of its SDMP for ANLP has also assisted its host and neighboring barangays to improve their social services in the areas of health, education, livelihood, public infrastructures and socio-cultural programs. Improvements were undertaken for public schools, scholarship grants were given to poor but deserving students, and school supplies were distributed to students. Health component included the improvement of health centers, provisions for medicines and medical assistance, and regular medical and dental missions for the impact communities. It is envisioned. that the same will be replicated in Agata Limestone Project's host and neighboring barangays.

2.11.3. Health and Sanitation Profile

As of Year 2016, Municipality of Tubay has strengthened its Rural Health Unit (RHU). On a barangay level, each is equipped with a barangay health center, manned by at least 5 barangay health workers and a registered nurse.

As to sanitation facilities like safe water supply in the impact areas, the 2 barangays claimed that 100% or all households already have access to safe water through different levels of water conveyance system. Sanitary toilet and basic facilities among all the affected households are also available. Each household practices solid and waste disposal. A general improvement in water supply and sanitation facilities is noted relative to the Year 2016 records.

Increase in population is evidently shown in Brgy. Tinigbasan while a decrease in the population in Brgy. Lawigan from Year 2016 to Year 2019. The mortality rate for the 2 impact barangays showed a slight increase, while, maternal death rate remained zero among all the impact barangays since Year 2012.

Unchanged, the identified leading cause of morbidity for the impact Barangays of Tubay is the upper respiratory tract infection. A common leading cause is pneumonia, hypertension, acute gastroenteritis, and tuberculosis. Accident and wound injury are less prevalent.

Leading causes of mortality among the impact communities vary across municipalities. In Barangays Lawigan and Tinigbasan, they are infection, pneumonia, hypertension, tuberculosis, and acute gastroenteritis.

A summary of the health profile of the two impact barangays are presented in **Table 2-61**.

Table 2-62 Health Statistics Data of Tubay Municipality

Service	Tubay	
	Year 2016	Year 2019
Birth Rate	Brgy. Tinigbasan 1.82 Brgy. Lawigan 1.99	Brgy. Tinigbasan - .005 Brgy. Lawigan - .05
Mortality Rate	Brgy. Tinigbasan 0.8 Brgy. Lawigan 0.3	Brgy. Tinigbasan – 0.1 Brgy. Lawigan - 0
Infant Mortality Rate	Brgy. Tinigbasan- 0.9 Brgy. Lawigan- 0.7	Brgy. Tinigbasan -0 Brgy. Lawigan - 0
Maternal Death Rate	Brgys.Tinigbasan -0 Brgy. Lawigan - 0	Brgys. Tinigbasan – 0 Brgy.Lawigan – 0.3
Leading Causes of Morbidity	Brgys. Tinigbasan, and Lawigan Infection Pneumonia Hypertension Tuberculosis Acute Gastroenteritis	Brgys.Tinigbasan, and Lawigan Infection Pneumonia Hypertension Tuberculosis Acute Gastroenteritis
Leading Causes of Mortality	Brgys. Tinigbasan, and Lawigan Congestive Heart Failure Cancer Acute Myocardial Infarction Cardiopulmonary Diseases	Brgys.Tinigbasan, and Lawigan Congestive Heart Failure Cancer Acute Myocardial Infarction Cardiopulmonary Diseases
No. of Health Care Facility	Brgy. Tinigbasan – 1 Brgy. Lawigan - 1	Brgy. Tinigbasan – 1 Brgy, Lawigan - 1
No of. Health Professionals	Brgy. Tinigbasan Brgy. Health Worker- 8 Brgy. Lawigan Brgy. Health Worker- 6	Brgy. Tinigbasan Brgy. Health Worker- 12 Brgy. Lawigan Brgy. Health Worker- 10
Household with access to safe water	Brgy. Tinigbasan 201 Households (100%) Brgy. Lawigan 192 Households (100%)	Brgy. Tinigbasan 216 Households (100%) Brgy. Lawigan 169 Households (100%)
Household with Toilet Facilities	Brgy. Tinigbasan 201 Households (100%) Brgy. Lawigan 192 Households (100%)	Brgy. Tinigbasan 216 Households (100%) Brgy. Lawigan 192 Households (100%)
Household with basic sanitation facilities	Brgy. Tinigbasan 201 Households (100%) Brgy. Lawigan 192 Households (100%)	Brgy. Tinigbasan 201 Households (100%) Brgy. Lawigan 169 Households (100%)
Household with solid waste disposal system	Brgy. Tinigbasan 201 Households (100%) Brgy. Lawigan 192 Households (100%)	Brgy. Tinigbasan 216 Households (100%) Brgy. Lawigan 169 Households (100%)

Source: Brgy. Development Plan

2.11.3.1. Threat to Public Health and Safety

Large-scale quarrying involves intensive movements of people, heavy and light equipment, quarry materials, products, supplies, etc. These, in turn, generate environmental pollution and pose significant concerns for the employees, contractors, and the community members. Chronic or acute exposure to cotaminated air and water can lead to adverse health effects. Surface mine studies identify dust and respiratory health risks as the most common health issue. This can include incidences of tuberculosis, asthma, and chronic bronchitis. Water contamination from domestic waste generation on the other hand, can lead to gastrointestinal diseases.

Pollution control measures implemented by the Company is expected to minimize the health impacts from pollution. Employees who are expected to be exposed to health and safety hazards will be provided with personal protective equipment. Safety briefing during the regular toolbox meetings will help the workers to be aware of the potential risks in their workplace that they can manage. The Safety Department will also be conducting regular trainings and drills on safety protocols and accident/ emergency response for both the communities and the company workers.

Potential air pollution sources on site include the equipment exhaust and dust generation from mining activities. Dust generated by quarrying, crushing and screening, and hauling activities will be mitigated through regular deployment of water trucks for spraying. Priority areas for dust control will include the hauling roads. A more frequent schedule is established during dry season. Regular road grading and surfacing will also be done at haul roads. Dust from the crushing plant will be addressed by ensuring that the plant is running in optimum, with negative pressure, with its bins and storage are properly designed. Final products will be housed in a covered stockyard.

Regular preventive maintenance of the mining fleet mitigates the issue on harmful diesel emissions. Maintenance activity will be the responsibility of the contractors. Compliance of the equipment providers to this requirement will be checked through regular inspection by the Safety Department.

Noise impacts will be relatively less critical primarily due to the rural nature of the project site and distances of the quarrying and crushing plant site from the community. Crushing and sizing equipment will have noise reduction built into them.

Potential source of water pollution from operation is siltation. Pollution control components to mitigate this will comprise of interceptor canals, silt traps, settling ponds, drainage, canals and sumps. These water management facilities will allow the sediment materials in water run-off to settle prior to discharge into draining water bodies. Covering of the stockpiles with laminated canvass is another measure to be implemented to prevent loose soils from being carried by surface run-off which contribute to siltation.

All motor pools will be equipped with oil-water separator for the generated wastewater from equipment washing and maintenance. Construction of used oil storage area in the contractor motor pools will be required to temporary contain the used oil materials, prior to its delivery to the main used oil storage facility. These pollution control structures will be constructed in accordance with the hazardous waste management guidelines. Regular inspection will be conducted by the Pollution Control Officer to monitor compliance to the pollution control protocols.

Influx of people into the Project site and into the host communities may create risks associated with spread of virus, for instance COVID-19 infection.. Regular and effective IEC campaigns will be conducted geared towards community health and safety protocols to help community officials in managing such infection.

Provisions for facial masks, etc. will be included in the SDMP P/P/As under the Health category. At present, ANLP has retrofitted one of its accommodation facilities into an 18 room COVID-19 quarantine facility. This will be maintained and be made available to residents subject to health and safety protocols of the Proponent.

The company will ensure that constant monitoring on health issues in the community will be addressed in coordination with Safety and Health Dept. and Brgy. Health Centers. Health programs will also account for almost 20% of the Development of Direct, Host and Neighboring Communities (DHNC) component of the SDMP. Among the major projects are regular medical missions in coordination with Municipal Health Unit and Brgy. Health Centers, provision of medical supplies and equipment, and capacity building for emergency response among the community members.

Through community participation, the Company will be assessing the health profiles of the communities to identify the medical needs and priorities of the community, and eventually develop action plans to address the health issues.

The Company will utilize the expertise of its existing medical team composed of three (3) Doctors, three (3) Nurses, Eighty Seven (87) trained First Aiders, three (3) Nurses from the Contractors, and Eighteen (18) competent ERT members. The company clinic is also open 24 hours daily, offering free medical consultation to both employee and community members. The company ambulance is also available to cater to medical emergencies of the community.

Sharing the safety and health culture to the stakeholders, the company partnered with Agusan del Norte Provincial Disaster Risk Reduction and Management Council (PDRRMC) in cascading the company ERT's emergency response exepertise to the community level. This gave birth to the formation of the Agata Community Emergeny Response Team (ACERT). All of the best practices on health and safety from ANLP will be continued and adopted during the ALP operations.

2.11.3.2. Threat to Security

Given the high value nature of the Project, entry of unlawful elements in the mine site can be a security threat to the Company, its employees, and community members. The Company will maintain its Security Department who is in charge of securing the MPSA. They will continue working in close coordination with the local security forces. Security detachments will be stationed within the mine site to regulate mine site access from vehicles and individuals.

2.11.4. Employment

The town of Tubay is included in the Lake Mainit Development Alliance (LMDA). The developmental focus of this group is on biodiversity conservation, agriculture, fishery, tourism, and mining development. Presented in **Table 2-62** and **Table 2-63** are the employment distribution of the residents of the two impact barangays. Labor, fishing, and farming are the top livelihood sources identified. The current ANLP operations is one of the big employers for labor workers.

Table 2-63 Employment Distribution, Brgy. Lawigan

Occupation	Number	Percentage	Monthly Income
Farming	105	14.50	Php 2,400.00
Fishing	152	20.99	Php 3,200.00
Labor Employment	301	41.57	Php 8,320.00
Professionals	41	5.66	Php 18,000.00
Business (small)	46	6.35	Php 6,000.00
Unemployed	52	7.20	-
Others	27	3.73	-

Table 2-64 Employment Distribution, Brgy. Tinigbasan

Occupation	Number	Percentage	Monthly Income
Government Employee	22	2.14	Php 10,000.00
Farming	186	18.13	Php 2,400.00
Fishing	252	24.56	Php 3,200.00
Labor Employment	305	29.73	Php 8,320.00
Professionals	64	6.24	Php 18,000.00
Business (small)	52	5.07	Php 6,000.00
Vendors	34	3.31	Php 3,000.00

Table 2-63 Employment Distribution, Brgy. Tinigbasan (continued)

Occupation	Number	Percentage	Monthly Income
Unemployed	52	5.07	
Gold Panning	18	1.75	Php 10,000.00
Carpentry	26	2.54	Php 5,000.00
Pump Boat Operation	15	1.46	Php 3,500.00

The two-mining impact barangay are located along the coastline. For this reason, a good number of families depend on fishing as their major source of income. Barangays Tinigbasan and Lawigan has an average production of 17.1 tonnes of fish per year.

The Municipality of Tubay is self-sufficient in terms of agricultural crops. Major crops include rice, corn, coconut, vegetables, and root crops. Tubay has 5,275 hectares devoted to coconut plantation. Vegetables and root crops are the secondary produce of Brgys. Tinigbasan and Lawigan. They are producing 2.7 tonnes of corn per hectare and 2.7 tonnes per hectare of coconut. Agricultural crop production data from Year 2016 and Year 2019 have not shown significant change.

Livestock raising is also practiced in Brgys Tinigbasan and Lawigan such as; native chicken and duck. Other livestock raised in the area are goats, cattle and carabaos, the latter being utilized for tilling their land. Hog raising is also included among the livelihoood projects implemented through ANLP Social Development Management Program.

2.11.4.1. Generation of Local Benefits from the Project

Locally, the Project will bring economic benefits into the impact barangays and into the town of Tubay itself. ALP will be a significant contributor to the GDP of Tubay. The relatively stable price of non-metallic minerals like limestone as compared to its metallic counterparts will be an economic advantage. Although the price of limestone is low compared to metallic ores, it is not subjected to highly volatile prices, hence continuity of operations is expected especially if the market expands. Among others, the benefits the host communities will enjoy from the Project will be:

- Royalties to the IP communities;
- Local taxes;
- Portion of excise taxes levied on mineral products;
- Employment of residents both directly and through livelihood programs;
- Social Development and Management Programs (SDMP);
- Capacity building in the area of technical skills, emergency response, etc.;
- Enhancement of the tourism sector; and
- Enhancement of the agricultural sector

The IP communities will continue to benefit from the royalty payments while the Project is in operation. Royalty share from the Limestone project will sustain the improvement of the IP sector and their communities in accordance with their Community Royalty Development Plan.

Benefit of the LGU and the National Government will be in the form of taxes (i.e., business taxes, excise taxes, withholding taxes, corporate income taxes, and occupational taxes). Other income includes various permit fees and license fees.

As shown in **Table 2-64 ,** approximately Php 392 million will be collected from the Project in the form of taxes and fees and projects for the first five years of its operation.

Table 2-65 Estimated Project Benefits from SDMP, Taxes, Fees, and Royalty (PHP)

Cost Item	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Volume, DMT	2,047,500	2,178,750	1,995,000	1,907,500	1,995,000	10,123,750
Revenue	921,375,000	980,437,500	897,750,000	858,375,000	897,750,000	4,555,687,500
Opex	534,983,540	564,672,742	520,902,860	497,897,059	519,201,860	2,637,658,060
SDMP	8,024,753	8,470,091	7,813,543	7,468,456	7,788,028	39,564,871
IP Royalty	9,213,750	9,804,375	8,977,500	8,583,750	8,977,500	45,556,875
Wharfage	18,785,813	19,990,031	18,304,125	17,501,313	18,304,125	92,885,406
Excise Tax	36,855,000	39,217,500	35,910,000	34,335,000	35,910,000	182,227,500
Business Tax	6,449,625	6,863,063	6,284,250	6,008,625	6,284,250	31,889,813
TOTAL	**79,328,941**	**84,345,060**	**77,289,418**	**73,897,143**	**77,263,903**	**392,124,465**

2.11.4.2. Enhancement of Employment and Livelihood Opportunities

The Project will employ 226 employees during production stage. A significant percentage of these will be sourced from the impact barangays. Skills enhancement and capacity building for the residents will be undertaken to increase their employability and provide options for sustainable income sources.

There is an existing Memorandum of Agreement signed between API and the host communities of the ANLP, stipulating that 50% of the manpower that will be hired for will be sourced out from the community provided they are qualified. It is also stipulated in the MOA to capacitate residents through skills training for possible employment not only in the project but also elsewhere. Employment will be flexible such that equal opportunities will be given to all genders depending on skills requirements and qualification. The same will be adopted and continued for the ALP Operations.

Livelihood programs will be implemented to improve economic activities in the barangays. The proponent will assist in marketing the product of the livelihood programs similar to its current practice in the Mabakas Farm located in Sitio Coro, Barangay Colorado, Jabonga. The company can link livelihood proponents to gov't agencies, private sectors, etc. to help increase productivity and product salability.

Generation of downstream industries is also expected to trigger employment, business, and livelihood opportunities for the local communities. Supply of food and other products will be sourced locally. Transport of people and goods will be brisk when the Project commences. Residents will be able to take advantage of this and may venture into land and water transport business. Sari-sari stores, local barber shops, eateries, lending business etc., is expected to abound in the communities thereby stimulating the local economy.

2.11.5. Perception Survey

Agata Processing Inc, through its Community Relations Office, commissioned a group of researchers to conduct a Project Perception Survey to assess the social acceptability of the proposed development and operation of ALP. A total of 192 residents from the two impact barangays namely, Brgy. Tinigbasan (111 participants) and Brgy. Lawigan (81 participants) responded to the survey conducted in February 2020.

The sample size was determined through a stratified random sampling technique wherein the updated population in terms of number of households (HH) from Barangay Tinigbasan and Barangay Lawigan were taken with respect to their population per purok. Given the 385 households and using 95% level of confidence and margin of error of 0.05, a sample size of 81 and 111 households were identified for Brgy. Lawigan and Brgy. Tinigbasan, respectively. **Table 2-65** shows the distribution of samples for every purok in each barangay.

Table 2-66 Distribution of Participants by Purok Origin

Barangay	Purok 1	Purok 2	Purok 3	Purok 4
Lawigan	33 (40.3%)	20 (25.2%)	12 (15.1%)	16 (19.5%)
Tinigbasan	22 (19.44%	65 (59.26%)	10 (8.33%)	14 (12.96%)
Total	55	85	22	30

After the sample size was determined, the actual survey participants were identified through a systematic random assignment. Participants were subjected to one-on-one interview using a survey questionnaire of 6 items mostly answerable by a Yes or a No. The survey instrument used is attached in the **Appendices.** The survey activity ran for two weeks, starting last week of February through the first week of March 2020.

Survey data were then encoded, then data cleansing and statistical analysis followed. Descriptive analysis involved determining the mean, standard deviation, frequency tables, and making the graphical presentations. Result of the survey is summarized below.

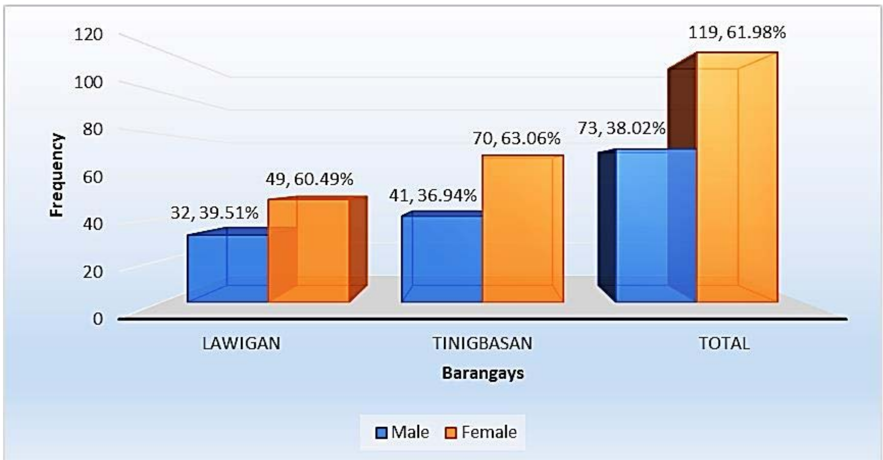
2.11.5.1. Demographic Profile of Respondents

A. Participant Distribution by Sex

Out of 192 survey participants, 62% are females and only 38% are males. Female dominated the survey participation, in both barangays as shown in **Figure 2-62.**

Women dominated this survey since they are the ones usually available in the households. Most of the males were working during the period of data collection. This statistics between sexes is also noteworthy since literature from various psychological research in social role theory suggests that women are generally more perceptive than men (Ashforth and Mael, 1989; Biddle, 1986).

Figure 2-62 Distribution of survey participants in their respective locales by sex



B. Participant Distribution by Age and Residency

In terms of age, the survey participants have a mean age of 45.86 as shown in **Table 2-66**. This suggests that most of the survey participants are already mature in terms of deciding and giving out their opinions on certain topics or issues. Piaget (2008) described that when individuals reach their mental maturity they move beyond concrete experiences and begin to think abstractly, reason logically and draw conclusions from the information available, as well as apply all these processes to hypothetical situations.

Table 2-67 Age distribution and length of residency of survey participants

Barangay	Total		Brgy. Lawigan		Brgy. Tinigbasan	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Age	45.86	15.088	44.99	14.394	46.5	15.409
Years of Residency	32.23	20.618	32.1	20.561	32.32	20.471

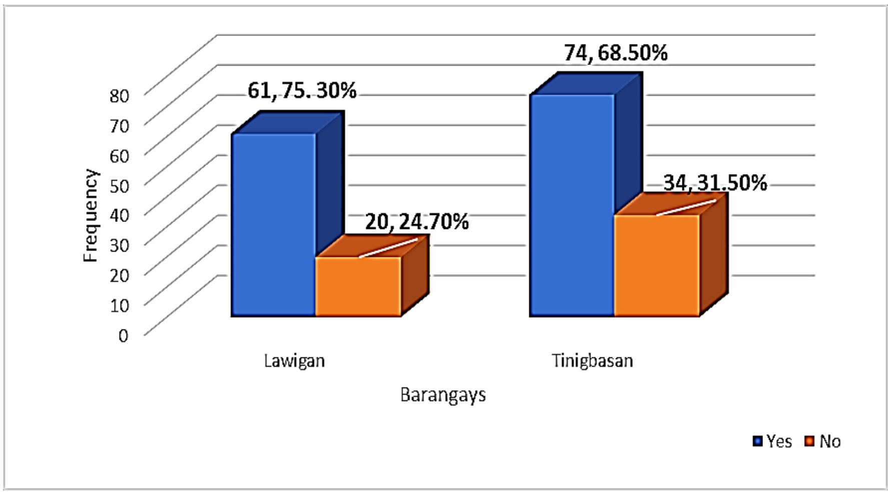
2.11.5.2. Perception Survey Results

The data and analysis presented in this section are the perceptions and observations of the survey participants from Barangay Tinigbasan and Barangay Lawigan. Perceptions in this discussion pertains to the participants' understanding and feelings that give meaning to their individual experience toward their environment and which make sense to them. A copy of the Perception Survey report will be included in the **Appendices.**

A. Acceptability on Extended Mining Operation

More than half or 71% of the participants expressed positive acceptance for an extended mining operation through the Agata Limestone Project. Positive response was accounted from both of the barangays. The most direct reason given by the participants for favoring the extension is the economic opportunities from the mining industry. This consist availability of employment opportunities, livelihood projects, perceived improvement of the community from the ANLP, and SDMP projects for the community. **Figure 2-63** below show the distribution of responses from Brgy. Tinigbasan and Brgy. Lawigan.

Figure 2-63 Participants' consent on the possible extension of mining operations



There were also respondents who gave a conditional yes, subject to some important conditions on the set agreements between the barangay and the mining company.

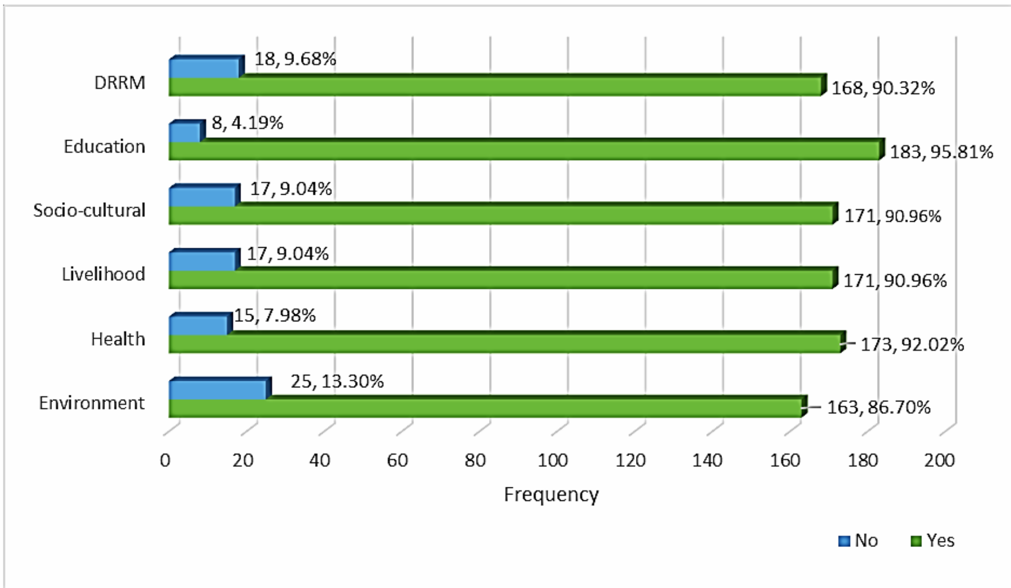
Respondents who answered "No" expressed their apprehensions on the possible risks that could be aggravated by mining activities particularly on the environment, health, and geological aspect. Some also noted that they don't think the project will provide them with employment opportunities.

B. Perceived Benefits from the Project

Most of the informants in Barangay Lawigan and Tinigbasan agreed to the idea that there will be an overall improvement if the mining activity will continue to operate in the area. As reflected in **Figure 2-64**, 96% of those who are in favor of the ALP cited the project's assistance to education as a major benefit from the project. Potential educational benefits cited included availability of educational

assistance through. scholarship programs and provision of school materials/supplies. They also mentioned their hope to have a school boat as means of transportation for the children/students.

Figure 2-64 Participants' responses on the positive impact of mining on various aspects



Other top benefits with more than 90% of the respondents answered included the company's contribution to Disaster Risk Reduction and Response Management (DRRRM) (90.3%) in form of relief goods, socio cultural benefits (91%) in terms of assistance to barangay and church activities, livelihood opportunities (91%), and health benefits (92%) in form of medical assistance. These positive responses can be credited on the awareness and/or availment of mining projects through the Social Development and Management Plan (SDMP).

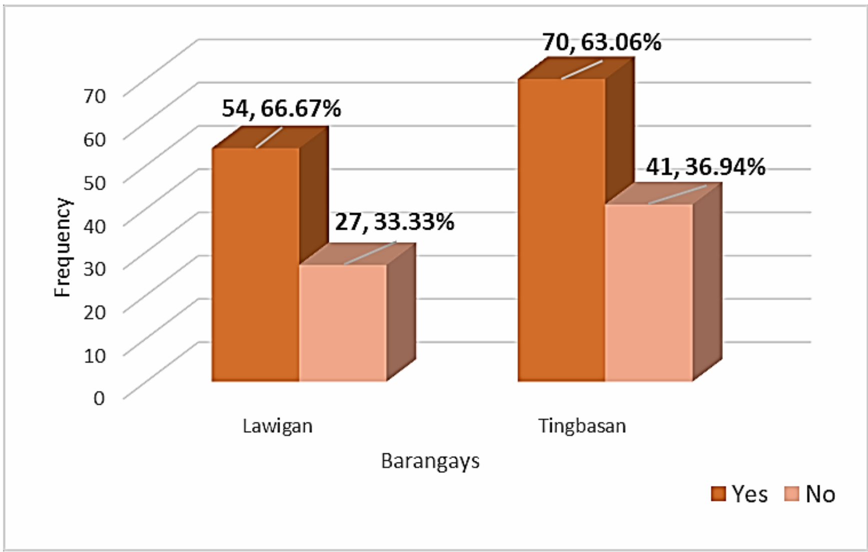
C. Awareness to other Mineral Deposits in the Area

Majority or 80% of the respondents indicated awareness that other deposits aside from nickel is available in the area. They were able to identify four (4) other mineable materials including limestone (65%), gold (25%), copper (7%), and rock aggregates (3%). Most of them claimed that they learned the information from the company.

D. Social Acceptability on the Limestone Mining

Both barangays expressed their support to the project, with 58% of the total respondent said they are in favor for the Limestone mining activities. The breakdown of response per barangay is shown on **Figure 2-65.**

Figure 2-65 Participants' response to possible extraction of limestone



Those who are in favor of the Limestone mining operations cited economic opportunities from the project, such as employment for the residents, as the primary reason. They believe that the benefit extends, not just for those who will be employed, but for the whole community as well. They think that the new project will have an additional support to the existing Social Development and Management Program (SDMP).

For the other 42% who answered no to Limestone operations expressed their fear regarding the possible environmental degradation to their respective communities from dust generation and water contamination.

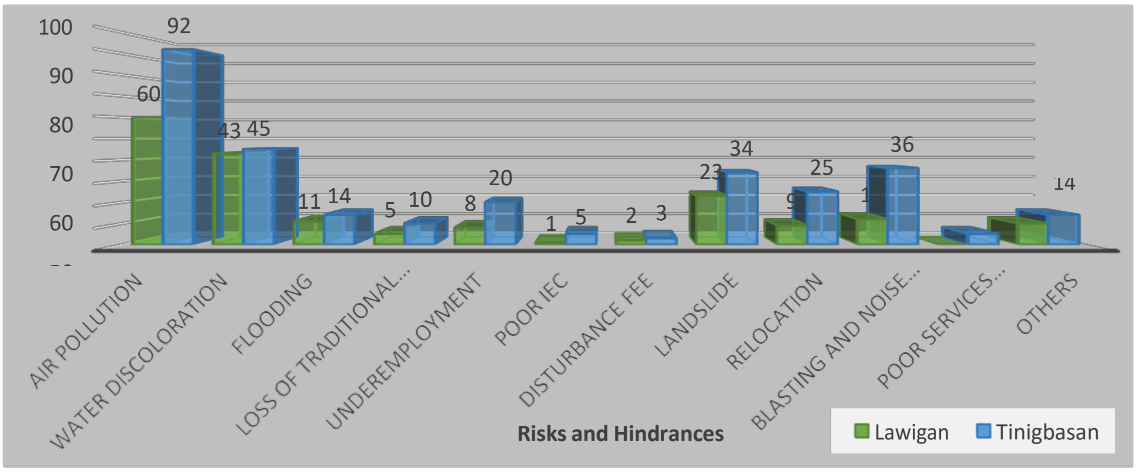
E. Perceived Negative Impacts from the Project

Perceived adverse impacts from the project can be categorized as Ecological Risks, Geological Risks, and Socio-economic Risks. The different impacts and the respondents' response are shown on **Figure 2-66.**

For the Environmental risks, the respondents expressed fear of potential air pollution (30%), water discoloration (10%), and noise from blasting activities (10%).

In terms of Geologic Risks, the respondents identified possible landslide (12%) and flooding (5%). The same response emerged when asked of their opinion on the potential expansion of the mining operation wherein those who are not in favor of the mining extension expressed concern on possible land deformation. Socio economic concerns cited by the respondents include relocation (7%), underemployment (6%) and loss of traditional livelihood (6%).

Figure 2-66 Distribution of perceived adverse impacts from the Limestone Project



F. Suggestions to Improve Project Operations

When solicited with recommendations on how the company can improve the project operations, the respondents suggested that the company must conduct a proper impact assessment of mining impacts and implement mitigating measures to ensure environmental protection.

Some wants transparency through an open communication with the company. They are suggesting that a Memorandum of Agreement, discussed with sectoral representatives, should be crafted first before the conduct of the new project.

Prioritization of local hiring is also highly suggested. Some expressed concern on selective hiring due to lack of skilled workers in the locality and that highly skilled and technical people are mostly outsiders. They added that there are skilled laborers who are brought in from the outside by the contractors.

There should also be a scheme for scholarship priority courses to harmonize the local needs. they are suggesting identifying priority courses appropriate for the community, such as medical practitioners, agriculturists, and tourism management.

Section 3 – Environmental Management Plan

3.1 Environmental Impact Management Plan Objectives

This section summarizes the mitigation, enhancement and management measures for the most significant impacts from each Project component identified for the different environmental sectors discussed in **Section 2.** The different mitigation measures and management plans are presented for each phase of the Project.

In addition to the mitigation plans, the impact management plan also includes identification of responsible or lead persons in charge of the implementation of the activities, the cost involved and guarantees, if applicable. The guarantee may be in the form of financial agreements, memorandum of agreements or certificates of approvals. These are intended to serve as assurance that the identified mitigation, enhancement or management options will be implemented. In many cases, the mitigation and management plans are part of the Progressive Rehabilitation programs to be implemented in accordance with the Annual Environmental Protection and Enhancement Plan and provide the foundation for implementation of the Final Mine Rehabilitation and Decommissioning Plan.

The company has an existing Environmental Management System (ISO 14001:2015) as part of its IMS (Integrated Management System) Certification. All standard operating procedures (SOPs), work instructions (WI) and process flow will be incorporated and implemented all throughout the life of the Agata Limestone Project.

Specific environmental management plans to address impacts during Construction, Operation, and Closure Phase are presented in **Table 3-1, Table 3-2,** and **Table 3-3,** respectively.

Table 3-1- Environmental Management Plan Construction Phase

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Enhancement, and Mitigation	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Site Preparation Clearing, Earthwork and development of Additional access roads	Land Resources	Change in surface landform, topography, terrain and slope.	Topsoil conservation, storage, and management.	MEPEO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES ISO 14001:2015 Certification MTF, RCF
			Topsoil is minimal due to the geomorphology of the deposit location, it varies from none to 15 cm. There is no overburden to strip, however, any incidental topsoil would be removed and stockpiled for future use.			
		Disturbance of flora and fauna during clearing and roads development	Collection of wildlings prior to vegetation clearing for endemic plant species preservation.	MEPEO/PCO	AEPEP Cost	
			Landscaping and revegetation activities Following slope stability techniques during construction (i.e. benching).			
			Replace all affected vegetation with diverse vegetative species to contribute a stable and compatible ecosystem in the progressive rehabilitation program			
		Increased soil erosion from exposed soil surface	Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	MEPEO	AEPEP Cost	
		Loss of vegetation and topsoil and exposure of soil materials	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Dept.	AEPEP Cost	
		Land contamination due to potential leaks or spills of oils and fuels from equipment.	Requiring of Spill Kit in heavy equipment used during clearing	Mines Dept. Contractors, PCO	AEPEP Cost	
		Reduction in soil fertility	Installation of erosion control materials to provide slope stability.	MEPEO	AEPEP Cost	
			Soil amelioration and conditioning during revegetation			
			Implementation of Sloping Agricultural Land Technology along steep slopes to prevent erosion			

Table 3-1- Environmental Management Plan Construction Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Site Preparation Clearing, Earthwork and development of Additional access roads	Water Resources	Threat to aquatic resource biodiversity	Installation of sediment control materials (i.e. silt traps, gabions, silt fence, wattlings, etc.) along waterways to prevent flow of silt and contaminants to natural water bodies.	MEPEO, PCO Engineering Dept	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Aquatic Resource & habitat degradation.				
		Threat to aquatic resource biodiversity	Regulate barges and conduct IEC on Barge and Vessel Crew Regarding Company Policies on Water Resource	MEPEO, PCO		
		Aquatic habitat degradation.	Provision of drainage system and water management structure at the periphery of the construction site.	MEPEO, Engineering		
		Sedimentation and siltation in local rivers and creeks.	Consider >20m Buffer Zone between the Areas of Disturbance and Rivers and Creeks.	MEPEO		
			Establishment of Drainage Maintenance Committee.			
		Changes in drainage patterns.	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Department		
			Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	MEPEO		
		Water quality degradation due to potential leaks or spills of oils and fuels from equipment.	Requiring of Spill Kit in heavy equipment.	Mines Dept. Contractors, PCO		
			Execute preventive maintenance as planned.			
	Air and Noise Resources	Dust Generation	Consider >20m Buffer Zone from mine area to the nearest community.	MEPEO		
			Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)			
		Noise generation from equipment operation	Provision of PPEs to employees directly working at the Crushing Plant.	Safety Department		
		Chemical emissions and related health and climate change impacts.	Efficient equipment utilization, achieve the same volume of work while maintaining lower diesel consumption for lower gas emissions	Mines Dept, Contractor		

Table 3-1- Environmental Management Plan Construction Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Pre stripping activities at the quarry site	Land Resources	Change in surface landform, topography, terrain and slope.	Topsoil conservation, storage, and management.	MEPEO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
			Topsoil is minimal due to the geomorphology of the deposit location, it varies from none to 15 cm. There is no overburden to strip, however, any incidental topsoil would be removed and stockpiled for future use.			
		Disturbance of flora and fauna during clearing and roads development	Landscaping and revegetation activities Following slope stability techniques during construction (i.e. benching).			
		Increased soil erosion from exposed soil surface	Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	MEPEO		
		Loss of vegetation and topsoil and exposure of soil materials	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Dept.		
		Land contamination due to potential leaks or spills of oils and fuels from equipment.	Requiring of Spill Kit in heavy equipment.	Mines Dept. Contractors, PCO		
		Reduction in soil fertility	Installation of erosion control materials to provide slope stability.	MEPEO		
			Soil amelioration and conditioning during revegetation			
	Water Resources	Threat to aquatic resource biodiversity	Installation of sediment control materials (i.e silt traps, gabions, silt fence, wattlings, etc.) along waterways to prevent flow of silt and contaminants to natural water bodies.	MEPEO, PCO Engineering Dept.		
		Aquatic Resource & habitat degradation.				
		Threat to aquatic resource biodiversity	Regulate barges and conduct IEC on Barge and Vessel Crew Regarding Company Policies on Water Resource	MEPEO, PCO		
		Aquatic habitat degradation.	Provision of drainage system and water management structure at the periphery of the construction site.	MEPEO, Engineering		
		Sedimentation and siltation in local rivers and creeks.	Provision of Buffer Zone of >25m between the Areas of Disturbance and Rivers and Creeks.	MEPEO, Engineering		
			Establishment of Drainage Maintenance Committee.			

Table 3-1- Environmental Management Plan Construction Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Pre stripping activities at the quarry site	Land Resources	Changes in drainage patterns.	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Department	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP)
			Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	MEPEO		
	Water Resources	Water quality degradation due to potential leaks or spills of oils and fuels from equipment.	Requiring of Spill Kit in heavy equipment.	Mines Dept. Contractors, PCO		
			Execute preventive maintenance as planned.	Engineering Contractors		MRFC, MMT, TSHES Audits
	Air and Noise	Dust Generation	Consider >20m Buffer Zone from mine area to the nearest community.	MEPEO PCO		
			Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)			ISO 14001:2015 Certification
		Noise generation from equipment operation	Provision of PPEs to employees directly working at the Crushing Plant.	Safety Dept.		MTF, RCF
		Chemical emissions and related health and climate change impacts.	Efficient equipment utilization achieves the same volume of work while maintaining lower diesel consumption for lower gas emissions.	Mines Dept. Contractors		
Construction of Additional Roads	Land Resources	Change in surface landform, topography, terrain and slope.	Topsoil conservation, storage, and management.	Mines Dept. Contractors, MEPEO		
			Topsoil is minimal due to the geomorphology of the deposit location, it varies from none to 15 cm. There is no overburden to strip, however, any incidental topsoil would be removed and stockpiled for future use.			
		Disturbance of flora and fauna during clearing and roads development	Landscaping and revegetation activities Following slope stability techniques during construction (i.e. benching).	MEPEO		
		Increased soil erosion from exposed soil surface	Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	MEPEO		
		Loss of vegetation and topsoil and exposure of soil materials	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Department		

Table 3-1- Environmental Management Plan Construction Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Construction of Additional Roads	Land Resources	Land contamination due to potential leaks or spills of oils and fuels from equipment.	Requiring of Spill Kit in heavy equipment.	Mines Dept. Contractors, PCO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Reduction in soil fertility	Installation of erosion control materials to provide slope stability.	MEPEO		
			Soil amelioration and conditioning during revegetation	MEPEO		
	Water Resources	Threat to aquatic resource biodiversity	Installation of sediment control materials (i.e silt traps, gabions, silt fence, wattlings, etc.) along waterways to prevent flow of silt and contaminants to natural water bodies.	MEPEO, PCO Engineering Dept.		
		Aquatic Resource & habitat degradation.				
		Threat to aquatic resource biodiversity	Regulate barges and conduct IEC on Barge and Vessel Crew Regarding Company Policies on Water Resource	MEPEO PCO		
		Aquatic habitat degradation.	Provision of drainage system and water management structure at the periphery of the construction site.	MEPEO, Engineering		
		Sedimentation and siltation in local rivers and creeks.	Provision of drainage system and water management structure at the periphery of the construction site.	MEPEO, Engineering		
			Establishment of Drainage Maintenance Committee.	MEPEO		
		Changes in drainage patterns.	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Dept.		
			Progressive Rehabilitation of inactive disturbed areas by area stabilization and vegetative cover placement (as applicable).	MEPEO		
		Water quality degradation due to potential leaks or spills of oils and fuels from equipment.	Requiring of Spill Kit in heavy equipment.	Mines, PCO, Contractors		
			Execute preventive maintenance as planned.	Engineering Contractors		
	Air and Noise	Dust Generation	Consider >20m Buffer Zone from mine area to the nearest community.	MEPEO		
			Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)	MEPEO PCO		

Table 3-1- Environmental Management Plan Construction Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Construction of Additional Roads	Air and Noise	Noise generation from equipment operation	Provision of PPEs to employees directly working at the Crushing Plant.	Safety Dept.	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Chemical emissions and related health and climate change impacts.	Efficient equipment utilization, achieve the same volume of work while maintaining lower diesel consumption for lower gas emissions.	Mines Dept. Contractors		
Construction of Crushing Plant, Explosive Magazine Area	Land Resources	Change in surface landform, topography, terrain and slope during construction of Plant.	The Plant will be installed on an existing Stockyard Area of ANLP. Minimal Excavation will be made. Continuously implement the existing Erosion control and surface grading.	MEPEO		
		Loss of vegetation and topsoil and exposure of soil materials	Limited clearing and earth movement according to the approved Site Development Plan.	Mines Department		
	Water Resources	Water quality degradation due to potential leaks or spills of oils and fuels from equipment. Sedimentation and siltation in local rivers and creeks. Changes in drainage patterns. Aquatic habitat degradation.	1. Development of proper benching to address the water drainage and minimize erosion 2. Peripheral drains around the mines, stockpiles, and waste dumps 3. Divert water run-off from hills away from the sedimentation area, active mining areas and dumps waste dumps for low quality limestones and fines raised at 10-meter lifts 4. Silt ponds for sediment removal prior to discharge of the clear water to the sea.	Mines Dept. MEPEO Engineering		
	Air and Noise	Dust Generation During Construction Phase	Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)	MEPEO PCO		
		Noise generation from equipment operation During Construction	Provision of PPEs to employees directly working at the Crushing Plant.	Safety Dept.		
		Chemical emissions and related health and climate change impacts.	Efficient equipment utilization, achieve the same volume of work while maintaining lower diesel consumption for lower gas emissions	Mines Dept. Contractors		

Table 3-2- Environmental Management Plan Mine Development Phase

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Clearing and Grubbing Ore Extraction (Loading, Hauling)	Land Resources	Loss of topsoil and exposure of soil materials Change in surface landform, topography, terrain and slope.	Topsoil is minimal due to the geomorphology of the deposit location, it varies from none to 15 cm. There is no overburden to strip, however, any incidental topsoil would be removed and stockpiled for future use.	MEPEO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Increased soil erosion from exposed soil surface	Progressive Rehabilitation of inactive disturbed areas/ mined out area.	MEPEO		
		Reduction in soil fertility	Installation of erosion control materials to provide slope stability.	MEPEO		
			Soil amelioration and conditioning during revegetation	MEPEO		
		Vegetation Loss	Limited clearing and earth movement according to the approved Mine Development Plan; phasing of activities (if possible)	Mines Dept.		
			Earth balling and transplanting of viable regenerations	MEPEO		
		Faunal migration	Consider >20m Buffer Zone from the mine disturbed area and natural faunal habitat.	MEPEO		
		Loss of biodiversity (Flora & Fauna)	Flora and Fauna Monitoring	MEPEO Third Party		
		Tenurial/ Land Use Issues with the CBFMA holders (Land Ownership)	Execution of MOA on temporary relinquishment of overlapping areas;	MEPEO Legal Dept.		
			Partnership with local Peoples Organization to improve the CBFMA areas outside the areas of overlap.	ComRel		
	Water Resources	Higher flow velocities and peak discharges during rainfall events	Provision of drainage system and water management structure at the periphery of the construction site.	MEPEO, Engineering		
		Potential downstream flooding	Installation of sediment control materials (i.e silt traps, gabions, silt fence, wattlings, etc.) along waterways to prevent flow of silt and contaminants to natural water bodies.	MEPEO, PCO Engineering Dept.		
	Land Resources	Solid waste generation from domestic, office, and industrial activities	Implementation of Solid Waste Management Program	MEPEO PCO		
			Good Housekeeping	MEPEO, HRAd		
		Land contamination	Implementation of Hazardous Waste Management Program	MEPEO PCO		

Table 3-3- Environmental Management Plan Mine Development Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Port Operations (Barging, Shipping)	Land Resources	Chemical and fuel use from daily operational activities	Chemical and Fuel Storage areas equipped with spill kits and secondary containment.	MEPEO PCO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
			Proper handling and storage of Hazardous Wastes			
	Land Resources	Soil and water contamination from accidental spillage of fuel and chemicals from the storage area	Regular spill drills to train employees and contractors of proper spill management.	MEPEO PCO		
			Hazardous waste disposal and treatment by DENR accredited facilities.			
			Soil and Water Quality Monitoring			
	Water Resources	Alteration of natural drainage pattern	Limited clearing and earth movement according to the approved Mine Development Plan; phasing of activities (if possible)	Mines Dept.		
		Reduced infiltration and water holding capacity of the affected watershed.	Construction of drainage control facilities for stormwater management	MEPEO Engineering		
		Higher flow velocities and peak discharges during rainfall events	Recharge Monitoring	MEPEO		
		Potential downstream flooding	Installation of sediment control materials (i.e. silt traps, gabions, silt fence, wattlings, etc.) along waterways to prevent flow of silt and contaminants to natural water bodies.	MEPEO, PCO Engineering Dept.		
		Domestic water Quality	Water sources separate from community water source.	MEPEO		
		Industrial Water Quality	Conditional Water Rights is secured from NWRB	MEPEO Permitting		
		Water supply competition	Water conservation measures	MEPEO		
		Wastewater generation and potential water quality degradation	Installation of septic tanks in buildings for domestic wastewater treatment	Engineering		
		Water run-off contamination due to exposed rocks and lose sediments	Installation of erosion control materials along slopes (coconets, gabion basket, stop logs, wattlings, and fascines)	MEPEO		
		Recharge of contaminated water in shallow aquifers	Establishment of drainage system (road berms, interceptor canals) around active disturbed areas for runoff management.	MEPEO Engineering		
		Siltation of draining creeks	Construction of water retention/ treatment facilities (silt/ sediment ponds) at catchment areas.			

Table 3-2- Environmental Management Plan Mine Development Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Port Operations (Barging, Shipping)	Water Resources	Freshwater habitat degradation	Regular maintenance of the drainage and water management facilities.	MEPEO Engineering	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Impediment in the natural biological processes of freshwater organisms	Freshwater Ecology Monitoring	MEPEO Third-Party		
		Nutrient influx from water run-off contaminated with domestic wastes.	Installation of silt fences along waterways to capture silt/ sediment materials discharged in the creeks.	MEPEO		
		Marine Biodiversity and Water Quality	Installation of erosion control materials along slopes (coconets, gabion basket, stop logs, wattlings, and fascines).	MEPEO		
		Marine Biodiversity: Siltation of near shore marine water due to erosion and ore spillage during loading activities.	Establishment of drainage system (road berms, interceptor canals) around active disturbed areas for runoff management.	MEPEO Engineering		
		Marine habitat degradation from siltation	Installation of silt fences, silt curtain along waterways to capture silt/ sediment materials discharged in the waterways.	MEPEO		
		Health effects on marine animals	Installation of raft under the loading ramp to catch ore spill.	MEPEO		
		Change in current pattern and littoral drifts due to alteration of wave refraction;	Careful site selection of Port location considering the discharge flow of creeks	MEPEO Engineering		
		Erosion of shorelines				
		Change in waterfront drainage	Installation of gabion baskets to serve as sea wall to prevent erosion.	MEPEO		
		Accelerated sediment deposition at the sea bottom due to water stagnation behind the Port facility.	Installation of silt curtain to capture silt/ sediment materials discharged in the ocean.	MEPEO		
Clearing and Grubbing Ore Extraction (Loading, Hauling) Port Operations (Barging, Shipping)	Land Resources	GHG emissions from fuel consumption	Carbon sequestration from reforestation activities.	MEPEO		
		Dust generation from equipment operation	Water truck deployment and speed limit regulation.	MEPEO PCO		
		Noise generation from equipment use	Regular road maintenance	Engineering		
		Human health impacts from air and noise pollution	Provision of Personal Protective Equipment (PPE) for employees.	Safety Dept.		

Table 3-2- Environmental Management Plan Mine Development Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Clearing and Grubbing Ore Extraction (Loading, Hauling) Port Operations (Barging, Shipping)	Land Resources	Faunal migration due to noise pollution	Restrict access to mining areas without proper PPE.	Safety Dept.	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP)
			Maintenance of >20m Buffer Zone in Project area periphery	MEPEO		
			Establishment of vegetation along roads as ecological curtain.	MEPEO		
Other Activities: Drilling	Land Resources	Change in surface landform, topography, terrain and slope. Slope Stability Caused by Drilling and Vibrations	Contract an Accredit Third Party Contractor to Conduct Drilling Activity	Exploration Dept. Third-Party		MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
	Air and Noise	GHG emissions from fuel consumption	Carbon sequestration from reforestation activities.	MEPEO PCO		
		Dust generation from equipment operation	Water truck deployment and speed limit regulation.	PCO Safety Dept.		
		Noise generation from equipment use	Regular road maintenance	Engineering Dept.		
		Human health impacts from air and noise pollution	Provision of Personal Protective Equipment (PPE) for employees.	Safety Dept.		
		Faunal migration due to noise pollution Noise Pollution Due to usage of Heavy equipment, it leads to noise and vibration generation	Restrict access to mining areas without proper PPE.	Safety Dept.		
			Maintenance of >20m Buffer Zone in Project area periphery	MEPEO		
			Establishment of vegetation along roads as ecological curtain.	MEPEO		
		Generation of Dust and Deposition of dust to the plants that leads to growth reduction as well as inhaling polluted air that leads to health problem	Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)	MEPEO PCO		

Table 3-2- Environmental Management Plan Mine Development Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Other Activities: Drilling	Air and Noise	Noise generation from equipment use (Drill Rig)	Drilling machine shall be fitted with dust suppression, collection and disposal arrangement. Deep wetting of drilling zones shall be done by water sprinkling before starting drilling. During the drilling operations efforts shall be made to reduce dust generation by taking appropriate measures	Exploration Dept.	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
Blasting	Land Resources	Change in surface landform, topography, terrain and slope. Slope Stability Caused by Drilling and Vibrations	Contract an Accredited Third Party to Conduct Drilling and Blasting Activity	Mines Dept. Third-Party		
		"Faunal migration due to noise pollution Noise Pollution Due to usage of Heavy equipment, it leads to noise and vibration generation"	Restrict access to mining areas without proper PPE.	Safety Dept.		
			Maintenance of >20m Buffer Zone in Project area periphery	MEPEO		
			Establishment of vegetation along roads as ecological curtain.	MEPEO		
		Fly Rock	Contract an Accredited Third Party to Conduct Drilling and Blasting Activity. Parameters such as, Drill hole spacing, Max Overburden limit, Stemming, Depth and Width of Drill Holes has to be fulfilled to do Controlled Blasting.	Mines Dept. Third-Party		
	Air and Noise	Generation of fines and dust is influenced by several blasting and rock parameters				
		Release of Fumes				
		Explosives handling and blasting operations high consequence risk				

Table 3-2- Environmental Management Plan Mine Development Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Crushing	Air and Noise	Generation of Dust during Crushing of Material	Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily).	MEPEO PCO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Issues of Structural stability of the Plant (Occupational Hazards)	All plants will undergo detailed stability analysis. These calculations take into consideration the machines expected operating configuration, envelope, and approved operating conditions (i.e. slope)	MEPEO		
	Land Resources	Structural Failure	Structural analysis takes into consideration a number of foreseeable forces including gravitational (based on rated capacity), dynamic, wind and manual forces.	Engineering		
	Water Resources	Higher occurrence of soil erosion	Reduce siltation by implementing all established water resources management and strategies	MEPEO PCO		
	Air and Noise	Generation of Dust and Deposition to the plants that leads to growth reduction as well as inhaling polluted air that leads to health problem	Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)	MEPEO PCO		
		Generate gases thru equipment use during operation	Require regular maintenance of equipment both inhouse and Contractors Execute preventive maintenance as planned.	Engineering		
			Efficient equipment utilization, achieve the same volume of work while maintaining lower diesel consumption	Engineering Safety Dept.		
Stockpiling	Air and Noise	Generation of Dust during Transport of crushed of Material	Deployment of Water Trucks for Dust Suppression (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily)	MEPEO PCO		
	Water Resources	The stockpile will absorb rainwater and lose strength (Stability)	To prevent creep, an expanding footprint and possible catastrophic failure, set the stockpile properly and cover when necessary	Mines Dept.		

Table 3-2- Environmental Management Plan Mine Development Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Stockpiling	Land Resources	Stockpiling may affect the water bodies around the vicinity	Stockpile Locations will be constructed at least 25m away from Natural Water Bodies	MEPEO, Mines Dept	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
			Installation of drainage and ponds within the Area to prevent direct flow of water to shorelines, creeks or rivers	MEPEO		
	Air and Noise	Dust blowing to adjacent land Degradation of air quality due to dust generation from extraction activities, loading and movement of hauling vehicles	Covering stockpiles to prevent dust and fines from blowing Set the stockpile Location with Natural Wind Barrier Dust Suppression by Deployment of Water Trucks (1 Water Trucks will at least have 5 Trips Per Shift with a total of at least 10 Water Trucks Daily) Enforce appropriate speed limit to hauler trucks and heavy equipment	MEPEO, Mines Dept		
		Increase in noise generation caused by pile drivers, hammer, heavy equipment and other noise generating equipment used for earth moving activities	Provide silencers and mufflers to minimize noise	Contractors, Mines Dept		
		Increase of air emissions due to the combustion of carbon-based fuel coming from hauling vehicles and heavy equipment	Consider >20m Buffer Zone near communities; development of green belt/plantation in the safety zone Progressive rehabilitation thru tree planting to sequester carbon emissions from quarry and transport operations Proper and regular maintenance of vehicles and heavy equipment	MEPEO Contractors, Mines Dept		

Table 3-4- Environmental Management Plan Abandonment Phase

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Disposal of Equipment and Scrap Materials.	Land Resources	Permanent changes in landform	Reduced impacts during Closure Phase due to previous Progressive Rehabilitation Program.	MEPEO	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Petrochemical spills (Soil Quality) Soil Contamination from Equipment/ Structure Removal. (Landform Stability)	Implementation of Soil Remediation program (as necessary) prior to Revegetation.	MEPEO		
		Face/ slope instability resulting to landslides (Land Use)	Conduct of research on site species matching and phytoremediation Design slope with correct elevation and level of benches for land stability			
		Exposure of Decommissioned Structures. (Aesthetic Value)	Conduct Geotechnical slope stability analysis prior to final rehabilitation			
		Waste generation (debris from decommissioning of structures)	Revegetation activities based on approved Final Land Use Plan of the Area.			
Benching, grading and earthwork for the closure of the disturbed areas (surface mine, water management structures, etc)	Water Resources	Localized Erosion from the Decommissioning and Rehabilitation activities	Operation and maintenance of the drainage system and water management structures as long as applicable.	MEPEO		
		Increased surface water run-off (Water Quality)				
		Potential Water Quality Degradation from Siltation and erosion of contaminated soil (Aquatic Habitat)				
		Health impacts from water contamination				
		Freshwater and marine habitat degradation				
		Health impacts to near shore marine habitat				
	Air and Noise	Air pollutants (dust and chemical exhaust) from earth moving and equipment operation	Regular equipment maintenance	MEPEO, Mines, Engineering, Contractors		
		Noise generation from equipment use	Continuous dust suppression activities			
		Health Impacts from air pollution	Provision of Personal Protective Equipment to workers			

Table 3-5- Environmental Management Plan Abandonment Phase (continued)

Project Phase/ Activity	Environmental Component	Potential Impacts	Management Plan for Prevention, Mitigation and Enhancement	Responsible Entity	Cost Allocation	Guarantee or Financial Agreements
Decommissioning or Rehabilitation of Mine Facilities (Office and Housing Buildings, Motorpool, Storage Areas, Nursery, and Pier	People	Theft of dismantled facilities/ components with residual value	Maintenance of a Security group regularly patrolling the area	Security Dept.	AEPEP Cost	Annual Environmental Protection and Enhancement Plan (AEPEP) MRFC, MMT, TSHES Audits ISO 14001:2015 Certification MTF, RCF
		Intrusion of outsiders/ illegal claimants in the Project area	Security checkpoints to control access to the area			
			Community Relations Office to remain during the Mine Closure Rehabilitation Period			

3.2. Cost of Environmental Management Programs

Funding of the EPEP will be done internally and will be part of the Environmental Management costs budgeted by the company during operations. Approval of the annual programs and costs is under the direction of the MRFC and monitoring of the expenditures is performed by the MMT. The minimum expenditures are expected to be 3% to 5% of the direct mining costs. The total minimum projected EPEP expenditures for the Agata Limestone Project would be in the range of Php 186 million to Php 310 million. The Rehabilitation Cash Fund will remain intact to the government bank, instead of frequent replenishment. The cost and expenditures for AEPEP are allocated to seven (7) sectors of environmental Management as shown on **Table 3-4**.

Table 3-6- Environmental Protection and Enhancement Plan (EPEP) Budget Allocation

Components	Budget Cost	Budget Cost per ton
1. Land Resource Management	$ 1,614,374	$ 0.05
2. Water Resource and Quality	$ 803,080	$ 0.03
3. Air Quality	$ 914,277	$ 0.03
4. Noise and Vibration	$ 6,172	$ 0.00
5. Conservation Values	$ 106,579	$ 0.00
6. Environmental Research	$ 33,065	$ 0.00
7. Training and Other Activities	$ 276,229	$ 0.01
TOTAL	$ 3,753,776	$ 0.12

The EPEP budget presented in the above table was computed from the direct mining cost based on the Feasibility Study.

Land resource management is composed of Progressive and temporary rehabilitation, erosion control/slope stabilization, maintenance of the plantation, thematic landscaping, and reforestation/NGP maintenance.

Water Resource and Quality component contains activities for settling pond/silt collector sump maintenance like desilting or improvement, Costal resource management, sewage treatment, water quality management, solid and hazardous waste disposal.

Air Quality component is consisting of dust suppression, air quality monitoring, source emission monitoring, and maintenance of pollution control devices. Constant monitoring of the noise level under Noise and vibration components.

For Conversation Values, Environmental Research, trainings, and Other activities are part of the AEPEP programs.

The funding source will shift to FMRD Fund when the mine closure phase commences. Based on the provisions of the Mining Act, for a 15- year project, the deposit of FMRD Fund to a government bank shall start during the third year of mine operation and shall be completed by the thirteenth year. This is to ensure that funding is available anytime in case of other closure scenario prior to the scheduled mine closure.

A more detailed list of activities, along with the corresponding cost estimates, shall be included in the Environmental Protection and Enhancement Plan and Final Mine Rehabilitation and Decommissioning Plan (EPEP/FMRDP) to be submitted to DENR-MGB after the issuance of the ECC.

Section 4 – Environmental Risk Assessment and Emergency Response Policy Guidelines

4.1. Environmental Risk Assessment (ERA)

The risks identified relative to the Limestone Project served as the basis for the development of the Safety Management Plan. The goal is to be able to develop proactive measures to avert incidents and to establish protocols and calibrated responses in case of emergency situations.

Based on the technical scoping conducted, a Risk Screening approach to ERA is required for the proposed Limestone Project.

Identified hazards associated with the mine operations can be grouped into the following categories:

- Flammable and Explosive Materials
- Toxic Chemicals and Substances
- Occupational Health Hazards

4.1.1. Explosive Materials

Explosives are substances capable of undergoing extremely rapid combustion/decomposition, which may propagate thermally below the speed of sound ("deflagration"), or via a supersonic shock wave ("detonation"). Many explosives produce large volumes of gas and high temperatures on explosion. Explosion may cause severe physical damage directly from the shock wave or extreme peak pressures, and indirectly from projectiles. Explosive materials also are prone to fire and burn hazards.

Blasting will be done to defragment the limestone materials before feeding to the crusher. The blasting design will utilize the staggered V pattern to maximize breakage of ore and minimize crushing operations. If the limestone material is amenable to dozer-ripping, then blasting will not be employed.

The primary type of explosives to be used is the mixture of ammonium nitrate and fuel oil (ANFO). ANFO is a mixture of ammonium nitrate (used also as a fertilizer) and fuel oil. Neither of which are intrinsically explosive in nature by themselves. ANFO is considered a dry blasting agent since no water is used in the formulation and cannot be used in watery conditions. Ammonium nitrate is soluble in water and therefore not water resistant. ANFO explosives are blasting agents that requires a primer and booster to initiate and intensify the explosive reaction. Technical properties of ANFO are presented in **Table 4-1.** During mining operations, dry blast holes will be charged with ANFO and primed with Cast Primer. Blasting activities will be conducted by a third-party licensed blasting contractor

Table 4-1 Properties of ANFO

Parameter	ANFO
Density (kg/m3)	960
Detonation velocity (m/s)	2, 500 – 4, 800
Gas production (L/kg)	970
Explosion Heat (MJ/kg)	3.8
Strength/unit weight (%)	100
Strength/unit volume	0.7 – 0.8

Source: Surface Drilling and Blasting by Tamrock, 1988

4.1.1.1. Risk Characterization of Explosion Incident

A common accident scenario related to explosive materials involves the misfire of an explosive charge and generation of fly rocks during blasting. These can result to personal injuries that can sometimes be fatal.

The Explosives Magazine where blasting materials are stored may also accidentally explode if safety protocols are not strictly implemented.

The impacts associated with an explosion are the effects of thermal radiation and air pressure. When an explosive charge is fired, it generates heat accompanied by a loud noise called airblast. Airblast is not simply the sound that is heard, but a change in atmospheric pressure to the immediate surrounding area. The change in atmospheric pressure and the sound produced can cause damage to men and resources nearby if not properly managed.

Table 4-2 summarizes the effects of an explosion to the surrounding area.

Table 4-2 Effects of Explosion Overpressure

Parameter	ANFO
7 kPa (1 psi)	Damage to internal partitions and joinery of structures. Probability of injury is 10%. No fatality.
14 kPa (2 psi)	A house maybe uninhabitable due to severe cracks.
21 kPa (3 psi)	Reinforced structures are distorted, storage tanks may collapse, and there is 20% chance of fatality to a person inside such affected building.
35 kPa (5 psi)	Structure maybe completely damaged. Eardrum damage, 50% chance of fatality for a person in the building and 15% chance of fatality for a person in the nearby open area.
70 kPa (10 psi)	Lung damage. 100% chance of fatality for a person in the building or in the nearby open area. Complete destruction of structures.

Source: Hazardous Industry Planning Advisory: Paper No.2

4.1.1.2. Hazard Control for Explosives and Blasting Materials

A. Storage/ Transport Explosion

- Proper and safe storage of all explosives and blasting material in Explosives Magazines that are constructed for such purpose and must comply with all mandated safety measures.
- Explosives shall be stored and used on a first-in-first-out (FIFO) basis.
- Explosives and blasting accessories shall be stored separately in the following manner (a) dynamite, detonating cord, and primer (b) blasting caps, connectors, delay (c) fuse, or safety fuse (d) ANFO.
- Inspection of all personnel upon entry to the storage area to prevent carrying of match box, lights, mobile phones, or cigarette lighters that can trigger uncontrolled explosion.
- The storage shall have the following additional features: signages on no open flame, restricted access, interior shall be kept clean and dry, walls are painted white, the floor is provided with matting (preferably wood), the outside surface shall be provided with lightning arrester and with an adequate fire extinguisher.
- The storage of the explosives and its transfer to and from the quarry area shall be strictly in accordance with the conditions set by the Government.
- Explosives shall be conveyed using special containers.
- Explosives and detonators shall not be carried in the same container.

- The vehicle to be used for transport shall be posted with warning signs that indicate the explosive contents and are signs are visible from all sides.
- During transportation a multipurpose (dry chemical powder) fire extinguisher (at least two units) shall be provided in the vehicle. Such firefighting device shall be provided for extinguishing fires involving ammonium nitrate.
- In the event of fire at the Explosive Magazine Area, try to extinguish using a fire extinguisher if safe to do so. Make sure that a fire extinguisher especially for ammonium nitrate fire are readily available. Call immediately the attention of the ERT-Fire Brigade and First Aid Team to assess and act on the matter.

B. Injuries related to Misfire and Flyrock Generation

- Blasting shall be conducted only during favorable weather conditions and only during the daytime at specified and regular hours.
- Public announcements ahead of time shall be made on the blasting schedule, location, and size of the blasting operations and on the precautions that needs to be taken by the public. Blasting notice boards/signs shall be placed in areas leading to the blasting site. It shall be updated by the Shot firer every morning with details of the blasting activity.
- Before charging the blastholes, clear and audible warning signals by sirens will be sounded so that people nearby can take the necessary precautions.
- All roads that will lead to the blasting area shall be blocked or closed temporarily for at least fifteen (15) minutes prior to blasting.
- Blast hole geometry shall strictly follow the drill and blast pattern designed for such blast area.
- Blast site shall, as much as possible, be wetted before blasting to minimize dust generation and after blasting operations to dissolve any unexploded ANFO.
- Follow strictly the explosives charge weight per blast hole and assure to place the minimum stemming column length relative to the explosives charge weight.
- The quantity of explosives to be used in blasting near structures or human habitations shall just be enough so as not to damage the structures/houses.
- Only competent blasters with issued blasters permit shall handle the explosives and conduct the blasting operations.
- The charged blast holes shall not be left unattended at any time until blasting is completed. A Security Guard should stand duty until blasting is completed.
- All affected workers shall be secured in a safe location prior to the conduct of blasting. The shelter area should be at least 200m distance from the blast area. Controlled blasting shall be undertaken near structures, community or public areas.
- The Shot-firer shall inspect the blast for misfires fifteen (15) minutes after firing and shall advice the Blast Controller of the after-blast status. If a misfire occurred, it shall be handled only by the Blasting Engineers and Safety Officers. The safest way to handle a misfired blast hole or shot is to fire it again at the earliest opportunity. Other ways to handle a misfire shall be based on the type of explosives used and safety guidelines as prescribed by the Government.
- If there are no visible misfires, the Blast controller shall broadcast the “All Clear” signal on the radio to notify all concerned that nearby areas can resume their activities.
- Throughout the blasting process the Safety and Health Department shall be on standby with its ERT to respond to any untoward incident.

4.1.2. Flammable Substances

Flammable and combustible materials in the mine site are normally the oil and lubricants for the equipment and machineries, including the crushing plant and fuel oils such as diesel and gasoline that are used for electric power generators, heavy equipment, and mine vehicles.

Diesel fuel consists of aliphatic, alicyclic and aromatic hydrocarbons. Generally, it is combustible with a flash point of 75°C and may contain carcinogenic components. Exposure to the substance may cause eye irritation upon direct contact. Prolonged or repeated skin contact may cause defatting and dermatitis. However, as long as normal precautions in handling fuel oils are observed and good standards of industrial and personal hygiene are maintained, no significant safety and health hazard is expected. Accidental spills and leakages to water resources may be harmful to aquatic organisms and may cause long term adverse effects to the aquatic environment.

Gasoline fuel contains non-lead additives. It is highly flammable with a flash point of -56°C and like diesel fuel, may contain carcinogenic components. Storage and handling requirements for gasoline fuel requires stringent safety measures due to its flammability properties.

The primary purpose of lubrication is to reduce wear and heat between contacting surfaces in relative motion. Lubrication is also used to reduce oxidation and prevent rust; to provide insulation in between the surface of the machine, to transmit mechanical power in hydraulic fluid power applications; and to seal against dust, dirt, and water. All lubricant starts with a base oil. It can be mineral, synthetic, and vegetable, the operation of crushing plant various mechanical parts will deal with mineral and synthetic types of lubricant (gear and hydraulic oil, greases, penetrating lubricants).

Oil is thin liquids made of long polymer chains, with additives for various combined properties. Common additives include antioxidants to keep the oil from oxidizing, corrosion inhibitors to prevent parts from corroding and detergents to keep deposits from forming. These long chains are hard to squeeze out from between surfaces, making oils useful as a smooth barrier between them. The oil comes in different weights such as 5W or 10W which correspond to viscosity. The lower the number, the thinner the oil and the more easily it will flow.

Greases are made by using oil (usually mineral oil) and mixing it with thickeners (such as lithium-based soap). It can be also contained additional lubricating particles such as graphite, molybdenum disulfide or polytetrafluoroethylene. Greases can even act as a barrier, protecting the surfaces from contaminants that can cause corrosion or damage. Like oils, greases come in a range of consistencies from thin to thick characteristic. Some downside to grease is that because of its thickness and stickiness, sometimes it can cause resistance in small or fast-moving mechanisms.

Penetrating lubricants are well known in the usage of loosening years of rust and debris in minutes for some stuck parts such as bolts. Different from the substances oil and grease, these penetrating oils are not designed for long-lasting lubrication, instead, they are low-viscosity oils with additives that are specifically designed to infiltrate the tiny cracks between surface, add lubrication and break-up the rust.

Fuel will be provided by commercial, third party suppliers and the same with requirements of the gear oil and lubricants. All fuel suppliers have their own existing storage tanks and dispensing unit located at the fuel depot. The storage facilities satisfy the applicable Philippine regulations for the storage of flammable liquids. A total of six (6) cylindrical diesel fuel storage tanks with a combined capacity of 96,000 liters will be maintained at the fuel depot. All tanks will be provided with safety control devices such as leak alarm monitors and flow regulators to prevent leaks. The storage area, where the fuel tanks are located, have bund walls with sump, serving as secondary containment for any accidental release. The storage area for gear oil and other lubricants which happened to be the warehouse shall also be equipped with an adequate control for safety such as containment, label, proper ventilation, and fire prevention controls.

4.1.2.1. Risk Characterization from Fire Incident

Risk of fire incidents are higher during the construction phase due to hot works. Hot work is any work that has the potential to ignite nearby combustible, flammable or explosive material. Common hot work tasks include welding, cutting, grinding and heat treatment. Hotworks activities have the potential to ignite fires that can travel beyond site boundaries, such as grass or bush fires. Fires may also start well after the completion of any hot work activities due to residual heat.

Fire hazards create a serious risk to employees' health and safety that can lead to injury, illness, and death. Common incidents can include burns from heat radiation or contact with flames, sparks, molten metal or hot surfaces, and exposure to hazardous fumes.

On a more severe scenario, one possibility is the occurrence of fire resulting from ignition of flammable fuel oil in the fuel storage area. Several forms of fire can occur and include jet fires, pool fires, flash fires and boiling liquid expanding vapor explosions. The last is sometimes referred to a fireball and is the most serious of different forms. This particular event was selected as the worst-case scenario for study.

The accidental release of petroleum product can create a pool, which if ignited will cause a pool fire. Hazard related to the pool fire is the thermal radiation (heat) emitted. If the level of thermal radiation is sufficiently high, other objects which are flammable can be ignited and human health may be at risk. The damage caused by thermal radiation can be calculated from the dose of radiation received. A measure of the received dose is the energy per unit area of the surface exposed to the radiation over the duration of the exposure.

Potential impacts to properties and human from thermal radiation is described in **Table 4-3**.

Table 4-3 Estimated Explosion Overpressure Effects at Distance

Incident Influx, Qt (kW/m^2)	Damage to Equipment	Damage to Human/Public Health
37.5	Damage to process equipment	100% fatality in 1 minute. 1% fatality in 10 sec.
25.0	Minimum energy to ignite wood at indefinitely long exposure w/out flame	100% fatality in 1 minute. Significant injury in 10 seconds.
12.5	Minimum energy to ignite wood with a flame; melts plastic tubing.	30% fatality in 1 min. 1st degree burns in 10 sec.

Source: World Bank Technical Paper No. 55

4.1.2.2. Hazard Control against Flammable Substances

The following control measures will be in place to minimize the impacts from the combustion of flammable materials.

- Fuel storage area is secured, adequately ventilated, and is equipped with secondary containment to prevent material leakage.
- Identify any potentially flammable or combustible materials in the workplace area, such as fuel oils, rubbish, dust, lubricants and oils, grease, rubber, plastics, or other substances that could be potential fuel sources or generate dust explosions.
- Before starting hot works, remove any flammable or combustible material in the area. If materials cannot be removed use flame proof covers or screens or wet the materials down before and during the work.
- Conduct post hot work inspections for smouldering material prior to leaving the area. For example, before a break, at the end of a shift or at the completion of work.
- Ensure employees are wearing appropriate non-flammable personal protective equipment for hot works activities.
- Ensure the availability of adequate firefighting equipment in the storage area and in hot works area.
- Establish and train all personnel on emergency and evacuation procedures.
- Establishment and maintenance of firebreaks in reforestation areas to prevent bush fire.

4.1.3. Toxic Chemical Substances

Processing of ore will be mechanical in nature and will not involve addition of chemicals listed under the Priority Chemical List by the DENR, which are those determined to potentially pose unreasonable risk to public health, workplace & the environment.

Hazardous substances associated in the limestone project will be in the form of the hazardous wastes generated from the mine operations and domestic activities. The hazardous wastes identified to be potentially generated from the project operations is listed in **Table 4-4.**

Table 4-4 Hazardous Waste from ALP

Waste	Hazardous Waste ID
Solvent and aqeous based paints	E601 and E602
Grease trap wastes	G801
Waste Oils	I101
Contaminated containers	J201
Medical/clinic waste	M501, M503
Ink cartridge	F699
Lead car batteries	D406

Source: DAO 2004-36

These are substances without safe commercial or economic usage but can present unreasonable risk to health and safety of people and the environment. Some possible health hazards can be through contact or exposure that can lead to irritation, sensitization, and in worst case carcinogenetic. Physical hazards such as flammability, corrosion, and explosibility is also a risk.

Health effects on exposed individual is relative to the nature of the material, degree of concentration, the route into the body, and the amount absorbed by the body (the dose). Individual susceptibility or bearing capacity of the user also plays a role. Effects may also occur immediately, or manifest in the long-term.

For environmental impacts in case of accidental release to the environment, there will be potential contamination of environmental media, such as soil, surface water, and groundwater.

Risk related to hazardous wastes will be addressed by the Hazardous Waste Management Program. This will include proper storage, handling, and transport of the wastes until it is treated and disposed through DENR accredited facilities.

4.1.3.1. Hazard Control against Hazardous Substances

The following control measures will be in place to minimize the impacts from hazardous waste generation

- Hazardous Waste Management Program in place and is communicated to all employees and service contractors.
- The use of the Hazardous Waste Storage Area that meets regulatory requirement (i.e enclosed, secured, well ventilated, impermeable flooring, equipped with secondary containment, spill kits, fire extinguisher, etc.)
- Proper identification, segregation, labelling of wastes, and posting of the Material Data Safety Sheet
- Following protocol in the collection, inventory, and consolidation of wastes from the service contractor to the central facility.
- Regular inspection for leaks, and compliance to the hazwaste storage protocols.
- Decontamination of containers prior to storage
- Oil water separator required for motorpools
- Regular maintenance of grease traps
- Disposal and treatment via DENR accredited facilities
- Regular awareness training and drills for emergency preparedness related to spills/ uncontrolled release.

4.1.4. Occupational Hazard

Occupational health is about protecting the general welfare of employees within their working environment. In addition to preventing ill health, other important aspects of occupational health include:

- Ensuring fitness and physical capability to perform a job safely.
- Health education and promotion.
- Providing medical services including health surveillance.
- Rehabilitation after illness or injury.

The following subsections will discuss the identified risks to occupational health at the mine site:

4.1.4.1. Dust Exposure

Dust is inevitable in all quarrying and opencast mining operations. While it is often considered to be more of an environmental issue, dust is a potential health risk and it is the nature of the dust that determines the associated risk. A larger particle of dust can be an irritant to the eyes and throat, while smaller respirable dust particles (less than 5 microns) can be inhaled, deposited in the lungs, and cause respiratory problems. The highest risk is presented by crystalline silica particles as these are toxic to defensive cells in the lungs and can lead to silicosis. Crystalline silica, or quartz, is found in varying amounts in sand, clays, muds, shale, and rocks such as granite. Long-term exposure to high levels of respirable crystalline silica can also lead to an increased risk of developing lung cancer.

4.1.4.2. Vibration

Exposure to vibration can lead to physical injury in two ways: whole-body vibration (WBV) that produces symptoms such as back and neck pain; and hand–arm vibration syndrome (HAVS). In the quarrying industry, crushing plant operation, heavy equipment operation, and blasting, are the potential sources of whole body vibration. Hand-arm vibration syndrome is attributed to powered hand tools and can cause damage to the blood circulatory system, nerves, and joints, which may result in severe pain and numbness in the fingers, and loss of sense of touch.

4.1.4.3. Noise

Noise is regarded as unwanted sound and has the potential to interfere with communication or damage a person's hearing. The quarrying operation is a significant source of noise. Health effect of being exposed to high levels of noise in the long term is noise-induced hearing loss.

4.1.4.4. Control against Occupational Hazards

Occupational health hazards identified will be generally prevented primarily by the following measures:

- Use of Personal Protective Equipment by the workers; proper fit and comfort to be considered.
- Provide regular IEC to workers on the hazards, risks and controls of dusty tasks. This will be discussed in the daily toolbox meetings prior to deployment to workstation.
- Safety orientation, operation instructions and trainings for workers.
- Supervision by foreman and availability of safety inspectors/ officers in the mine site.
- Limited exposure to occupational hazards through worker rotation, job task changes, rest periods, etc.
- Regular maintenance of equipment
- Regular inspection of work tools and replenishment, as necessary.
- Identification of tools and equipment that is most appropriate to the task; to consider ergonomics.
- Maintenance of conducive and safe working environment (adequate ventilation, lighting, safety signages, ergonomics considered)
- Availability of medical professionals (doctor and nurses) on site for consultations, first aid, or health condition management.

4.2 Emergency Response Plan

An Environmental Emergency Response Preparedness and Response Plan (ERPP) is developed to provide guidelines on how to react positively and effectively to specific environmental emergencies that may have an impact on the environment, health, and safety of the stakeholders. This document is integral to the Integrated Management System (IMS) implemented by the Company under its ISO 9001, 14001, and 45001 compliance.

Identified emergency situations and their potential impacts to environment and people are summarized in **Table 4-5.**

Table 4-5 Possible Safety and Environmental Emergency Scenarios

Possible Scenario	Possible Scenario	Possible Scenario
Fire/ Explosion	Natural / Man-made	▪ Partial or total loss of properties such as building, equipment and machinery. ▪ Injuries and loss of lives of personnel. ▪ Loss of vegetation and disturbance to wildlife in cases of forest/bush fires
Release of Hazardous Material (Spill)	Human error/ Mechanical Failure	▪ Pollution of the river system. ▪ Damage of freshwater ecology ▪ Groundwater contamination
Storm / Typhoon	Natural Calamity	▪ Partial or total destruction of properties and facilities, including environmental controls. ▪ Injuries and fatalities to workers and resident of the surrounding communities. ▪ Loss of lives and properties including resident/s in the surrounding communities.
Earthquake	Natural Calamity	▪ Partial or total destruction of properties and facilities, including environmental controls ▪ Injuries and fatalities to workers and resident of the surrounding communities. ▪ Loss of lives and properties including resident/s in the surrounding communities.
Collapse of Mine Benches	Natural (Typhoons, Earthquake)	▪ Rock falls during mining operations. ▪ Landslides in the mining area. ▪ Loss of lives and property. ▪ Adverse effect on the environment from siltation ▪ (i.e. disturbance/ damage of marine and freshwater ecology)
Failure / Collapse of Siltation Ponds	Natural (Typhoons, Earthquake)	▪ Adverse effect on the environment from siltation ▪ (i.e. disturbance/ damage of marine and freshwater ecology)

4.2.1 Emergency Response Team

The Emergency Response Team (ERT) will be established, trained, and convened to respond to cases of an emergency. They will be composed of staff and employees that have been provided with training specific to the roles that are assigned to them. The ERT composition and responsibilities are presented in **Table 4-6.**

Table 4-6 Emergency Response Team Roles and Responsibilities

Designation	Responsibility
Incident Commander	▪ Senior Safety Officer shall act as the incident commander. ▪ Responsible for overall management response operation. ▪ Check if adequate safety measures are in place. ▪ Establishes priorities in consultation with the members. ▪ Determine incident objective and strategies.
Environmental Manager	▪ Shall check if the EEPRP is updated ▪ Shall act as the leader of the Spill Response Team and other environmental incidents.
Safety Officer	▪ Serves as the primary contact person responsible for coordination of all emergency actions ▪ Exercises overall supervision of response teams ▪ Attends to the scene as appropriate ▪ Alerts every one of the emergencies ▪ Shall act as the ERT Leader for the rescue and fire fighting ▪ Submits formal report to the GM and to MGB.
Planning Team (Environment, Engineering Services/Mines, Spill Team, Safety)	▪ Responsible for planning services. ▪ Collects situation and resources status information, evaluates, and process them. ▪ Develops incident action plan to accomplish objectives. ▪ Maintains resource and situation status.
Operations Team (ERT: First Aider, Fire Fighting, Rescue, Spill Team) Safety, Security.	▪ First group possibly deploy in the incident location. ▪ Responsible for directing, coordinating all tactical operations at the incident.
Public Affairs Officer	▪ Maintains communication with the General Manager and other department heads ▪ Designates spokesperson for media communication ▪ Primarily responsible for statement release to media and the public ▪ Controls false information to the public.
Security Force Section (SFS) Security Officer	▪ Exercises overall supervision and control of the evacuation operations ▪ Alerts every one of the emergencies. ▪ Shall act as the leader of traffic and crowd control.
General Engineering Services/Mines Department	▪ Initiates remedial repair of engineering structures damaged as appropriate. ▪ Responsible for the availability and possible deployment of heavy equipment as needed.
Logistic Team (Admin, Material Mgt., Health Section, Mobile Section)	▪ Provide resources and all other services needed to support the emergency, example; transportation, supplies equipment, fuel, food services, medical services ▪ Provides logistics and medical support to the ERT.
Finance Department	▪ Monitor incident costs. ▪ Maintain financial records.

Community Relations Department	▪ Control spreading of false information to the public
Company Nurse	▪ Shall lead the operation of the medical team.
Employees	▪ Full compliance to this manual ▪ Understanding of the emergency processes and the locations of assembly and muster locations. ▪ Fully comply with instructions and direction of supervisors unless unsafe to do so. ▪ Evacuate in an orderly calm manner. ▪ Stay at muster point until instructed to leave by Incident Commander. ▪ Report any information of the incident to the Incident Commander thru the immediate supervisor.

4.2.2 Emergency Communication Protocol

Emergency response will start upon notification of an emergency incident. Depending on the emergency, evacuation may be required. It is critical that an early warning of the emergency be communicated to all employees and members of the immediate community and timely evacuation from the hazard area is executed. An alarm system is used to signal the occurrence of an emergency. A secondary means of notification is by telephone from an area not involved in the emergency or by hand-held portable radio if available. Upon signal of an emergency, initial management and response will be handled by the Incident Commander or the immediate supervisor available at or near the location of the incident. The ERT will be deployed upon the instruction of the Incident Commander.

In case of evacuation, personnel is to gather in designated muster points, wherein it is safe from danger but is close enough to be controlled. The primary Muster Point identified is the basketball court within the Administration area. An alternate Muster Point is at the old exploration camp near the Administrative area.

4.2.3 Safety and Environmental Emergency Response

The general response procedures for different safety and environmental emergencies are identified in the following subsections:

4.2.3.1 Personal Injury

These injuries such as minor cuts or burns are common in the workplace but there can be injuries as severe as hazardous effects of chemical exposure or serious incidents such as overpressure from explosion and severe burns. Injuries can also be obtained from sudden loss of control as in the case of heart attacks or strokes. The following procedures are intended to limit injuries and prevent further damage should personal injuries occur:

A. First Aid Cases

- Locate the First Aid Kit. Supplies in a First Aid Kit can be used to treat minor scratches, cuts, and burns.
- Render assistance to persons involved and remove them from exposure to further injury, if necessary.
- Warn personnel in adjacent areas of potential hazards to their safety.
- Inform a First Aid Team Member of the injury.
- Turn off nearby electrical apparatus and remove flammable materials from the area.

B. Medical Emergencies

- In the case of a medical emergency, remain calm and do only what is necessary to protect life.
- Inform supervisor or call the ERT-First Aid Team, Camp Nurse and or the Physician.
- Do not move an injured person unless they are in further danger.
- Keep the injured person warm. If feasible, designate one person to remain with the injured person.
- If clothing is on fire, knock the person on the ground and roll them around to smother the flames or douse under a safety shower. A fire blanket should only be used as a last resort.
- After the administration of first aid, a nurse or physician qualified to handle medical emergencies should provide further examination and treatment.

C. Severe Injury Procedures

- In cases of severe injury, trained personnel (First Aid Team Member) should quickly perform the following steps:
- Do not move the victim unless imminent danger exists. Examples include fire, structural damage, chemical spills, toxic fumes, explosion danger, etc.
- Keep the victim still and comfortable.
- Ask the victim, "Are you okay? What is wrong?"

- Check breathing and give artificial respiration if necessary.
- Follow Red Cross guidelines for exposure to pathogens.
- Control bleeding by direct pressure on the wound.
- Look for an emergency medical ID on the victim.
- Question witnesses and be ready to give all information to the paramedics when they arrive.

D. Fire

- After the emergency notification, the observer may attempt to extinguish the fire using fire extinguisher if it safe to do so. If there is any risk of personal safety, the primary requirement is to evacuate the area and wait for the ERT.
- All personnel and visitors shall immediately evacuate to the nearest muster point
- Shut off any electrical connections.
- The first arriving Fire Brigade member shall fight the fire applying extinguishing method appropriate to the class of fire.
- Other members of the ERT shall assist in the evacuation of employees and visitors and proceed with appropriate mitigating measure whenever possible.
- ERT – Medical shall check the physical and medical condition of evacuees.
- Notify BFP- Municipality of Jabonga, Santiago, and Tubay, if the fire has the potential to go beyond the control or capability of in-house Fire Brigade.
- Security shall provide a person on standby, preferably at the site entrance, to meet and direct incoming fire trucks from BFP.
- Establish a telephone response line for incoming inquiries from employee and visitor relatives concerning site activities.
- After the evacuation, Security Officer shall determine the headcount of employees and visitors and shall notify the Incident Commander for further instruction.
- Safety Officer to submit incident report to the highest Officer on site.

E. Chemical Spill

- Alert personnel in adjacent areas.
- ERT – Spill Response Team shall respond immediately upon receiving the advice from the incident commander, or hearing the alarm securing availability of the spill equipment.
- Confine the spill and evacuate nonessential personnel from spill area.
- ERT – First Aider Team shall attend to contaminated personnel, if any. First aid measure is carried out as prescribed in the SDS. First, protect yourself, and then remove injured person or persons to fresh air, if safe to do so.
- If spilled material is in flame, extinguish flames and all other sources of ignition
- Never assume gases or vapors do not exist or are harmless because of lack of smell
- Do not touch the spill without protective clothing; wearing gloves is a must
- If flammable vapors are involved, do not operate electrical switches. Try to turn off or remove heat sources, where safe to do so.
- Secure appropriate cleanup supplies. Use specific-classified absorbents to collect its appropriate substances. Reduce vapor concentrations and control enlargement of the spill area by covering the surface of a liquid spill with absorbent.
- During cleanup, use appropriate personal protection.
- A copy of the chemical's SDS shall accompany the victim when brought to the hospital as basis for further treatment.

F. Oil Spill

- The observer reports the incident to the immediate supervisor or to the responsible person assigned in the area or calls the Safety Officer thru two-way radio communication.
- Upon arrival in at the area the Safety Officer and Spill Team will assess the situation and take steps to prevent further product escape by closing the valves.
- All sources of ignition must be removed, and the area cordoned off and isolated to prevent entry of other workmen and equipment.
- In case the spill is outside the secondary containment area, contain and limit spill from flowing to the ground or water channels using the absorbent materials included in the oil spill kit or by diverting flow to concentrate spillage within the premises.
- If necessary, stop the spill from entering storm water drains by blocking the drain inlet.
- Take the immediate steps to recover the product into the nearest available tank.
- Immediately place temporary catchment basin to contain leakage from valves, pipe or dispenser.
- Apply earth material such as saw dust to contain spillage. Scrape fuel / oil spilled to land and place in salvage drums / container for proper disposal.
- Check if the area is free of all possible danger and effect ground or facility restoration activities (total clean-up).

G. Structural Failure

This procedure intended to address all possible soil stability failures such as berm failure, slope failure, siding slope of silt pond, etc. that may result in environmental damage.

- The observer should report immediately any possible suspected areas for erosion to Environment, Safety Department, or with his immediate supervisor.
- During heavy rains, the Environment, Safety, Engineering Services, or Mines Department should conduct immediate road and environmental structure (earth bund) assessment as soon as it is safe to do so to identify eroded structures or those suspected for erosion.

- If landslide occurred, the Incident Commander shall immediately deploy the ERT (Rescue Team), together with the Safety Officer to assess the area and determine possible damage or casualties.
- The Response Team will secure the affected area and will wait for heavy equipment arrival.
- After the assessment, the Incident Commander will coordinate with the Engineering Services/Mines Department for immediate deployment of necessary heavy equipment for clearing, repair of slope or soil structure re-stabilization.

4.3.4. Terminating the Emergency Event

Proper termination of the emergency is critical to properly account all employees, staff, and community residents and to check if the impact areas have been restored to a safe condition. Activities to be performed during the post-emergency period are focused on the following:

- Recovery of Operations – The recovery of site operations and services will depend on the extent of the damage suffered. The General Manager/OIC will prioritize activities that can be accomplished with available staff and resources. Immediately following the emergency phase of the incident, the management will begin the implementation of the site business recovery plan.
- Damage Assessment – Following the emergency crisis event and assessment of the damage to property and equipment and remediation measures required to mitigate the impacts of the event and restore the facility for operational use will be prepared.
- Incident Debriefing– The purpose of incident debriefing is to inform personnel about any environmental hazards that may remain on the site property following the incident and to identify unsafe conditions that may still exist. Some employees may be impacted by the events surrounding the incident, especially those involving injuries or loss of life. It may be necessary to provide critical- incident stress debriefing sessions following such incidents.
- Investigation– Following the investigation, a review of what actions took place during the incident, both good and bad are done. This activity is not designed to place blame, but rather to allow for the flow of ideas and recommendations to improve the emergency action plan and the facility policies and procedures.
- Reporting– Environmental incidents must be reported to the Incident Commander. Additional details of the incident are to be documented.

4.2.5 Emergency Response Trainings

Incident management training for the ERP members, employees, contractors, and the local community will be provided on a regular basis. This will be done either through the Safety Department or in partnership with local agencies. Emergency simulation and drills will also be conducted on-site to practice the incident response procedures for improved retention and response times.

Section 5– Social Development Plan and IEC Framework

5.1. Social Development and Management Program

Agata Processing Inc. will develop a Five-Year Social Development and Management Program (SDMP) for the Agata Limestone Project, upon securing the Notice To Proceed from Mines and Geosciences Bureau.

SDMP is a comprehensive five-year plan of a mining contractor towards the sustained improvement in the living standards of the host and neighboring communities by creating a responsible, self-reliant and source-based communities capable of developing, implementing, and managing community development programs, projects and activities in a manner consistent with the principle of people empowerment.

Its implementation is based on: (a) Chapter X of R.A. 7942 (PH Mining Act of 1995); (b) Section 134, Chapter XIV, DAO No. 96-40 (The Revised Implementing Rules and Regulations of R.A. 7942); (c) DAO 2000-99 (Rules and Regulations on the Implementation of the Social Development and Management Program (SDMP) for mining projects); (d) DAO 2010-13 (Amendments to Section 16 [Ancestral Lands] and to Chapter XIV [Development of Mining Communities, Science & Mining Technology] of DAO 96-40; and (e) DAO 2010-21, (Consolidated DAO for the IRR of RA 7942).

API is mandated to allot a minimum of 1.5% of the operating costs annually, distributed as follows:

(a) 75% for implementation of SDMP;
(b) 10% for the development of mining technology and geosciences, as well as the corresponding manpower training and development; and
(c) 15% for implementation of IEC programs

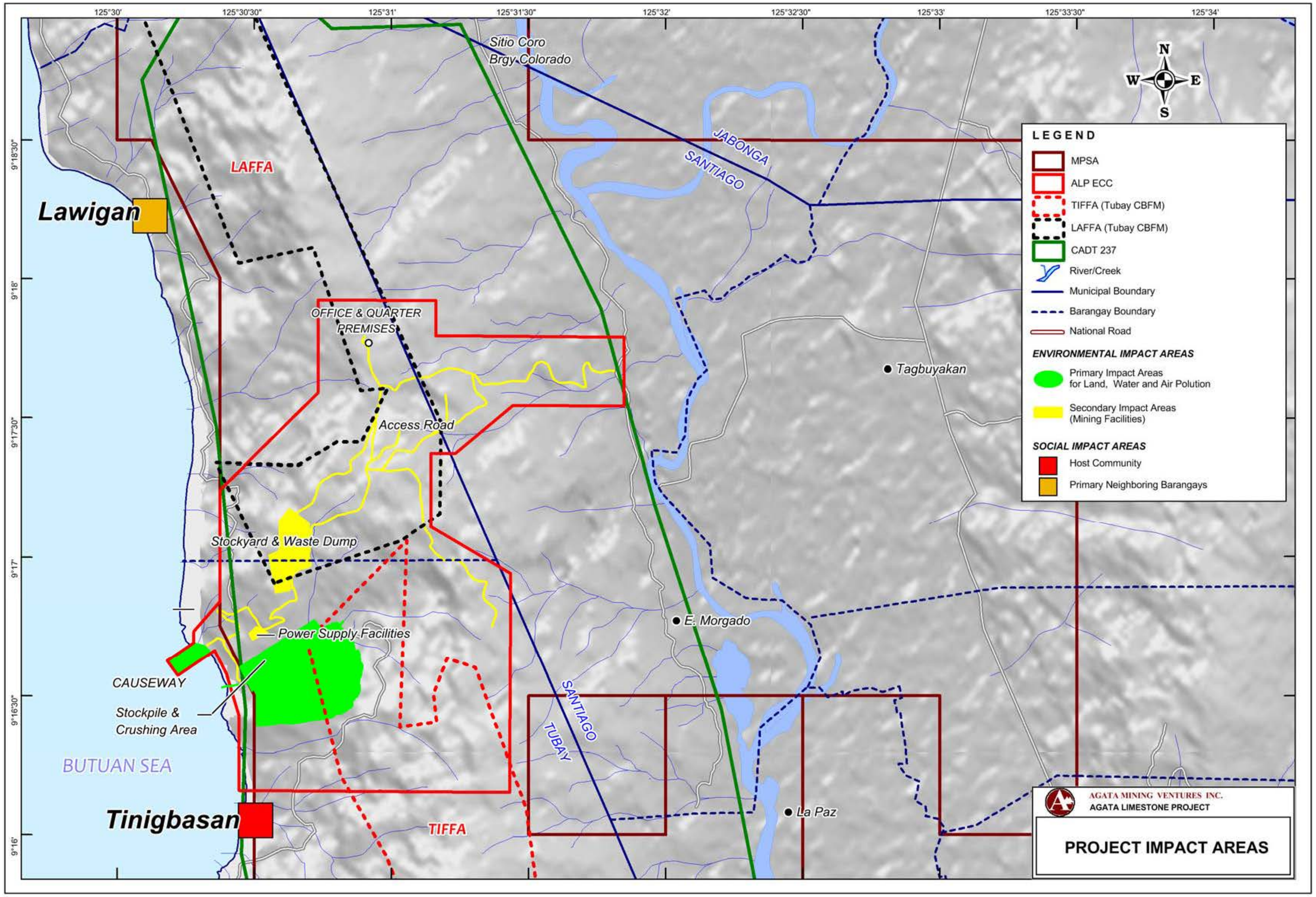
The primary impact barangays include two (2) barangays within the MPSA area, where the Agata Limestone surface mine and the mine facilities will be located. These include Brgy. Lawigan and Brgy. Tinigbasan, both within the Tubay Municipality. They will be the most susceptible to the direct and/or indirect environmental impacts relative to the air and noise quality, watershed functions including stream flows and water quality, and to disturbance of flora and fauna resources. They are also affected by socio-cultural impacts, determined based on several qualitative factors such as livelihood, and cultural impacts from the Project.

The impact areas and how they are affected by the Project is listed in **Table 5-1**. Location of the impact areas are also shown in **Figure 5-1.**

Table 5-1 Project Impact Areas by Sector

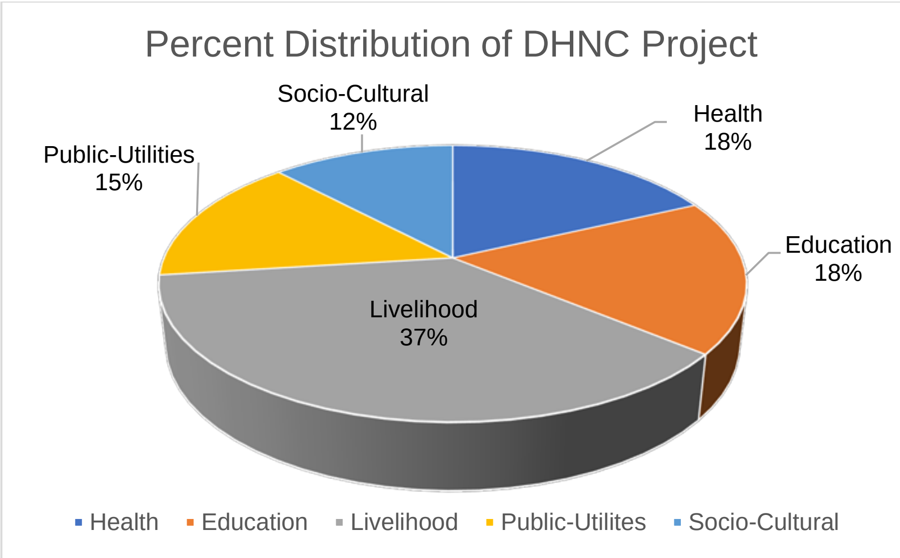
Impact	Impact Area	Impact	Impact Area
Land Resource Impacts		Water Resource Impacts	
Clearing of vegetation	Brgy. Tinigbasan	Siltation of waterways	Brgy. Tinigbasan
Sedimentation of agricultural lands	Brgy. Tinigbasan	Diversion of streamflow	Brgy. Tinigbasan
Overlapping tenurial instruments	Brgy. Tinigbasan	Social Impacts	
Air Impacts		Socio-cultural impacts to IPs	CADT 237
Dust generation	Brgy. Tinigbasan, Brgy. Lawigan	Socio-cultural impacts to non-IP communities	Brgy. Tinigbasan
Exhaust emission	Brgy. Tinigbasan, Brgy. Lawigan	Increase in Employment and Business Opportunities	Brgy. Tinigbasan, Brgy. Lawigan
Noise	Brgy. Tinigbasan, Brgy. Lawigan		

Figure 5-1- Project Impact Area Map



The SDMP will be focusing on projects under Health, Education, Livelihood, Public Utilities/ Infrastructure, Socio-Cultural Activities, and Disaster Risk Reduction and Management (HELPS-Plus). The budget for the livelihood program is identified to be the highest among the component sectors, at 37% of the total funding for the SDMP for the benefit of the Direct, Host and Neighboring Communities (DHNC). Budget allocation per component sector is shown on **Figure 5-2**.

Figure 5-2 Percent (%) Distribution of DHNC Project



The **Table 5-2** shows generalized community development programs/activities the Proponent envisages for the impact barangays. These are based on the SDMP that have been implemented in the past. Detailed Programs/Projects/Activities will be provided as soon as the SDMP is finalized in coordination with the impact barangays.

Table 5-2 Generalized community development programs under SDMP

Community Development Programs	Beneficiaries	Partner Institutions	Proponent	Indicative Timeline	Source of Funds
Health programs: Medical missions for two (2) Brgys Provisions of medicines Emergency Respoinse Training	All residents of Brgy. Tinigbasan and Brgy. Lawigan Members of Sanguniang Kabataan	Regional Health Unit Brgy. Health Center BHW MDRMMC SK Council	Community Relations Officer	As soon as the Project starts	18% of 75% of SDMP
Educational programs: Assistance to Elementrary and High School Students Scholarship Program for Mining Engineering and Forestry Student	2 Elementary Schools 1 High School Qualified High School Graduate of Tinigbasan H/S	DepEd Tinigbasan E/S Lawigan E/S Tinigbasan Natl. HighSchool CSU	Community Relations Officer	As soon as the Project starts	18% of 75% of SDMP
Livelihood Projects; One-Pump Boat-One-Family Program; Seedlings propagation for tree plantation project Micro Enterprise	TIFFA, LAFFA,LASFFA Womens Organizations TiFFA, LAFFA	DA TESDA DENR DTI	Community Relations Officer	As, soon as the Project starts	37% of 75% of SDMP
Public Infrastructures: Improvement of Water System Improvement of Brgy. Hall	BLGU of Brgys. Tinigbasan and Lawigan	Municipal Govt. of Tubay Mun. Engineering Office	Community Relations Officer	As soon as the Project starts	15% of 75% of SDMP
Socio-cultural: Support to Fiesta Support to Araw celebration Improvement of Church and Chapel facilities	Religious Sector Chapels Church BLGU Puroks	Tubay Parish Religious Sector Church MLGU BLGU	Community Relations Officer	As soon as the Project starts	12% of 75% of SDMP
Emergency Preparedness : Trainings/ Seminars and Drills	BDRRMC, MDRRMC	PDRRMC	Community Relations Officer	As soon as the Project starts	Part of Health Programs
DMTG: Scholarship for students taking mining and Forestry related courses;	Deserving K12 Graduates from Brgys. Tinigbasan and Lawigan	CSU	Community Relations Officer	As soon as the Project starts	10% of SDMP

5.2. IP Royalty

The Mamanwa-Manobo IP sector has already acquired their Certificate of Ancestral Domain Title (CADT) Number 237 giving this sector ancestral authority over areas within the Agata MPSA including the ALP area. They have an existing Community Royalty Development Program (CRDP), which was duly approved by the NCIP Commission En Banc and is basis of the Indigenous Cultural Communities' development programs. The royalty payment, as well as the implementation of the CRDP will be done during the mine life of the ALP.

The following tribal groups comprise the CADT 237 holders with their corresponding royalty shares:

- Mamanwa Tribal Management Organization – 23%
- Agata Mamanwa Tribal Organization – 23%
- Mamanwa Manobo Mapaso Tribal Sectoral Organization – 24%
- Coro Mamanwa Management Organization – 30%

Approximately PHP 45.5 million worth of royalty will be received by the IP beneficiaries for the first five (5) years of the Project, as shown on **Table 5-3.**

Table 5-3 Estimated Royalty Payments (PHP)

Cost Item	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
IP Royalty	9,213,750	9,804,350	8,977,500	8,583,750	8,977,500	45,556,850

The royalty payments they will receive will be used for the implementation of their Community Royalty Development Plan (CRDP). Fund allocation will be 50% for CADT governance and 50% for IP community development program. The corresponding allocations per program groups is presented in **Figure 5-3** and **Figure 5-4.**

Figure 5-3 IP Royalty Allocation for Community Program

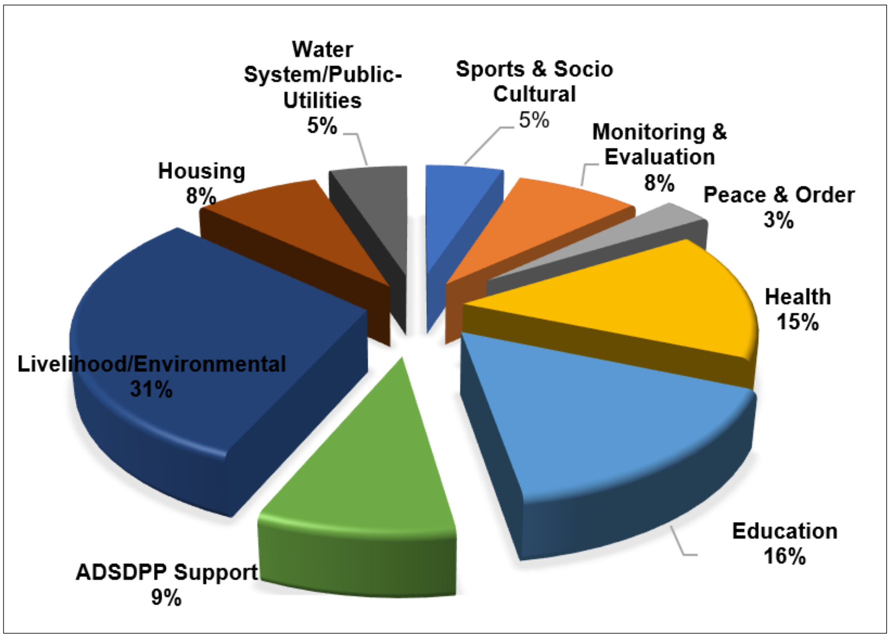
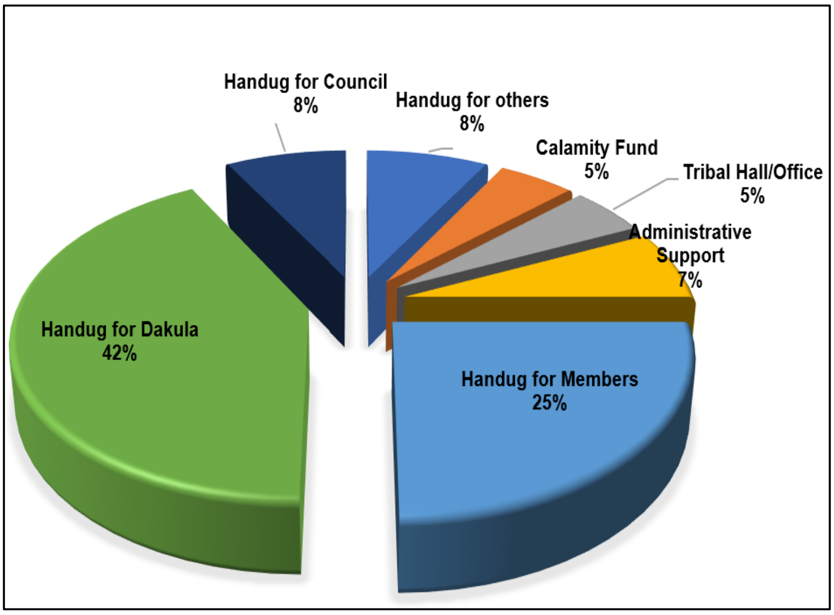


Figure 5-4 IP Royalty Allocation for Governance



5.3. Information and Education Campaign (IEC)

Information, Education and Communication campaign of the Agata Limestone Project will be strengthened in order to address the misconception of the community pertaining to mining operations. Strong and effective IEC programs will help address the disinformation propagated by the anti-mining advocates regarding issues on the discoloration of waters and other coastal issues. Regular information regarding the implementation of the SDMP will be enhanced. This will also help communities appreciate the programs that alleviate their living condition.

Strong and effective Public Relations will also play a vital role in the Project's effective development strategies. Intensification IEC campaigns through regular interactions with all the stakeholders will be given priority. The policy on Community Feedback implemented in the previous project will be continued during the limestone operations. These are all part of the Company's programs to promote transparency in its dealings with the communities. The following are some of the identified strategies for IEC, and the budget allocation planned for the first year of operations in **Table 5-4.**

A. Community Consultations

In the preparation and development of SDMP, the Host and Neighboring communities including their People's Organizations and identified stakeholders will be consulted as to their priority needs for inclusion in the SDMP projects. These are discussed and rationalized to ensure PPAs will be most effective.

B. Community Meetings

Meetings with Representatives of the Host and neighboring Communities (RHNC), sectoral groups and other Local Government representatives will be convened regularly to review and approve identified projects. Quarterly meetings will be called for projects updates, among others.

C. Public Awareness

Aside from regularly posting billboards and informative tarps in strategically located areas in the communities, the Project will extensively use various social media platform to maximize its reach in providing relevant information about the Project.

D. Information Center

An Information Center will be established in the Host and Neighboring Barangays. Coordination with the Sangguniang Barangays will be strengthened for proper dissemination of information.

E. Publication of Information, Education and Communication Materials

Aside from the Project-owned community newsletter, publication of community events and development will also be printed in local and national print media as the needs arise.

F. Radio Program

Constant airing of project's development will be conducted at local radio stations at Surigao City and Butuan City. Discussions on pressing issues of the Project and of the whole mining industry in general will be tackled.

G. Stakeholders Complaint and Feedback Settlement

The Project will continue implementing its Community Complaint and Feedback policy to better respond to issues and concerns from the stakeholders. Feedbacks from the community will be processed by the CRO and submitted to Project/Site Management who in turn will assign the concerned Department to act on the complaint for immediate settlement. CRO will be facilitating the complaint and feedback process.

Table 5-4 Information, Education, and Communication Plan

Target Sector Identified as Needing Project IEC	Major Topic/s of concern in Relation to Project	IEC Scheme/ Strategy/Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
1.Sanguniuang Bayan of Mun. of Tubay	• Project Description • EIA finding	• Group method • Group method	• Audio Visual Presentation • Primer • Brochures	• 2 months prior to start of project construction • Quarterly update	• 20,000.00 for meals and venue • 15 to include staff
2. Brgy. Development Council	• Project Description • EIA Findings	• Group methods • Group method	• Audio Visual Presentation • Focus Group discussion • Primer • News paper	• Monthly update	• 15,000.00 for meals and snacks • 20 members
3. Community Assembly	• Issues and concern on water discoloration	• Group method • Multimedia	• Audio Visual Presentation • Hand outs • Posters • Flyers • brochures	• Quarterly	• 120,000.00 for meals and snacks • 900 participants per Brgy.
4. Peoples Organization	• Discussion on SDMP Programs	• Group Method	• Focus group discussion	• Quarterly	• 15,000.00 for meals and snacks
5. School faculty	• Issues and concerns on water discoloration • Discussion on School assistance	• Group method	• Focus group discussion	• Monthly visitation	• 1,000.00 for snacks • 15 faculties
6. Sanguniang Kabataan Council	• Project Description • EIA Findings • Discussion on Youth Programs	• Group method	• Focus group discussion	• Monthly visitation	• 1,000.00 for snacks • 15 Youth Council members
7.Represrentrative of Host and Neighboring Communities	• Project Description • EIA Findings • Discussion on SDMP Projects	• Group method	• Focus group discussion • Multimedia presentation	• Quarterly	• 30.000,00 for meal and snacks to include venue

6. Environmental Monitoring Plan (EMOP) and other Monitoring Modes

Effective monitoring of the environmental management performance of the Project includes both self-managed programs and multi-sectoral involvement. The monitoring programs serve the need to quantify the environmental impacts and assess the efficiency of the mitigating measures in place. Any deficiencies or issues identified during the monitoring and audits are documented. The causes are then identified and discussed with the responsible parties. Subsequently, corrective actions are scheduled for implementation.

The most significant impacts previously identified, and the monitoring approaches being implemented include:

- Geotechnical and Landform Stability
- Erosion and Sedimentation
- Habitat Modification
- Air Quality and Noise
- Water Quality of Surface Water, Groundwater, and Marine Water
- Health and Safety

6.1. Self-Monitoring Plan

The self-monitoring team will be composed of Agata personnel under the Environmental Department. Representative from other departments will be engaged from time to time to provide assistance and technical expertise. This will include personnel from the Assay Laboratory which will provide water quality testing services on a regular basis, and coordination with the Mines and Port Operation for water management activities, monitoring of discharge points and ensuring loading activities are environmentally compliant.

The assistance of third-party consultants or experts in different fields of environmental management will be included to provide additional specialized expertise and to remove any perceived bias that may be associated with the self-monitoring aspect of the program.

6.2 Multi-Sectoral Monitoring Framework

Multi-sectoral monitoring provides for the participation of different stakeholders including government regulatory agencies and civil society in monitoring the impacts of the project. This framework is identified in Section 182 of DAO 2010-21: Providing for a Consolidated Department Order for the Implementing Rules and Regulations of Republic Act No. 7942 and Section 16 of DAO 2017-15: Guidelines on Public Participation Under the Philippine Environmental Impact Statement (EIS) System.

The key provision of this Section provides for the creation of a Mine Rehabilitation Fund Committee (MRFC) and Multi-Partite Monitoring Team.

This MRFC shall have the following duties and responsibilities:

Conducts preliminary evaluation of the submitted Environmental Protection and Enhancement Program (EPEP) and consults with credible experts, as may be required, to clarify proposals and to

- Discuss the adequacy of control and rehabilitation measures. Manages, operates and monitors the Mine Rehabilitation Funds and Final Mine Rehabilitation and
- Decommissioning Fund and ensures these funds are kept separate.

- Resolves issues involving the progressive mine rehabilitation programs that shall be implemented.
- Hires credible experts to perform independent studies and research on the environmental,
- engineering and socio-cultural impacts of the Project.
- Ensures that the approved EPEP and AEPEP's shall be strictly implemented by the Proponent.
- Assembles and deputizes a Multi-Partite Monitoring Team (MMT) to serve as the monitoring arm of
- the MRFC.
- Monitors and evaluates the performance of the MMT and reports on its functioning to the
- Contingent Liability Rehabilitation Fund Steering Committee (CLRF).

With reference to the assembly of the MMT, Section 17 of DAO 2018-18 states that an MMT shall be deputized by the MRFC to serve as its monitoring arm. Pursuant to Section 16 of DAO 2017-15: Rationalization of the Multi-Partite Monitoring Team Existence, Composition and Leadership and Section, the MMT for this project shall be composed of the following representatives:

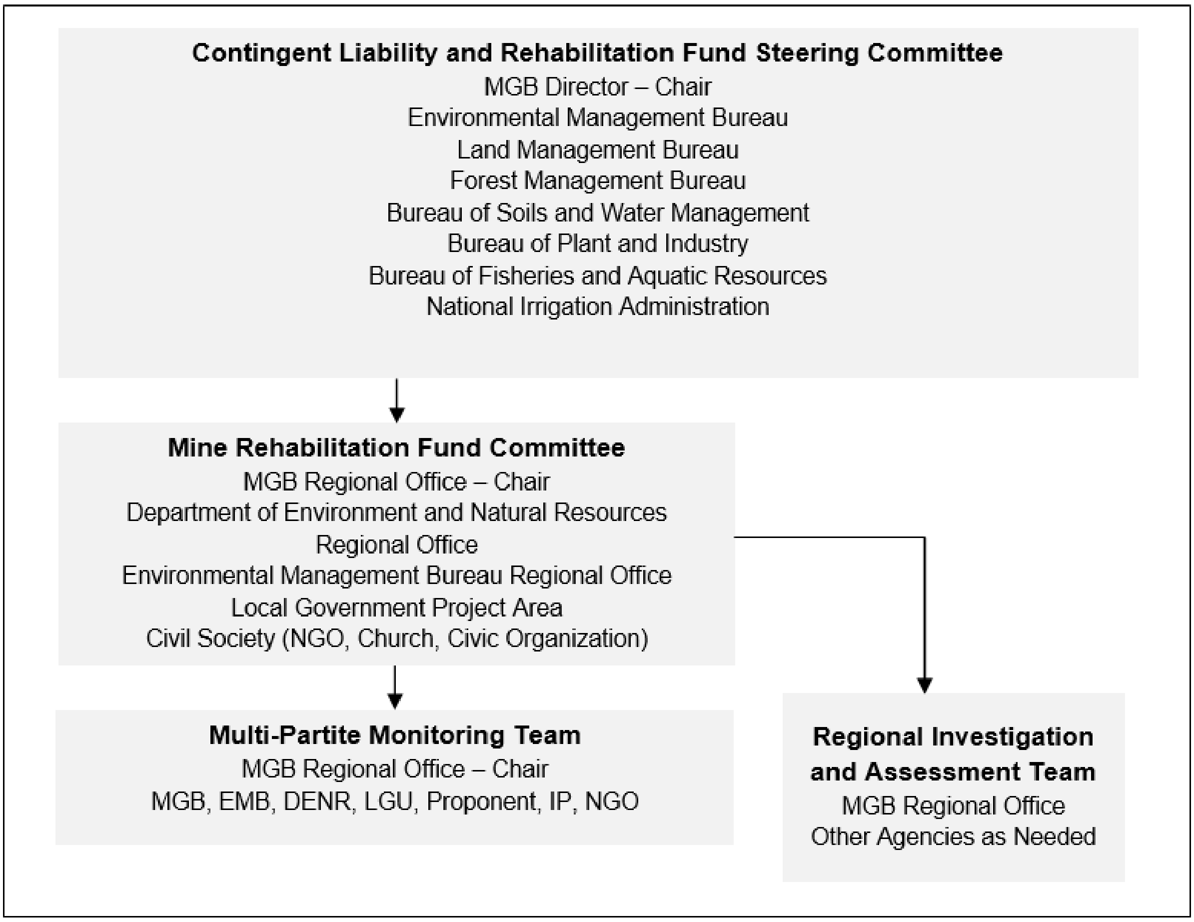
- Representative from the Municipal Environment and Natural Office (MENRO) of Tubay, Agusan del Norte
- Barangay Captain of Tinigbasan, Tubay, Agusan del Norte
- Barangay Captain of Lawigan, Tubay, Agusan del Norte
- Chief Rural Health (DOH) Unit of Agusan del Norte
- Representative from an Environmental NGO
- Representative from the Affected Indigenous Cultural Community
- Representative from Locally Recognized Leaders- Tinigbasan Farmers and Fisherfolks Association (TIFFA)
- Representative from the DENR – Provincial Environment and Natural Resources Office (PENRO)
- Representative from the DENR-City Environment and Natural Resources Office (CENRO)

The team shall conduct quarterly audits to oversee the implementation of the environmental programs relative to the submitted Annual EPEP and the conditions stipulated in the approved ECC. Another audit team composed of MGB-13 representatives is responsible for the quarterly Integrated Safety, Health, Environment and Social (ISHES) Validation to evaluate the company's environmental, safety, and social accomplishments.

Organizations that will form part of the MMT will be evaluated during discussions with the MRFC to determine their validity and value to the MMT. It is important that organizations potentially affected by the Project are represented in the MMT. Additional members may be included, with the approval of the MRFC.

The MRFC itself is under the direction of the Contingent Liability and Rehabilitation Fund (CLRF) Steering Committee which is convened at the National Level. This Committee has the responsibility of final approval of the EPEP and the Final Mine Reclamation and Decommissioning Plan. An organizational diagram of the different committees is shown on **Figure 6-1.**

Figure 6-1 Third Party Compliance Monitoring Organization



6.3. Summary of the Environmental Monitoring Plan

The Environmental Monitoring Plan (EMoP) is summarized in **Table 6-1.** The Environmental Quality Performance Level (EQPL) values established by the proponent during this pre ECC stage is the "Limit Performance Level". The EQPL values are limited to the existing thresholds set by national agencies, such as the ambient air and water quality standards by DENR and the ambient noise levels by the National Pollution Control Commission (NPCC). The environmental management measures in place are designed to meet the applicable standard limits. Monitoring results that will show deviation from the prescribed values are verified, root-cause analysis performed, with the appropriate corrective action identified and implemented. The post ECC EQPL commitments under the Action and Alert Levels will be established later, after discussion with the members of the MMT and will be made part of the MMT Operations Manual.

Sampling Maps for water and air and noise quality, freshwater ecology, and marine monitoring are provided in, **Figure 6-2**, **Figure 6-3**, and **Figure 6-4**, respectively.

Table 6-1 Environmental Monitoring Program (EMoP)

Key Environmental Aspect		Potential Impacts	Parameters Monitored	Sampling and Measurement Plan			Lead Person	Annual Cost	EQPL Management Scheme					
									EQPL (Alert level) Management Scheme			Management Measure		
Sector	Component			Location	Frequency	Management Measure			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Land Resources	Access Roads/Haul Roads	Erosion/ Soil loss Siltation Structural Failure	Stability Area of Disturbance	Mine Area	Daily Monthly	Visual Inspection Survey Data	Environment Department Mines Department	Php 25,000	70% good road condition	60% good road condition	• 100% Good Road Condition with the ff. monitoring parameters; • Crowning- 2.5% slope from the center of the road width to the side • Longitudinal Gradient- 10% Slope • Road width- 12 m width min. - Mine Haul Road / 10m - service/secondary road • Super Elevation (Curve Slope)- 8% minimum slope @ a speed of 20kph loaded trucks • Curve Radius- 14 meters minimum @ a speed of 20 kph loaded trucks • Surface Condition- +10mm / -20mm using 3.0 m straight-edge variation level of surface • 0.50-meter-thick surfacing materials	• Regular road mainte-nance • Speed limit • Drainage manage-ment • Slope stabiliza-tion measures • Erosion control measures • Repair as needed.	Immediate conduct of repair to achieve 100% Good Road Condition.	Immediate suspension of road transport and implement road construction and maintenance standard operating procedure.
	Ore Stockpiles and Waste dump	Erosion/ Soil loss Siltation Structural Failure	Stability Area of Disturbance	Overburden/ Ore Stockyards	Daily Monthly	Visual Inspection Sediment Pond Erosion Control Survey Data	Environment Department Mines Department	Php 25,000	Bench height > 5m Slope angle > 35 degrees	Bench height >8m Slope angle > 45 degrees	• Bench height < 10m • Slope angle < 80 degrees • No visible signs of instability (landslides, damaged slopes and benches)	Bench forming shall be done in lifting the materials for. stockpile with more than 6 meters height	Covering of stockpiles Provision of Drainage	Implementation of the Standard Operating Procedure on Ore Stock Piling and Waste Dumping.
	Diversion Canals	Erosion/ Soil loss Siltation Structural Failure	Stability, Clogging Area of Disturbance	Surface Mine area Overburden/ Ore Stockyards Access roads	Monthly	Water Samples/Testing Survey Data	Environment Department Mines Department	Php 25,000	Bench height > 5m Slope angle > 35 degrees	Bench height >8m Slope angle > 45 degrees	• Bench height < 10m • Slope angle < 80 degrees • No visible signs of instability (landslides, damaged slopes and benches)	Periodic Monitoring and Evaluation every after-rain event.	Immediate maintenance and Repair as needed.	Regular canal desilting and maintenance Repair as needed.

Table 6-2 Environmental Monitoring Program (EMoP)- continued

Key Environmental Aspect		Potential Impacts	Parameters Monitored	Sampling and Measurement Plan			Lead Person	Annual Cost	EQPL Management Scheme					
									EQPL (Alert level) Management Scheme			Management Measure		
Sector	Component			Location	Frequency	Management Measure			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
	Water Quality Management Ponds	Erosion/ Soil loss Siltation Structural Failure Aquatic Habitat Degradation Biodiversity Loss	Stability Capacity Proper Drainage	Surface Mine area Access roads Overburden/ Ore Stockyards	Monthly Daily	Water Samples/ Testing Discharge Measurements Survey Data Visual Inspection	Environment Department Mines Department	Php 25,000	Full at 60% capacity	Full at 65% capacity	Full at 75% capacity	• Conduct of close monitoring and evaluation • Regular pond desilting and maintenance	• Slope stabilization measures • Repair as needed.	• Implement-ation of the SOPs for the construction and Mainte-nance of Water Mngt. Structures. • Regular pond desilting and mainte-nance • Slope stabilization measures • Repair as needed.
	Surface Mine	Erosion/ Soil loss Siltation Structural Failure	Stability Area of Disturbance	Surface mine area	Monthly Daily	Survey Data Water Samples/Testing Erosion Controls Visual Inspection	Mines Department Environment Department	Php 25,000	• Bench height > 5m • Slope angle > 35 degrees	• Bench height >8m • Slope angle > 45 degrees	• Bench height < 10m • Slope angle < 80 degrees • No visible signs of instability (landslides , damaged slopes and benches)	• Proper establishme nt of bench forming • Provision of Drainage System	• Proper Bench forming and overburden stripping • Repair as needed	Planned Development Drainage management Slope stabilization measures Erosion control measures
	Nursery	Biodiversity Loss	Seedling Production and Disposal	Agata Central Nursery	Weekly	Manual Inventory	Environment Department	Php 25,000	At least 60% survival rate	At least 70% survival rate	At least 90% survival rate	Collection of representative per species before removal of vegetation.	• Site Species Matching • Soil Ameliora-tion • Cloning	• Soil conditioning, • Application of appro-priate plant propagation technology
	Flora and Fauna	Biodiversity Loss	Abundance Species Richness Importance Value Conservation Status	MPSA Area	Annual	Quadrat Sampling Netting, Herping, Observation Transects	Third Party/ Environment Department	Php 1,200,000	30% reduction of Species richness and abundance	40% reduction of species richness and abundance	No loss of important species	Conduct of period Biodiversity Assessment	• Establish-ment of Biodiversity Monitoring Plots • Preservatio n of Bio-diversity Zones • Plantation of Endemic Species	• Mainte-nance of buffer zones • Establish-ment of Biodiversity Monitoring Plots • Preserva-tion of bio-diversity Zones • Plantation of Endemic Species

Table 6-1 Environmental Monitoring Program (EMoP)- continued

Key Environmental Aspect		Potential Impacts	Parameters Monitored	Sampling and Measurement Plan			Lead Person	Annual Cost	EQPL Management Scheme					
									EQPL (Alert level) Management Scheme			Management Measure		
Sector	Component			Location	Frequency	Management Measure			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Water Resources	Water Supply	Water Supply Shortage	Streamflow Measurements/ Discharge	Water Sources	Daily	Weir measurements	Environment Department	Php 100,000	30% reduction in water supply	20% reduction in water supply	10% reduction in water supply	Conduct of period stream flow monitoring Intensify IEC re Water conservation measures	Intensify water conservation measures Repair of Leaks as needed	• Intensify IEC re Water conservation measures • Water Source Reforesta-tion
	Surface Water	Surface Water Quality Degradation Biodiversity Loss	BOD Chloride Color DO Fecal Coliform Nitrate pH Phosphate Temperature TSS COD Ammonia Fluoride Surfactants Trace Metals Hardness	Local rivers and creeks (FW stations) Station Reference **Figure 6-2**	Quarterly	Water Sampling and Third Party laboratory testing	Environment Department	Php 2,000,000	Alert Level Refer to **Table 6-3**	Action Level Refer to **Table 6-3**	Limit Level Refer to **Table 6-3**	Root cause analysis/ investigation	Drainage management	• Pollution control at source • Retesting
	Coastal Marine	Marine Water Quality Degradation Biodiversity Loss		Coastal stations within Butuan Bay (MW stations) Station Reference **Figure 6-2**	Quarterly	Water Sampling and Third Party laboratory testing	Environment Department		Alert Level Refer to **Table 6-4**	Action Level Refer to **Table 6-4**	Limit Level Refer to **Table 6-4**	Root cause analysis/ investigation	Drainage management	• Pollution control at source • Retesting
	Groundwater and Springs	Ground Water/ Potable Water Quality Degradation		Groundwater Sources (DW stations) Station Reference **Figure 6-2**	Quarterly	Water Sampling and Third Party laboratory testing	Environment Department		Alert Level Refer to **Table 6-2**	Action Level Refer to **Table 6-2**	Limit Level Refer to **Table 6-2**	Root cause analysis/ investigation	Drainage management	• Pollution control at source • Retesting
	Marine Resources	Siltation Biodiversity Loss Marine Habitat Degradation	Coral Cover Colony Size of Relocated Corals Marine Species Inventory/ Survey Species Diversity and Richness Water Quality (pH, Siltation Rate)	Coral Relocation Site and surrounding Coral reefs Station Reference: **Figure 6-4**	Semi-Annual Daily	SCUBA Diving for visual inspection head count/ Photo transect Physical Measurement Silt Trap Measurement Visual Inspection	Third Party Marine Biologist/ Environment Department	Php 700,000	Water Quality Alert Level Refer to **Table 6-4**	Water Quality Action Level Refer to **Table 6-4**	• Water Quality Limit Level Refer to **Table 6-4** • No significant species mortality compared to baseline.	Root cause analysis/ investigation	Drainage management	• Pollution control at source • Retesting
	Freshwater Ecology	Siltation Biodiversity Loss Aquatic Habitat Degradation	Macroinvertebrate Assessment Species Richness, Abundance Diversity Index Family Biotic Index Fish Inventory Endemicity Conservation Status Morphometric Character	Payong-payong and Tinigbasan Creeks Station Reference: **Figure 6-3**	Annual	50-mTransect Physical Sampling/ netting Physical Sampling/ netting Interviews with local fisherfolks	Third Party Freshwater Ecology Expert/ Environment Department	Php 400,000	Alert Level Refer to **Table 6-3**	Action Level Refer to **Table 6-3**	• Limit Level Refer to **Table 6-3** • No significant species mortality compared to baseline.	Root cause analysis/ investigation	Drainage management	• Pollution control at source • Retesting

Table 6-1 Environmental Monitoring Program (EMoP) - continued

Key Environmental Aspect		Potential Impacts	Parameters Monitored	Sampling and Measurement Plan			Lead Person	Annual Cost	EQPL Management Scheme					
									EQPL (Alert level) Management Scheme			Management Measure		
Sector	Component			Location	Frequency	Management Measure			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Water Resources	Freshwater Ecology	Siltation Biodiversity Loss Aquatic Habitat Degradation	Macrofaunal Assessment Species Richness, Abundance Diversity Index Endemicity Conservation Status Water Quality (pH, DO, Temp)	Payong-payong and Tinigbasan Creeks Station Reference: **Figure 6-3**	Annual Annual	Physical Sampling/ netting Interviews with local fisherfolks In-situ measurement	Third Party Freshwater Ecology Expert/ Environment Department	Php 400,000	Water Quality Alert Level Refer to **Table 6-3**	Water Quality Action Level Refer to **Table 6-3**	Water Quality Limit Level Refer to **Table 6-3**	Root cause analysis/ investigation	Drainage management	• Pollution control at source • Retesting
Air Resources	Ambient Air Quality	Fugitive Dust Generation Health Impacts to employees and nearby community.	Ambient Air: TSS TSP Particulate Matter (10u)	Stations: Crushing Plant Causeway Barangay Tinigbasan, Station Reference **Figure 6-2**	Quarterly	24-hr sampling TSP PM-10: Gravimetric Analysis Additional Parameters for Station A-4: SOx- Pararosaniline NOx- Griess Saltzman CO- NDIR	Third Party	Php 1,500,000 (Ambient Air and Noise)	Residential Area TSP= 138-160 µg/Nm3 PM10=90-104 µg/Nm3 Mining Area TSP=180-209 µg/N m3 PM10=120-139 µg/N m3 CO=6.0-6.9 mg/Nm3 SOx= 108-125 µg/Nm3 NOx=90-104 µg/Nm3	Residential Area TSP= 161-229 µg/Nm3 PM10=105-149 µg/Nm3 Mining Area TSP=210-299 µg/N m3 PM10=140-199 µg/N m3 CO=7.0-9.9 mg/Nm3 SOx= 126-179 µg/Nm3 NOx=105-149 µg/Nm3	NAAQS for Residential TSP ≥ 230 µg/Nm3 PM10 ≥ 150 µg/Nm3 NAAQS for Industrial TSP ≥ 300 µg/N m3 PM10 ≥ 200 µg/N m3 CO ≥ 10 mg/Nm3 SOx ≥ 180 µg/Nm3 NOx ≥ 150 µg/Nm3	Root cause analysis/ investigation	Intensify water spraying	• Pollution control at source • Retesting
	Air Quality	Chemical (Stack) Emission Contribution to GHG Emissions	Source Emission: Carbon Monoxide, Nitrogen Dioxide, Particulate Matter 10 microns (PM10), Sulfur Dioxide	Genset Stacks Assay Laboratory equipment Vehicle stack	Annual	US EPA Sampling Methods Analysis: Gravimetric Barium Thorin Titration Phenol Disulfonic Acid NDIR	Third Party	Php 750,000	PM= 120-139 mg/Nm^3 SOx= 420-489 mg/Nm^3 NOx= 1200-1399 mg/Nm^3 CO= 300-349 mg/Nm^3	PM= 140-199 mg/Nm^3 SOx= 490-699 mg/Nm^3 NOx= 1400-1999 mg/Nm^3 CO= 350-499 mg/Nm^3	DAO 2000-81 for Diesel Genset: PM ≥ 200 mg/Nm^3 SOx ≥ 700 mg/Nm^3 NOx ≥ 2000 mg/Nm^3 CO ≥ 500 mg/Nm^3	Conduct of Periodic Air Quality Monitoring	• Maintenance of Pollution control device. • Minimiza-tion of air pollution sources.	• Stop usage of source, subject to maintenance/ repair. • Root cause analysis/ investigation. • Pollution control at source

Table 6-1 Environmental Monitoring Program (EMoP) - continued

Key Environmental Aspect		Potential Impacts	Parameters Monitored	Sampling and Measurement Plan			Lead Person	Annual Cost	EQPL Management Scheme					
									EQPL (Alert level) Management Scheme			Management Measure		
Sector	Component			Location	Frequency	Management Measure			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Noise and Vibration	Ambient Noise Quality	Health Impacts to employees and nearby community.	Ambient Noise Levels	Stations: Crushing Plant Causeway Barangay Tinigbasan, Station Reference **Figure 6-2**	Quarterly	Direct Measurement of Noise level using Portable Equipment at 4 sampling periods	Third Party	Php 1,500,000 (Ambient Air and Noise)	Community (dB): Morning 30-34 Day 33-38 Evening & Night 27-31 Industrial (dB): Morning 45-52 Evening 42-48 Nighttime 27-31	Community (dB): Morning 35-49 Day 39-54 Evening & Night 32-44 Industrial (dB): Morning 53-74 Evening 49-69 Nighttime 32-44	NPCC standards • Community: Morning≥50dB Day≥55dB Evening & Night≥45dB • Industrial: Morning≥75dB Evening≥70dB Nighttime≥45 dB	Root cause analysis/ investigation.	• PPE provision • IEC to users and affected community .	Stop usage of source, subject to maintenance / repair.
	Noise Blast Vibration	Health Impacts and Structural stability	Ground Vibration	Quarry Area	During blasting event	Instrument measurement (vibrometer)	Third Party	c/o Contractor	Peak Velocity: 4.0 mm/sec Noise Over pressure: 110 dB	Peak Velocity: 4.5 mm/sec Noise Over pressure: 112 dB	Peak Velocity: 5.0 mm/sec Noise Over pressure: 115 dB	Discussion with blasting contractor s	Root cause analysis/ investigation	Impose sanction/ agreed penalty with contractors.
Meteorology	Hydrome-teorology Characteristics	Climate characteris-tics Hydrologic Conditions	Rainfall Evaporation Temperature Humidity	Project area	Daily	Meteorological station readings	Environment Department	Php 25,000	N/A	N/A	N/A	N/A	N/A	N/A
Waste Management	Solid Waste Hazardous Waste	Health Impacts to employees and nearby community. Soil Degradation	Waste Generation	Project Site	Daily	Segregation Collection Inventory	Environment Department	Php 1,000,000	25% increase in waste generation	>30% increase in generation level	Waste generation increase less than 25% of average level.	• IEC on Solid Waste Manage-ment Policy • Imposition of Fines and Penalties	• Upcycling of recyclable waste. • Implemen-tation of Waste Control	Intensify IEC re waste management

Table 6-3 Environmental Quality Performance Level (EQPL) Used in Drinking Water Quality Monitoring

Monitoring Parameter	Unit	LIMIT	ACTION	ALERT
Mandatory Water Quality Parameters Reference DAO 2016-08 for PSIC O894 and OC3				
Biological Oxygen Demand	mg/L	3	2.1-2.9	1.8-2.0
Chloride, mg/L	mg/L	250	175-249	150-174
Color, TCU	TCU	50	35-49	30-34
Hardness (as $CaCO_3$)	mg/L	300	210-299	180-209
Dissolved Oxygen (DO)	mg/L	5	3.5-4.9	3-3.4
Fecal Coliform	MPN/ 100ml	<1.1	<1.1	<1.1
Nitrate	mg/L	7	5.0-6.9	4.2-4.9
pH		6.5-8.5	5.1-6.4	4.0-5.0
Phosphate	mg/L	0.5	0.35-0.49	0.3-0.34
Temperature	deg. Celsius	26-30	25-23	20-22
Total Suspended Solids	mg/L	50	35	30-34
Chemical Oxygen Demand	mg/L	7	5.0	4.2-4.9
Ammonia	mg/L	0.05	0.035	0.03-0.034
Flouride	mg/L	1	0.7	0.6-0.69
Surfactants	mg/L	0.2	0.15-0.19	0.12-0.14
Oil and Grease	mg/L	1	0.7-0.9	0.6-0.69
Manganese	mg/L	0.2	0.15-0.19	0.12-0.14
Iron	mg/L	1	0.7-0.9	0.6-0.69
Arsenic	mg/L	0.01	0.007-0.099	0.006-0.0069
Cadmium	mg/L	0.003	0.0021	0.0018-0.002
Mercury	mg/L	0.001	0.0007	0.0006-0.00069
Lead	mg/L	0.01	0.007-0.009	0.006-0.0069
Applicable to Water Samples in Stations DW-2, DW-3				

Source: DAO 2016-08 Water Quality Standards for Class A, Class C, and Class SC.

Table 6-4 Environmental Quality Performance Level (EQPL) Used in Surface Water Quality Monitoring

Monitoring Parameter	Unit	LIMIT	ACTION	ALERT
Mandatory Water Quality Parameters Reference DAO 2016-08 for PSIC O894 and OC3				
Biological Oxygen Demand	mg/L	7	4.9-6.9	4.2-4.8
Chloride, mg/L	mg/L	350	245-349	210-244
Color, TCU	TCU	75	53--74	45-52
Hardness (as $CaCO_3$)	mg/L	300	210-299	180-209
Dissolved Oxygen (DO)	mg/L	5	3.5-4.9	3-3.4
Fecal Coliform	MPN/ 100ml	200	150-199	100-149
Nitrate	mg/L	7	5.0-6.9	4.2-4.9
pH		6.5-9.0	5.1-6.4	4.0-5.0
Phosphate	mg/L	0.5	0.35-0.49	0.3-0.34
Temperature	deg. Celsius	25-31	24-21	23-20
Total Suspended Solids	mg/L	80	56-79	48-55
Chemical Oxygen Demand	mg/L	7	5.0-6.9	4.2-4.9
Ammonia	mg/L	0.05	0.035-0.049	0.030-0.034
Flouride	mg/L	1	0.7-0.9	0.6-0.69
Surfactants	mg/L	1.5	1.05-1.49	0.9-1.04
Oil and Grease	mg/L	2	1.4-1.9	1.2-1.39
Manganese	mg/L	0.2	0.14-0.19	0.12-0.13
Iron	mg/L	1.5	1.0-1.4	0.9-1.04
Arsenic	mg/L	0.02	0.014-0.019	0.012-0.13
Cadmium	mg/L	0.005	0.0035-0.0049	0.003-0.0034
Mercury	mg/L	0.002	0.0014-0.0019	0.0012-0.0013
Lead	mg/L	0.05	0.035-0.049	0.03-0.034
Applicable to Water Samples in Stations FW-11, FW-12,				

Source: DAO 2016-08 Water Quality Standards for Class A, Class C, and Class SC.

Table 6-5 Environmental Quality Performance Level (EQPL) Used in Marine Water Quality Monitoring

Monitoring Parameter	Unit	LIMIT	ACTION	ALERT
Mandatory Water Quality Parameters Reference DAO 2016-08 for PSIC O894 and OC3				
Biological Oxygen Demand	mg/L	N/A	N/A	N/A
Chloride, mg/L	mg/L	N/A	N/A	N/A
Color, TCU	TCU	75	53-74	45-52
Dissolved Oxygen (DO)	mg/L	5	3.5-4.9	3-3.4
Fecal Coliform	MPN/ 100ml	200	150-199	100-149
Nitrate	mg/L	10	7-9	6-6.9
pH		6.5-8.5	5.1-6.4	4.0-5.0
Phosphate	mg/L	0.5	0.35-0.49	0.3-0.34
Temperature	deg. Celsius	25-31	24-21	23-20
Total Suspended Solids	mg/L	80	56-79	48-55
Chemical Oxygen Demand	mg/L	10	7-9	6-6.9
Ammonia	mg/L	0.05	0.035-0.049	0.03-0.034
Flouride	mg/L	1.5	1.05-1.49	0.9-1.04
Surfactants	mg/L	1.5	1.05-1.49	0.9-1.04
Oil and Grease	mg/L	3	2.1-2.9	1.8-2.0
Manganese	mg/L	0.4	0.3-0.39	0.24-0.29
Iron	mg/L	1.5	1.05-1.49	0.9-1.04
Arsenic	mg/L	0.02	0.014-0.019	0.012-0.013
Cadmium	mg/L	0.005	0.0035-0.0049	0.003-0.0034
Mercury	mg/L	0.002	0.0014-0.0019	0.0012-0.0013
Lead	mg/L	0.05	0.035-0.049	0.03-0.034
Applicable to Water Samples in Stations MW-2, MW-3				

Source: DAO 2016-08 Water Quality Standards for Class A, Class C, and Class SC.

Figure 6-2- Sampling Map for Air, Noise, and Water Monitoring

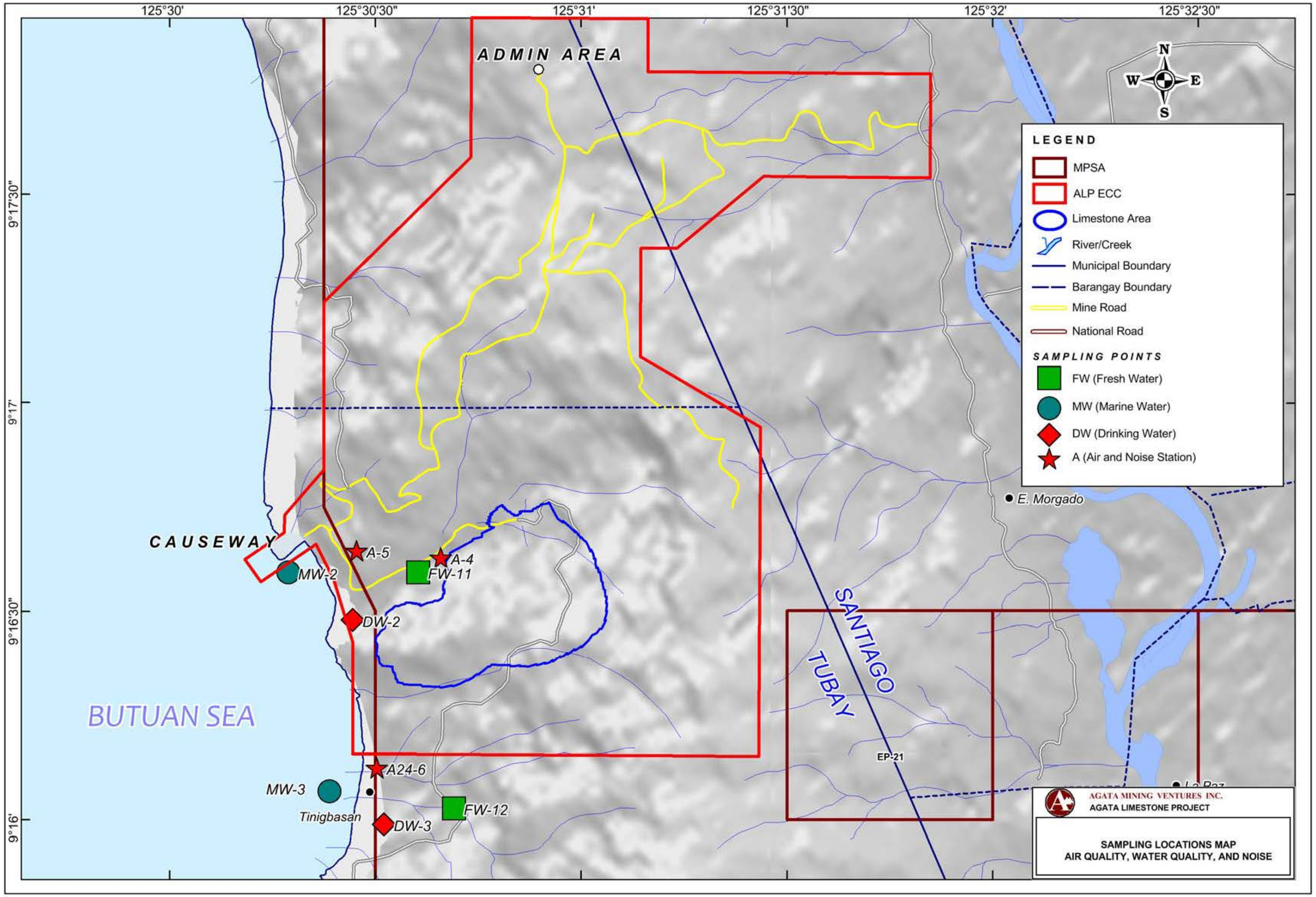


Table 6-6 Sampling Location Reference Table (Reference **Figure 6-2**)

River/Creek	Station No.	Description
Water Monitoring Stations		
Payongpayong Creek	FW-11	Downstream Payongpayong Creek
Tinigbasan Creek	FW-12	Confluence of Tributaries
Payongpayong, Tinigbasan	DW-2	Sitio Payongpayong Water Source
Tinigbasan, Tubay	DW-3	Brgy. Tinigbasan Water Source
Payongpayong Coastal Area	MW-2	Coastal area at Sitio Payongpayong
Tinigbasan Coastal Area	MW-3	Coastal area at Brgy. Tinigbasan
Ambient Air Monitoring Stations		
Pier yard	A-4	Near Limestone Crushing Plant
Pier yard near Causeway	A-5	Stockyards at the causeway;
Brgy. Tinigbasan, Tubay	A24-6	Near Brgy. Hall

SW- Surface Water, MW- Marine Water, DW- Drinking Water

Figure 6-3 Freshwater Ecology Sampling Map

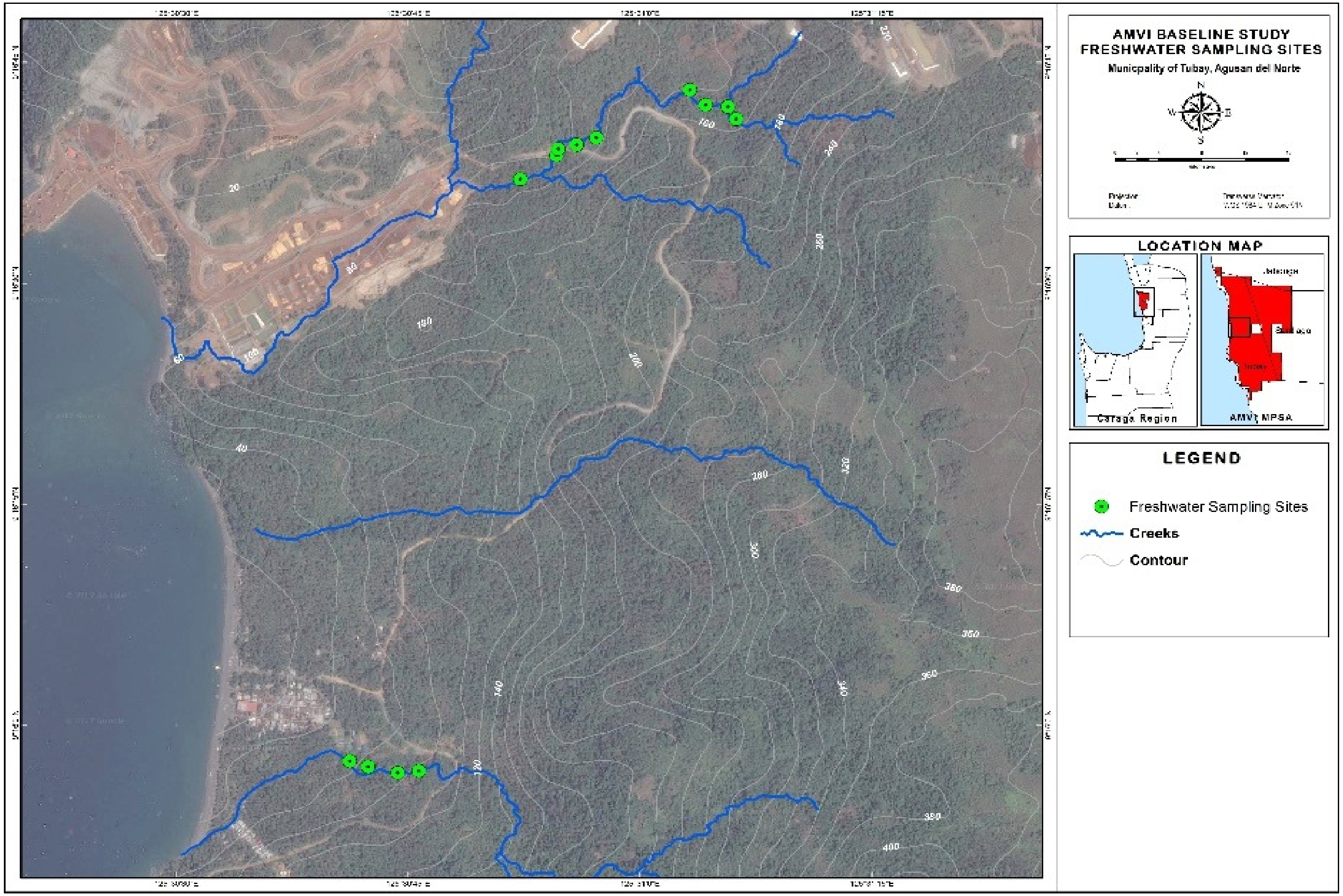
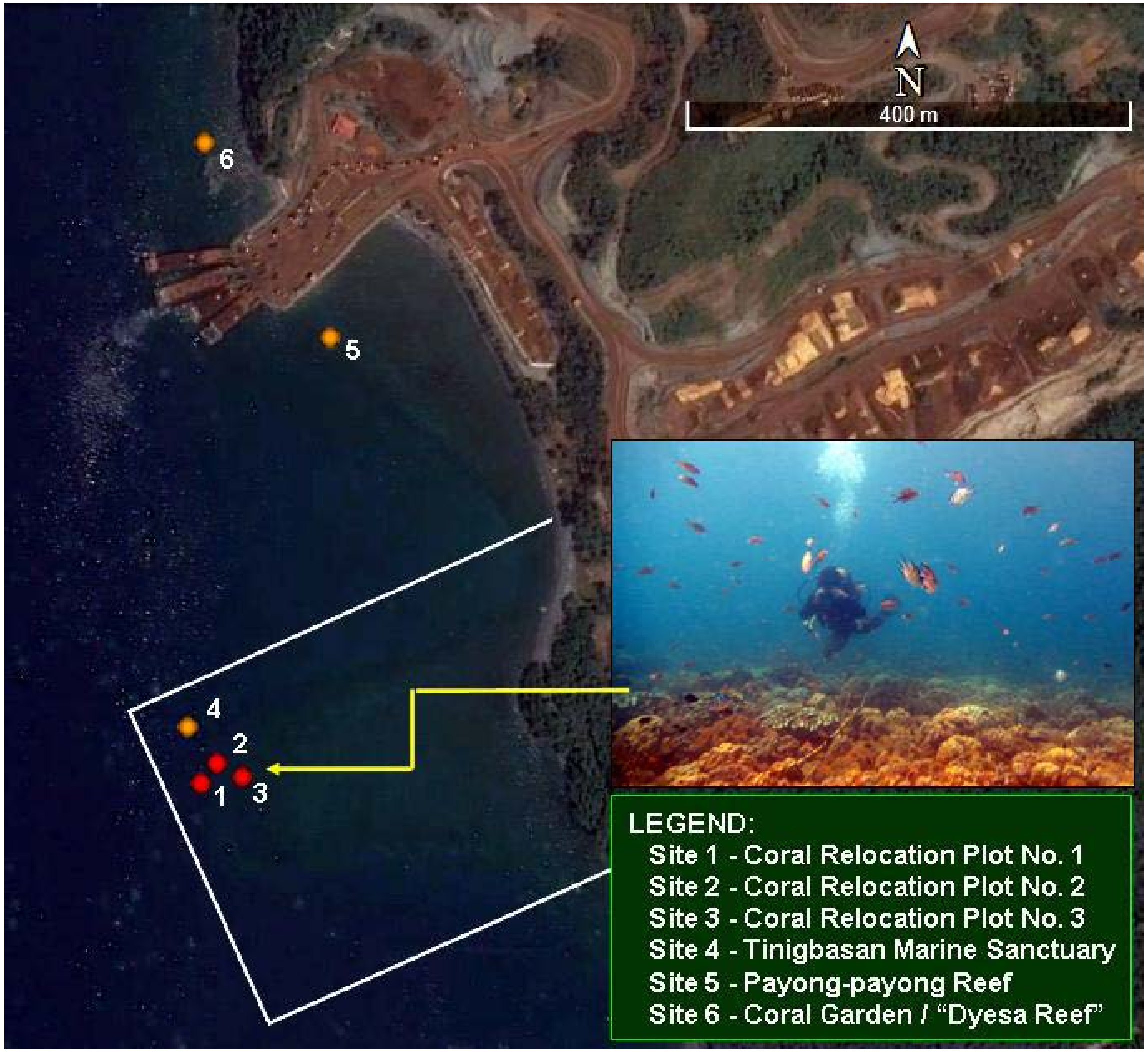


Figure 6-4 Marine Resources Monitoring Location Map



6.4. Environmental Guarantee and Monitoring Fund Commitments

6.4.1. Mine Rehabilitation Fund

According to Section 181 of DAO 2004-54, "A Mine Rehabilitation Fund (MRF) shall be established and maintained by each operating Contractor/Permit Holder as 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 during specific project phase. The MRF shall be deposited as a Trust Fund in a Government depository bank and shall be used for physical and social rehabilitation of areas and communities affected by mining activities and for research on the social, technical and preventive aspects of rehabilitation."

The MRF is divided into two separate funds known as the Monitoring Trust Fund (MTF) and the Rehabilitation Cash Fund (RCF). These two funds are established by the Proponent as a reasonable environmental deposit to ensure availability of funds for satisfactory compliance with the commitments and performance of the activities identified in the EPEP/ AEPEP during specific Project phases.

6.4.1.1. Monitoring Trust Fund

The Monitoring Fund is created for the exclusive use in the monitoring of environmental management programs approved by the MRFC. The deposited amount is not less than Php 150,000. This fund is intended to cover maintenance and other operating budgets for the transportation and travel expenses, cost of laboratory analysis, cost of supplies and materials, cost of communication services, cost of consultancy work and other reasonable expenses that may be incurred by the monitoring team. The Proponent may be requested to increase the deposit amount by the MRFC.

6.4.1.2. Rehabilitation Cash Fund

The Rehabilitation Cash Fund is created to ensure compliance with the approved rehabilitation activities and schedules, including research programs, as defined in the EPEP/ AEPEP. The RCF shall be equivalent to 10% of the total amount needed to implement the EPEP or Php 5.0 million, whichever is lower. The final amount to be deposited will be discussed and approved by the MRFC.

6.4.2. Environmental Trust Fund

The Environmental Trust Fund is created to use for payments to damages related to mine facilities operation. The ETF is pegged, at a minimum, of Php 100,000. The final amount to be deposited will be discussed and approved by the MRFC.

6.4.3. Final Mine Rehabilitation and Decommissioning Fund

Deposits to Final Mine Rehabilitation and Decommissioning Fund are made each year prior to the ending or operations for the purpose of post mining rehabilitation and project decommissioning. The total amount to be deposited will be based on the estimated cost to implement the programs to be identified in the Final Mine Rehabilitation and Decommissioning Plan as approved by the CLRF Steering Committee.

Based on the provisions of the Phil. Mining Act, a project with a 15-year mine life shall have a 11-year payment accrual schedule to start by the third year of operations. Full FMRDF deposit shall be in place by Year 13 or two years prior to the end of operations.

6.4.4. Annual Environmental Protection and Enhancement Program (AEPEP) Cost

Funding of the EPEP will be done internally and will be part of the Environmental Management costs budgeted by the company during operations. Approval of the annual programs and costs will be under the direction of the MRFC and monitoring of the expenditures is performed by the MMT. The minimum expenditures are expected to be 3% to 5% of the direct mining costs. The total minimum projected EPEP expenditures for the Agata Limestone Project would be in the range of Php 186 million to Php 310 million. The estimated budget for the various EPEP management components is provided in **Table 3-4** in **Section 3.**

7. Abandonment and Rehabilitation Program

This document provides the framework for the protection, conservation, enhancement and restoration of the areas affected by the ALP and its auxiliary facilities. The Company has identified programs to protect and restore the environment while optimizing the contribution to the sustainable development of its host communities.

Since the ALP lies at the southwestern portion of the ANLP, there will be auxiliary facilities including the causeway, roads, and stockyards which were originally planned to be rehabilitated after the mining life of the ANLP but will be extended for the use of the ALP.

The scope of the Final Mine Rehabilitation and Decommissioning Plan (FMRDP) covers both the restoration of the areas directly affected by the ALP and the decommissioning and rehabilitation of other facilities originally built for the ANLP. These shall include the ALP surface mine area, existing causeway, roads, camp facilities, processing plant, and stockyards.

The overall mine rehabilitation strategy to be implemented is shown on **Figure 7-1.**

7.1. Plan Objectives

The overall objective of the rehabilitation and closure plan is to rehabilitate the Project area in a manner that promotes sustainable environment towards a self-reliant community. Key action items in this process include the following:

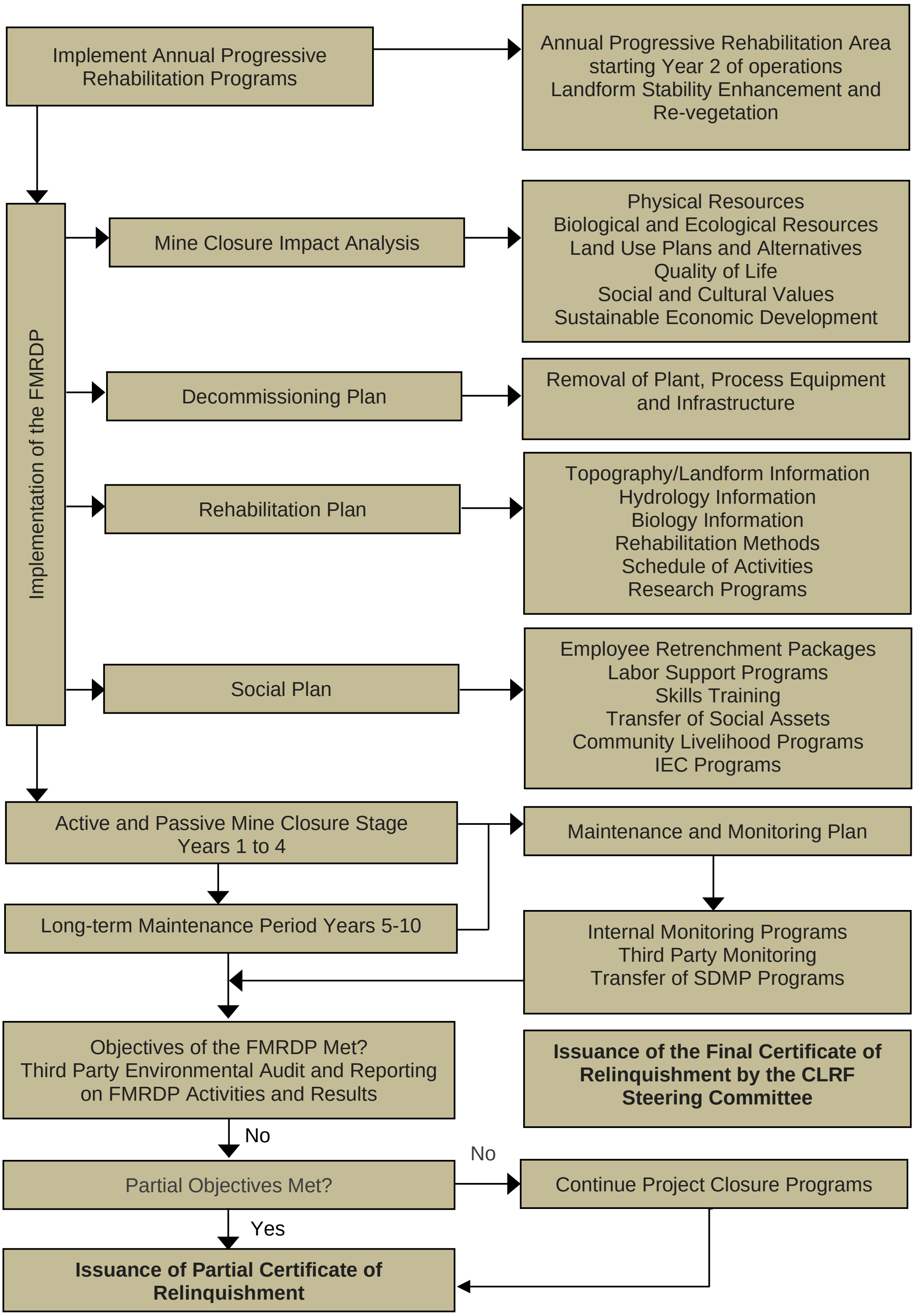
- Implementation of a responsible and environmentally sound decommissioning process.
- Restoration of the floral and faunal biodiversity of the disturbed areas and preservation of endemic species.
- Establish the sustainability of community programs implemented during the mine operation.
- Promote a self-reliant and sustaining community after the closure of the mining Project by establishing income generation projects for the community as part of the final rehabilitation.
- Establish the final land use of the Project area such that long term environmental impacts are prevented or eliminated in harmony with the ANLP Final Land use which will be the transformation of mined- out areas into an Agroforestry-Tourism Site after the end of Mine Life.

7.2. Rehabilitation Criteria and Performance Standards

Adopted from the ANLP Rehabilitation plan, the following mine closure and general performance standard shall be the basis in evaluating the success and efficiency of the rehabilitation;

- Water, noise, and air quality sampling results are within the standards set by the DENR.
- Minimal soil erosion is visible in all disturbed areas.
- Minimal siltation of rivers, creeks and other water bodies.
- Disturbed areas are densely vegetated with a seedling survival rate of not less than 80%.
- Terrestrial floral and faunal species are visible within the rehabilitated areas.
- Members of the People's Organization handling the reforestation program are actively monitoring the rehabilitated area and are generating income from their agricultural products.
- The community is sustainably managing the livelihood projects being implemented through the SDMP prior to the end of the mine operations.

Figure 7-1 Progressive Rehabilitation and Closure Activities Process Diagram



7.3. Progressive Rehabilitation Program

The principle of progressive rehabilitation will be applied as mining progresses. Rehabilitation will be undertaken in areas that are considered as inactive mining sites. While not considered as part of the FMRDP activities, the progressive rehabilitation program will in effect constitute the start of the closure activities. Given the mining plan, the rehabilitation of the quarry areas will happen after Year 15 and rehabilitation of rest of the quarry sites will be carried out during final rehabilitation phase. The rehabilitation of other disturbed areas outside the quarry site will be done progressively.

The progressive rehabilitation involves slope stabilization measures, revegetation, and reforestation to reduce the long-term exposure of the disturbed area. This shall be implemented concurrent with the mining operations.

It is estimated that by end of Year 15, approximately 95.97 hectares, or 18% of the total disturbed area has been subjected to progressive rehabilitation. This includes the auxiliary facilities like road, stockpile areas, and other surface mine areas. Vegetation established within these areas will be continuously maintained all throughout the duration of the project. A map of the progressive reforestation and rehabilitation areas is shown on **Figure 7-2.**

7.4. Closure and Decommissioning Plan

A ten (10)-year closure program has been established to meet the objectives of the FMRDP. The first five (5) years are considered the active phase of rehabilitation and decommissioning period. This will be followed by another three (3) years of the passive phase which consist primarily of monitoring, care and maintenance and validation of the viability and long-term sustainability of the rehabilitation programs. Internal and third-party monitoring programs will continue during this three (3) year period. The processing of necessary documents for final relinquishment will commence on the remaining last two (2) years of the final rehabilitation schedule. A map of the reforestation and rehabilitation during abandonment is shown on **Figure 7-3.** The overall Final Mine Decommissioning and Rehabilitation Plan is divided into five (5) major phases; Transition Period, Active Rehabilitation, Passive Rehabilitation, Relinquishment and Post Rehabilitation Transition.

The Transition period will cover Years 2036-2037 which will be the end of Operations. This is where consultation with relevant stakeholders in terms of the FMRDP implementation will take place and decommissioning of mine facilities commences. Decommissioning is defined as the transitional period that will begin with the end of the quarry operations and ends with the removal of all unwanted infrastructure. Former active working areas and immovable structures that will no longer be functional will be removed during the decommissioning activity. All movable structures such as heavy equipment, generator set, and buildings will be removed from the project area except for selected equipment which is intended for the mine rehabilitation. Decommissioning strategies and protocols for each mine component will be developed. Included in these will be mitigating measures to assure that potential adverse environmental impacts will be minimized during decommissioning period. All building structures, recreational facilities, housing, pier and causeway will be turned over to the appropriate Local Government Units.

The Active Rehabilitation Phase comes in the first five (5) years after operation, covering Year 2037 through Year 2041. Activities in this period will include rehabilitation and revegetation of the quarry areas and camp facilities covering approximately 18.89 hectares. Overburden waste and topsoil materials from the waste and topsoil stockpiles will be used to reclaim disturbed areas in preparation for the rehabilitation and re-vegetation program. Structural improvements are considered to be items necessary for erosion control, soil stabilization, revegetation and infrastructure support.

Figure 7-2 Annual Progressive Rehabilitation Schedule

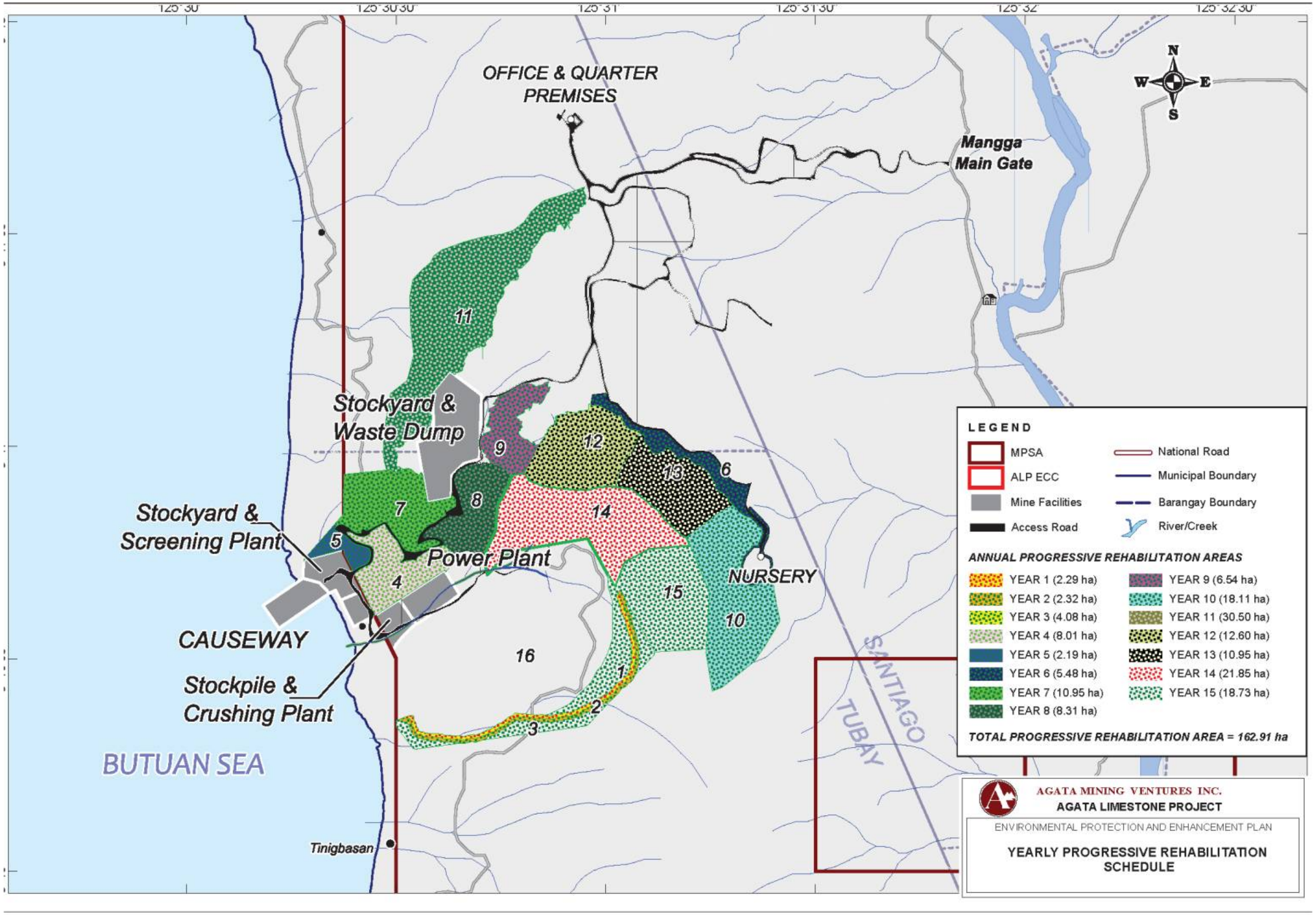
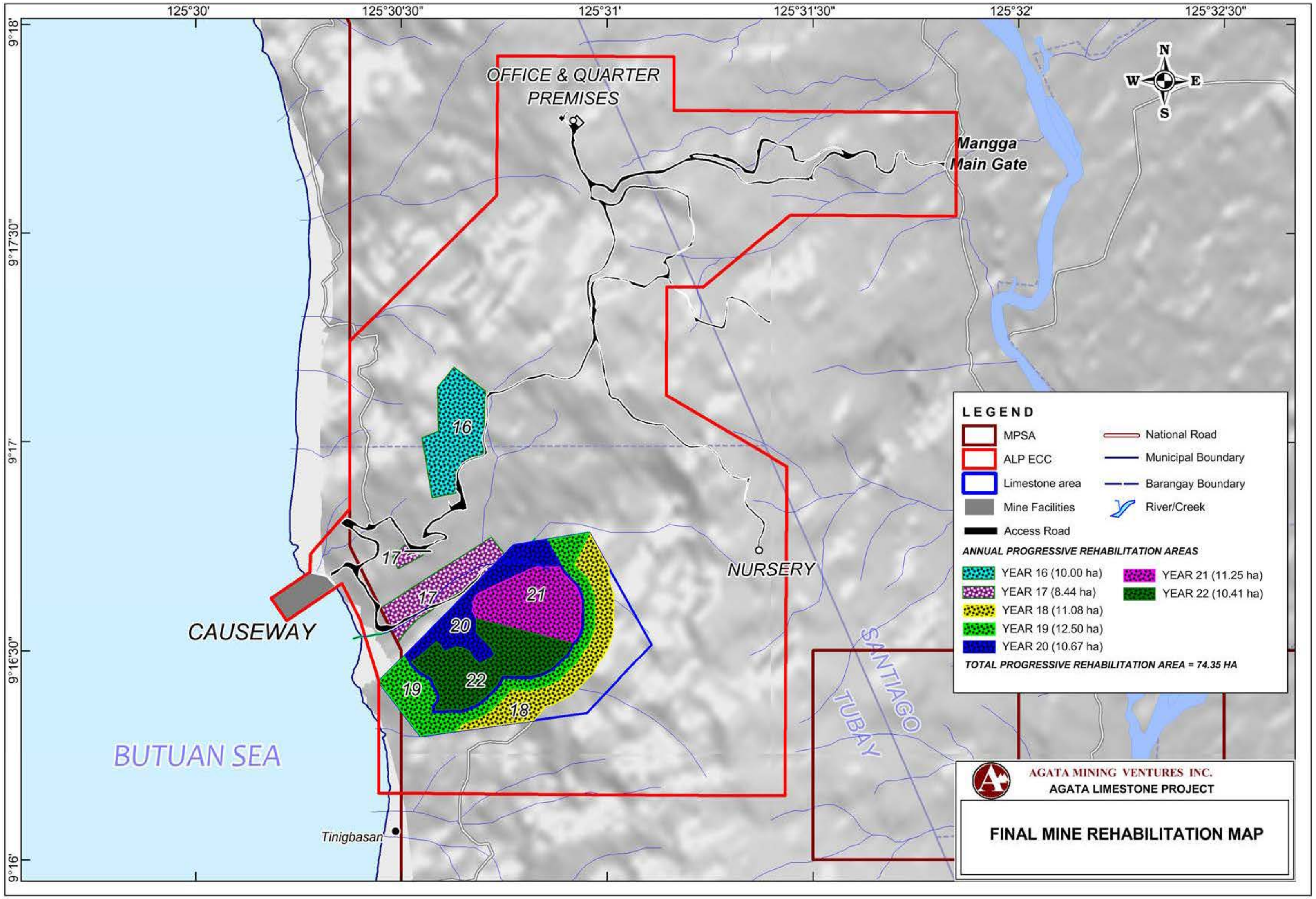


Figure 7-3- Final Mine Rehabilitation Schedule



This will be followed by soil treatment to prepare areas for revegetation. Finally, the area will be reforested based on the pre-determined Land Use Plan. Rehabilitation activities during the Closure Period will be a continuation of the rehabilitation activities from the Operations Phase.

After five (5) years of active rehabilitation, Passive Rehabilitation shall then take place from Year 2042 through Year 2044. Care and maintenance of the rehabilitated areas will be continued. Environmental control structures such as siltation ponds and silt fences will be maintained until the area is fully rehabilitated. Decommissioning of these structures maybe considered after a final assessment to determine if these structures will no longer be necessary in the long-term. Further, Environmental Monitoring Program will be in place throughout the Mine Closure and Decommissioning Phase of the Project. Periodic environmental monitoring and evaluation will be conducted to evaluate compliance with regulations set by the DENR related to water, air and noise quality standards. The monitoring will also include evaluation of the stability of the rehabilitated areas with regards to erosion, siltation, progress of reforestation, and changes in the hydrologic conditions.

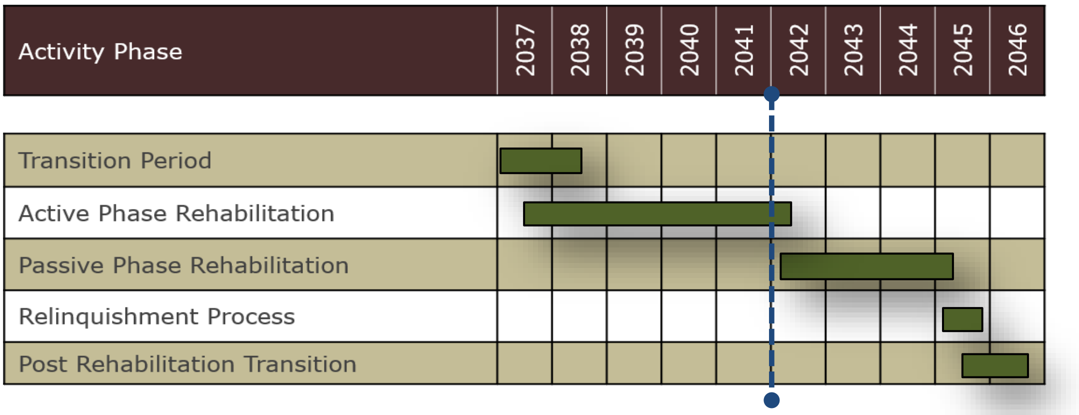
Relinquishment process will commence in Year 2045 once the rehabilitation plan is completed. A third-party audit team will be commissioned by the Government thru the MRFC, CLRF-SC, and the Company to determine compliance to the FMRDP. This audit shall continue until the post rehabilitation transition where management of the entire concession area will be turned over to the Government or to beneficiaries approved by the DENR and MRFC.

7.5. Mine Closure Team and Schedule

The Tenement and Mine Environmental Protection and Enhancement Office (MEPEO) will take lead in the implementation of the Abandonment Plan and will oversee the monitoring and evaluation activities. These activities will be performed for the final rehabilitation period until the Certificate of Relinquishment is issued to the Company and the rehabilitated areas will be turned over to the host communities.

An overall diagram of the entire process of rehabilitation and closure activities is shown on **Table 7-1.**

Table 7-1 Overall Final Rehabilitation Schedule



7.6. Final Land Use

Consistent to the final land use plan of the ANLP and ALP and the Comprehensive Land Use Plan (CLUP) of the three (3) host Municipalities of Tubay, Santiago, and Jabonga all in the province of Agusan del Norte, and the Community Resource Management Framework (CRMF) of the People's Organization, the Mining Cum Tourism Plan of Tubay, and the Memorandum of Agreement signed by and in between the LGU of Tubay and the Company, the final land use of the ALP area would be a Agroforestry-Ecotourism Land.

As envisioned by the Company and its stakeholders during the community consultation, the Project area will be hosting the CARAGA Sustainable Agricultural Resource and Learning Center after mine life thru the collective efforts of the Company, Local Government Units, the CBFMA-POs and the DENR. This is in accordance with the vision of the host Municipalities to become the center of Agri-Tourism and Responsible Mining Industry in the Province. Final Land Use Concept is shown on **Figure 7-4.**

The management zones within the Project area will be established depending on the identified land use. Protection Zone will be areas with regulated human activities. These will include the headwater sources and the biodiversity enrichment areas determined by the community. The established agro forestry area will be part of the Production Zone. Resource extraction and livelihood activities will be concentrated in this area.

7.7. Mine Closure Cost

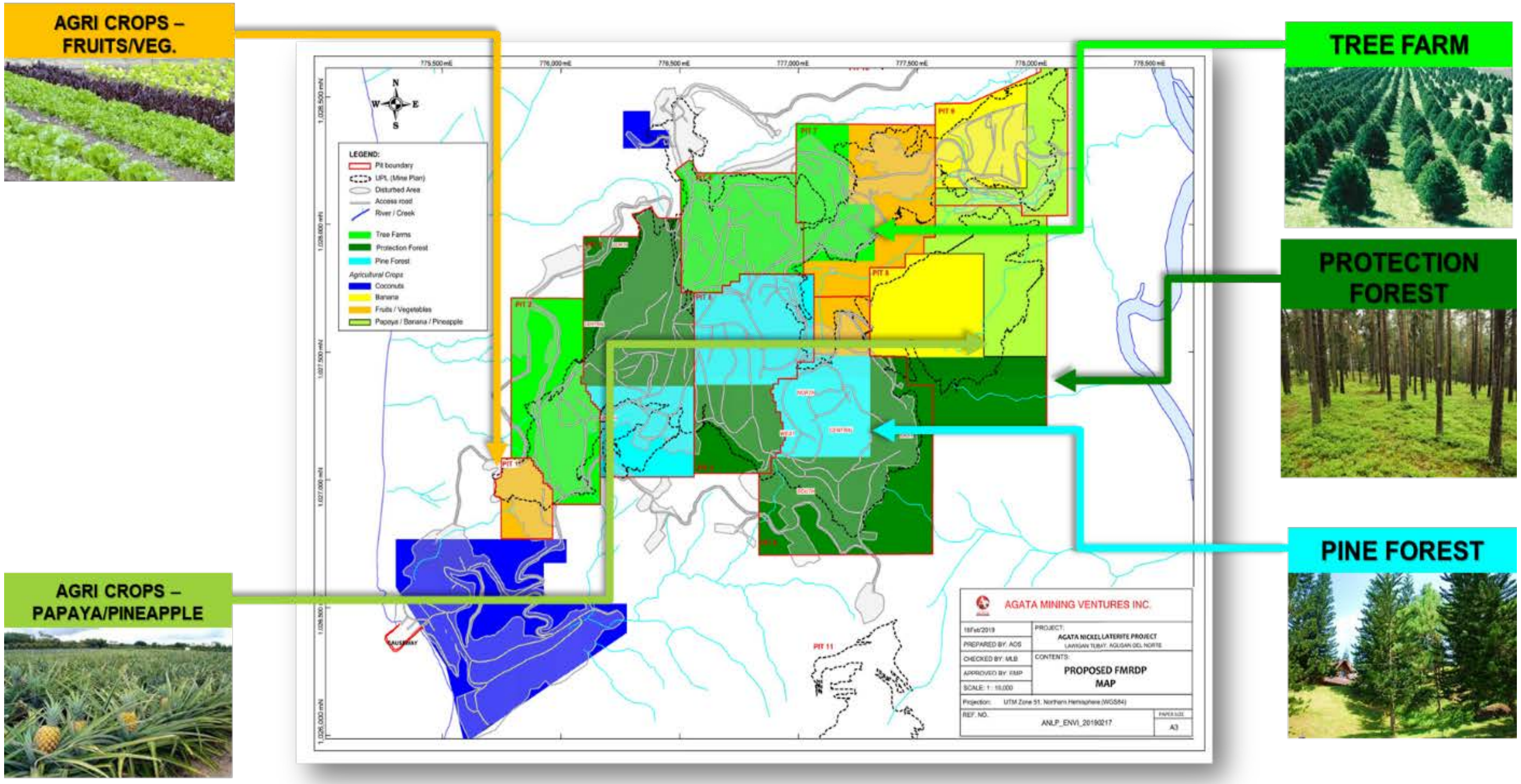
In accordance with Section 71 of RA 7942 and Item f, Section 1 of Executive Order No. 270-A, a Final Mine Rehabilitation and Decommissioning Fund (FMRDF) will be established by the Proponent. This is to ensure that the full cost of the approved FMRDP is accrued before the end of the operating life of the mine. The cost estimates will be based on the closure methodology and concepts, taking in consideration expected inflation and technology advances among other items. The estimates will also cover full extent of work necessary to achieve the objectives of mine closure, such as but not limited to, decommissioning, rehabilitation, maintenance and monitoring, and employee and other social costs, including residual care, if necessary, over a ten-year period.

The Annual cash provisions shall be made based on the following formula:

Annual Provision = (Cost of Implementing the FMRDP) x (Percentage Required)

A project with a 15-year mine life will have a 11-year payment accrual schedule to start by the third year of operations. Full FMRDF deposit will be in place by Year 13 or two years prior to the end of operations. A detailed cost evaluation and expenditure schedule will be included as part of the FMRDP.

Figure 7-4 Proposed Final Land Use Concept



Section 8 – Institutional Plan for EMP Implementation-

8.1 Institutional Set-Up

The Tenements and Mine Environmental Protection and Enhancement Office (TMEPEO) is established for the Project to implement and monitor the environmental management programs. The TMEPEO is headed by the TMEPEO Manager who supervises approximately 50 personnel, including a Forester, Environmental Compliance Officers, Pollution Control Officer, ISO Management, Tenements and Liaison Officers and a contingent of rank and file employees. The unit will be part of the Tenements and Permits and SHES group of the project (**Table 1-30**).

The Corporate Environment and Social Compliance group is also providing assistance to the Project operations with regards to the technical and legal aspect of the implementation of the environmental management programs. Coordination with regional environmental agencies is done by the site Environment Department while coordination with environmental agencies located in Manila is done by the Corporate Environment Department.

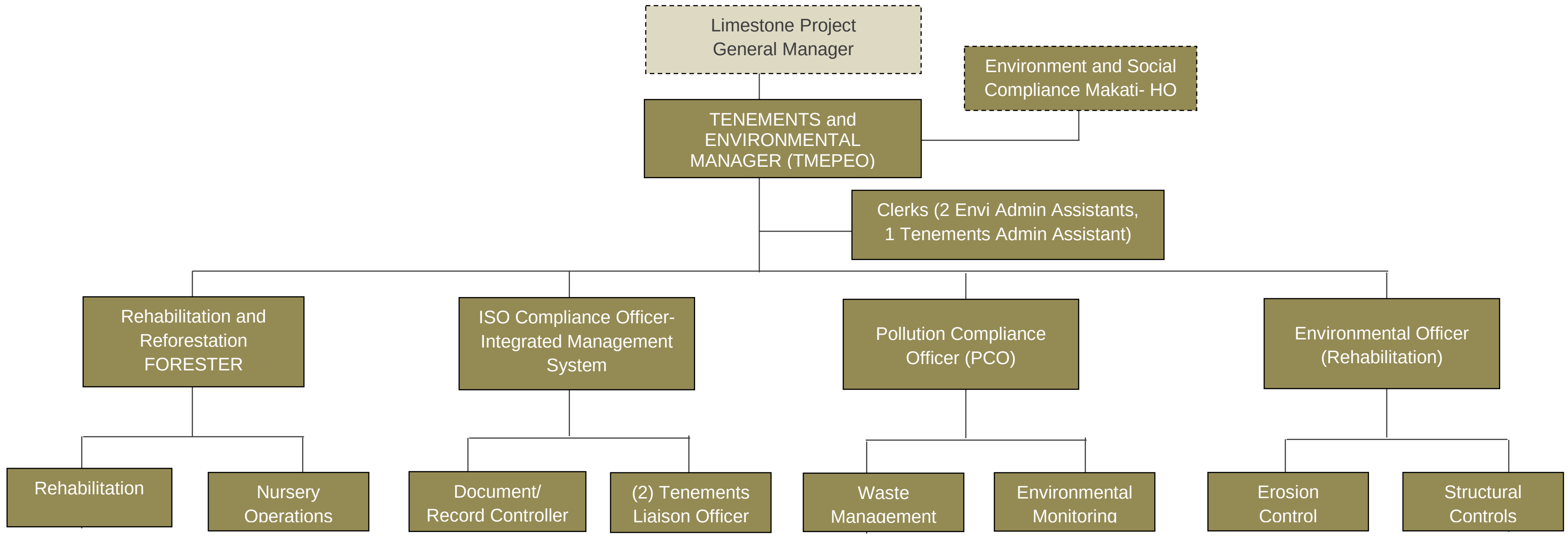
The functional and administrative head of the TMEPEO Department will be the Project General Manager. Concerns and recommendations by government agencies, institutions and other interested parties, relative to the environmental compliance and performance are both assessed and reviewed by the Corporate and site Environment-Permitting Departments. Regular update on the environmental performance of the Project is discussed on a weekly basis through the weekly management committee meeting attended by the executives from the Corporate Office and by the Project GM. A separate meeting, specific for monitoring of the overall legal compliance of the company, including environmental compliance, will be scheduled also on a weekly basis.

In compliance with the requirements of the DENR, there will be a designated Pollution Control Officer (PCO) under the TMEPEO to oversee the pollution control program of the company as mandated by DENR. The implementation of the entire environmental monitoring program is also under the supervision of the PCO. The Forester will be in charge of the nursery operations and overall rehabilitation strategies. There will also be a separate Environmental Officer for structural rehabilitation (i.e slope control and structural controls). And lastly, since the company intends to certify the ALP under an Integrated Management System (ISO 14001- Environmental Management System; ISO 9001- Quality Management System; and ISO 45001- Occupational Health & Safety Management System) similar to the nickel operations, an ISO Compliance Officer will also be included as part of the MEPEO.

For the tenements side, there will be 2 liaison officers and an administration assistant.

The functional diagram of the MEPEO is shown on **Figure 8-1.**

Figure 8-1 Mine Environmental Protection and Enhancement Office (MEPEO) Functional Diagram



SUBJECT : **Summary of Response Re: First EIARC Meeting Comments on API Limestone Project**

Comment	Response	Reference on EIS Report
Project Description – Terrestrial Ecology (Mr. Pablo delos Reyes)		
1. On 2-51. (D) Endemically, Conservation Status and Invasiveness, we took note of the hereunder: *" There are 7 vulnerable, 8 endangered and 1 critically species, which is 8% (16 out of 206 species) of the total number of species recorded… The presence of endemic and threatened species demonstrates the need of concerted and pragmatic concertation and management efforts from the company and other stakeholders in order to preserve these species in the area*. " May we be clarified whether the above-mentioned species of plant communities observed only within the direct impact area (DIA)	The above-mentioned species of plant communities are not all observed in the direct impact area. There are four threatened species that can be found only in the direct impact area, (Payong-payong site), there are also four species located in adjacent (Tinigbasan site), and seven species common to both study sites. These brings the total number of threatened species in the DIA to eleven (11) species.	Sec 2.4.1 D (pp. 2-51)
2. Under 2.4.1.1. Vegetation Removal and Loss of Habitat, please discuss on how to go about the above-mentioned species of vegetation in consideration that it was mentioned that there is a "need of concerted and pragmatic conservation and management efforts from the company and other stakeholders in order to preserve these species in the area".	Efforts will include establishment of a small portion of forest reserve within the direct impact area for the protection and conservation of the important species, the collection of wildlings of threatened species in the area for planting in the proposed forest reserve; and a suitability assessment prior to the establishment of forest reserve.	Sec 2.4.1 D (pp. 2-51)
3. We recommend prior to the removal of tree species to collect wildlings from the areas targeted to be stripped and set aside in established nurseries for future rehabilitation. Seeds should also be collected from native trees within the MPSA or propagation in the nurseries.	This will be incorporated as part of nursery operation activities under the Land Resource Management of ALP, as adopted from the best practices from the ANLP.	Sec 2.4.1 B (pp. 2-47)
4. Please include in the discussion of the establishment of plant nurseries and should be designed for the propagation of biodiversity to sustain its ecosystem goods and services	Discussions on nursery establishment and operation is elaborated in Section 2.4.1. B.	Sec 2.4.1 B (pp. 2-47)
5. A detailed rehabilitation plan is desired, and a progressive rehabilitation be undertaken at every stage of mining operation to restore mined-out areas close to its natural ecosystems and to allow regeneration of biodiversity to sustain its ecosystem goods and services.	Progressive rehabilitation is one of the key strategies to be employed to mitigate environmental impacts from the quarry and processing of limestone. The detailed rehabilitation plan will be presented in the FMRDP for approval of MGB once the ECC is issued.	

6. Terrestrial Fauna. Under Bird Assessment, there was no indication on the time and season that the assessment was conducted.	Rapid assessment of birds was conducted within and outside the proposed limestone mining project. The procedure particularly followed the simple line transect count which was limited to a total of 12 man-hours. The outside transect was traversed for four man-hours every 5:00 to 9:00 in the morning, while eight (8) man-hours were spent in the two kilometer transect within the proposed project. The transect was divided into eight central points marked at every 250 meters and traversed at every 5:00 to 9:00 in the morning and in the afternoon at 3 to 6 PM for a period of two days.	Sec 2.4.2 B (pp. 2-57)
7. It is recommended to establish a reference ecosystem within the MPSA as basis for progressive rehabilitation. It is also suggested that the reference ecosystem be utilized as permanent biodiversity monitoring area. The recommendation can also be reflected in freshwater and marine ecology.	For the freshwater ecosystem, the sampling stations in Tinigbasan Creek were established as permanent biodiversity monitoring area.	Figure 2.41 Map of Collection sites in Payong-Payong and Tinigbasan Creeks (pp. 2-91)
8. Under Freshwater Ecology. Clarification on the conduct of study on the affected riparian areas by the proponent/preparer.	Included discussions on study period and location. Methodology, as well as its results was also discussed in Sec.2.8	Sec 2.8 (pp. 2-90).
9. Under 2.8.1.1. Threat to existence and/or loss species of important local and habitat, please ensure that a biodiversity friendly/geotextile material that will be used to arrest sedimentation so as to decrease the impact to freshwater and marine environment.	Details on the utilized geotextile material is added in Section 2.8.1.1 and Section 2.9.7.2. Alternatively, jute sacks made with natural abaca fibres, are also used in the production of the silt curtain.	Sec 2.8.1.1 (pp. 2-97) Sec 2.9.7.2 (pp. 2-112)
10. Please consider the conduct of Biodiversity Assessment Monitoring System be undertaken pursuant to TB No. 2016-05 entitled "Guidelines on Biodiversity Assessment and Monitoring System for Terrestrial Ecosystems"	"Guidelines on Biodiversity Assessment and Monitoring System for Terrestrial Ecosystems" was the primary basis used in the conduct of the Biodiversity assessment with a slight modification in methodology.	Sec. 2.4 (pp. 2-42)
Marine Ecology (Mr. Pablo delos Reyes)		
1. In consideration that approximately 8,000 individual live hard corals for the fringing reef of Payongpayong Bay were relocated to mitigate the potential adverse impacts on the living hard corals and the associated reef communities from the rock-filling works to be done as part of the port facility construction. Please consider our Technical Bulletin No. 2019-04 "Technical Guide on Biodiversity Assessment and Monitoring for Coastal and Marine Ecosystem" in your monitoring program (coral reefs, associated fish through visual and mangrove assessment, if any).	The monitoring program relevant to marine ecology in line with Technical Bulletin No. 2019-04 "Technical Guide on Biodiversity Assessment and Monitoring for Coastal and Marine Ecosystem" is highlighted in Section 2.9.8.	Sec 2.9.8 (pp. 2-114)
2. Please provide discussion under mitigating measures on how the proponent can support on the government's effort of climate	Monitoring and removal of COTs are conducted in line with the established Coastal Resource Management activities of the company in partnership	Sec 2.9.7.1C (pp. 2-112).

change and the proliferation of the starfish so called Crown of Thornes (COT).	with the local fisherfolks association. Trained employed local divers schedule removal of COTs based on sightings and seasonal changes. The collected COTs are weighed before being disposed by means of deep ground burying. Further discussions shall be incorporated in the edits on the corresponding sections.	
People- Dr. Chester Cabalza		
1. Health Issues caused by limestone extraction, i.e. cough, pneumonia hypertension, noise pollution and dust emission, and other related sickness • What are the sustainable and participative programs initiated by the company that redounds to the health and welfare of the community?	The company will ensure that constant monitoring on health issues in the community will be addressed in coordination with Safety and Health Dept. and Brgy. Health Centers. Among the major projects relative to health are regular medical missions in coordination with Municipal Health Unit and Brgy. Health Centers, provision of medical supplies and equipment, and capacity building for emergency response among the community members.	Sec 2.11.3.1 (pp. 140-141)
• Penalties associated to health effects on the surrounding community.	The approach is more on mitigating the health impacts and capacitating the community to respond to natural and medical emergency situations, rather than imposing penalties. There is an existing company protocol on emergency response and related health and emergency training for employees, following Agata's ISO Certification on Integrated Management System (ISO: 14001, 45001, 9001). The safety and health culture is shared to the community through provision of safety and health trainings, health equipment, medical assistance, and capacitating the local emergency response unit of the impact communities.	Sec 2.11.3.1 (pp. 140-141)
2. Historical / archaeological landmarks and the Indigenous Peoples • Are there historical sites found in the area?	During the Field -Based Investigation of the NCIP, which was part of the Free and Prior Informed Consent (FPIC) process, it was established that there is no historical or archaeological landmarks within the host IPs' ancestral domain, nor information relating to the presence of historical sites in the host and neighboring barangays.	Sec 2.11.1.6 (pp. 2-134)
3. Disaster Risk Reduction Mitigation Measures: • How safe/fatal is the plant?	Limestone crushing and screening plants and similar plants exist all over the country. There is nothing new in erecting and operating plants like the one envisaged for the ALP, As such, proper safety and health protocols are already widely implemented to ensure the plant's safety. The plant will not be using any chemicals in crushing and screening limestone. It is standard procedure to identify, assess, and address all possible hazards related to the crushing-screening plant. Plant personnel will	

	receive task trainings to address safe work procedures in the various aspect of the plant's operations. The company has an Existing IMS where occupational health and safety standards are strictly followed.	
• Reduction of noise pollution caused by heavy equipment and other noise generating equipment	Management plan relative to noise generation is tabulated in Sec 2.10.2 and in Items 31-33 in the updated EMP Table	Sec 2.10.2 (pp. 129) and Table E-13 (pp. E-41- E-42)
• Are the mitigating measures for the plant and the affected community during natural and human-induced disasters? i.e. flood control, fire protection, earthquake drills.	The far location of the plant to the community area lowers the impact of plant related disaster. Apart from the strictly implemented Safety and Health Protocols of API which will be replicated in the ALP operations, the company and the host communities have existing separate Emergency Response Teams (ERTs) trained to respond during emergencies. In case of emergency, API has a standby 24/7 Ambulance, a Fire Truck and a clinic staffed with a Doctor and Nurses ready to receive emergency cases. The Company has existing MOA with Jabonga Hospital located 7.5 km by road from the Agata Clinic.	
4. Employment Opportunities: • Priority for hiring plant employees to qualified workers from the community, short-term, medium-term, and long-term employment opportunities to residents of affected areas.	There is an existing MOA signed between API and the Host Brgy. stipulating that 50% of the manpower that will be hired for will be sourced out from the community provided they are qualified. It is also stipulated in the MOA, which is actually a Company policy, to capacitate residents through skills training for possible employment not only in the project but also elsewhere. Employment will be flexible such that equal opportunities will be given to all genders depending on skills requirements and qualification.	Sec 2.11.4.2 (pp. 2-144)
5. Submit updated Baseline study on Socio-Economic Development Plan (SDP) and other related activities on Corporate Social Responsibility (CSR) to the affected community	API conducted a Social Impact Assessment with Caraga State University.	

Air and Water Module- Engr. Dodjie Maestracampo		
1. Include "water supply competition" as potential impact on all Project Phase/Activities that requires the deployment of water tanks for dust suppression. Activities such as: a. Construction of Additional Roads b. Construction of Crushing Plant, Explosive Magazine Area c. Ore Extraction d. Clearing and Grubbing e. Drilling f. Crushing	Included in the updated IMP Table E-13: Impact No. 21	Table E-13 (pp E-37)
2. Include "degradation of water quality" as a potential impact in all Project Phase/Activities that generates dust from equipment operation. This dust will eventually settle, and some will end up in surface water reservoirs.	Included in Impact No. 13 in the updated IMP Table E-13	Table E-13 (pp E-32)
3. Domestic water quality and Industrial Water Quality are not potential impacts. What will happen to domestic water quality and industrial water quality are the potential impacts.	Revised as Water Quality degradation in the updated IMP Table E-13: Impacts 13-18	Table E-13 (pp E-32 to E-35)
4. "Provision of PPEs to employees directly working at the Crushing Plant" only addresses the potential impact on employees and contractors. What about the community? Also, the term "Crushing Plant" appeared to other Project Phase/Activity that does not involve crushing	• Rectified statement with inappropriate "Crushing Plant" entries. • Additional mitigating measures for community health impacts include implementation of health programs under SDMP (i.e. medical missions and medical assistance program). (Impacts 20, 29, 33, and 34 of the updated IMP Table E-13)	Table E-13 (pp E-37, E-39, E-42)
5. In several instances, the Management Plan does not address the impacts	Rectified. Please refer to the updated IMP Table E-13	Table E-13 (pp E-26- E-44)
6. The formulation of Bicarbonate (Ca $(HCO3)_2$(ag) was identified as potential impact in section 2.7.1.1. As part of the monitoring activity, the section states that: "Regular water quality monitoring of water bodies potentially impacted by the Project operations will be continuously done. Monitoring parameters will include metals, solids, pH, and bacteriological content". However, there's no indication of the monitoring of bicarbonates of water hardness in the Environmental Monitoring Plan (Table 6-1).	Hardness is included among parameters for monitoring in drinking water quality.	Drinking water EQQPL Table 6.2; and Surface Water EQPL Table 6.3 (pp. 6-9)
7. In Table 6.1 why is the EQPL value for the LIMIT is less than ALERT and ACTION (Water Supply Shortage).	Adjusted EQPLs for water supply level: ALERT: 30% reduction in water supply ACTION: 20% reduction in water supply LIMIT: 10% reduction in water supply	Table 6-1 (pp. 6-6)
8. I can't find Table 6-2 reference Table of the EQPL values.		Table 6.2 (pp 6-9)

9. Reformat Table 6-1 to make font more readable.	Done	Table 6-1 (pp. 6-4 to 6-8)
10. Include strategies on water conservation to address impacts on water resource competition/ depletion.	Item 21 in the updated IMP.	Table E-13 (pp. E-37)
Project Description and Mining Engineering- Engr. Danny Berches		
Land resources		
1. The MPSA area has an existing ECC for ANLP covering an area of 603 hectares while the proposed ALP within the same MPSA covering an area of 554.4 hectares, including support facilities. It was indicated that the proposed ALP overlapped with the existing ECC of ANLP. Clarify why the proposed ALP included almost the coverage area of the existing ECC for ANLP. It was indicated the delineated limestone resource area for future development is 66.94 hectares in Table 1-12 page 1-20.	A large part of the ANLP ECC shall also be part of the components of the ALP mainly because the main haul roads of the ANLP project will be transformed as secondary access roads for the ALP. These roads will be used for transport of supplies and materials. The settling ponds and other environmental structures to address impact areas also account for a large area of overlap.	Sec 1.4.1 (pp. 1-16)
2. Page E1-19, E.3.2.1 Land Resources: Stated that *"The limestone deposit is compact and is situated in a single ridge located at Payongpayong area. This setting conveniently limits the excavated area within 52-hectares at most."* Please reconcile;	The quarry will also have an additional 14.94-hectare buffer area around the 52-hectare excavation to allow for noise and vibration effects to be minimized. This adds to a max disturbed area of 66.94 ha. Table 1-12: Delineated Limestone Resource Area with buffer zones for future development	Sec E.3.2.1 B (pp. E-19) Table 1-12 (pp. 1-20)
3. Rectify the tenement number from MPSA-XIII-007 to MPSA No. 134-99-XIII in page E-5 1st par of Item E.3.3 EIA Study Area.	Rectified to MPSA No. 134-99-XIII	E.3.3 (pp. E-5)
Impact Assessment and Management Plan- Engr. Danny Berches		
1. In page E-24 Table E-13 Summary of Impact Management Plan- Construction Phase under 1.) site preparation clearing activity, 2.) pre-stripping activity and 3.) construction of additional roads: Clarify the statement *"100% Turn-over of Mined out Areas to MEPEO for Final Revegetation every end of the Month. Area with mineable ore will be temporarily Revegetated."*	Mine disturbed areas will be evaluated of readiness for rehabilitation by the Mine Operations Team. Those areas which are mined out and will no longer be developed will be turned over to the MEPEO Team so progressive rehabilitation can be done. Further, following the DAO 2018-19 on the limiting the maximum disturbed areas for metallic mines, areas that will exceed to the 60 hectare limit will be temporary revegetated.	Item 23 and 30 (pp. E-37 and E-40)
2. Table E-13 Under construction of crushing plant and explosive magazine area: Clarify the activity measures provided under column of management plan 3rd row. What do you mean by this statement *"All machineries will be properly submitted for approval of the DENR prior to operation."*	Rectified to: *The design of the plant and other facilities will be subject to required review and approval of the regulators (DENR) prior to construction and operation.*	Table E-13 (pp E-26 to pp E-44)
3. Table E-14 Under Port Operation (Barging/Shipping): No provisions on the potential impacts and management plan if there is an accidental spillages happened during loading and conveying (thru conveyor belt) of crushed limestone materials from stockpile to the ship loading area	Accidental ore spillage is included as Impact No. 13 in the updated IMP Table E-13	Table E-13 (pp E-33)

4. Table E-14 under blasting activity: Provide additional mitigating measures/management plan during drilling and blasting operations	Added mitigating measures for blasting in Impact No. 1 and Impact no. 34 in the updated IMP Table E-13	Table E-13 (pp E-26 and E-42)
5. Table E-14 under crushing plant operation: No provisions on the potential impact and mitigating measures for noise generation and spillages from plant operation.	Impacts from accidental spillage of hazardous materials is listed as Impact No. 15; while noise impacts from crushing plant operation is reflected as Impact No. 31 in the updated IMP Table E-13	Table E-13 (pp E-34 and E-41)
6. Table E-14 under Stockpiling: Provide additional potential impacts and management plan for stockpiling of limestone particularly near the port area	Impacts from stockpiling is integrated in the updated IMP Table E-13	Table E-13 (pp E-25- E-40)
7. Table E-15 under Decommissioning and rehabilitation of mine facilities: Clarify the decommissioning of mine facilities mentioned is also discussed in the FMR/DP of ANLP of API	An amended FMRDP will be submitted for review of MGB. Changes will include revised plan on the disturbed areas and facilities from ANLP, integrating the activities under ALP operation.	Sec 1.7.4 (pp 1-49)
8. The ECC coverage area for ANLP is 606.06 in page 1-1 under project description while in page 1-19 (legend of route map) the total hectarage indicated is 603.6 hectares. Pease reconcile	Rectified: The amended ECC covers a total mining area of 603.06 hectares with annual production capacity of 3.5 million DMT per year.	Sec 1.1 (pp 1-1)
9. In page 1-2 clarify the statement "It is expected however, that ANLP operation is completed by the time ALP commences	The commencement year of Agata Limestone Project is set after the completion of the Agata Nickel Laterite Project. The two projects shall not operate simultaneously as all facilities used for ANLP are needed for ALP such as causeway, roads, camp and stockyards, etc.	Sec. 1.1 (pp. 1-2)
10. Will the proposed ALP affect the existing mining operations and the ongoing implementation of the environmental protection and enhancement program of ANLP? Clarify	The proposed limestone project will be not be directly affecting the existing Nickel Mining operation considering that the resource area is separate from the nickel mining site. The implementation of the EPEP will not also be affected since the two projects will be implemented simultaneously. However, the FMRDP of ANLP needs to be amended as other facilities used for ANLP shall be retained for ALP, hence final rehabilitation in these areas cannot be undertaken as planned until the limestone project is completed.	
Causeway- Engr. Danny Berches		
11. In page 1-22 Item 1.4.2.2 Causeway: it was mentioned that the existing causeway is located … approximately 1.5 km from the limestone quarry area but in the same page Item 1.4.2.4 Crushing and Screening Plant, stated limestone products will be conveyed to the port via a 1.5 km conveyor belt. Please clarify	Limestone products will be conveyed to the port via a 1.0 km conveyor belt.	Sec 1.4.2.4 (pp. 1-22) Table 1-16 (pp 1-23)
12. What is the final level or elevation of the quarrying operation	Mining activities will progress from the topmost elevation to the bottommost part of the mine (0 msl).	Sec 1.4.2.1 (pp. 1-21)
13. Will the settling ponds to be constructed with total area of 48.81 hectares for ALP separate from existing 41.99 hectares of ANLP? Clarify.	About 87% of the existing ANLP settling ponds will also be part of the ALP to address siltation at the secondary impact areas of the ALP.	Sec. 1.4.3.5. (pp. 1-25)

14. In page 1-29 Fig.1-11 Drainage Map: The arrow for drainage direction coming from the stockpile/waste dump area (Fig.1-1 ALP Project Location Map) goes to the crushing plant and stockpile areas as shown Fig. E-2 project Impact areas map. Clarify	Revised Drainage Map is provided in Figure 1-9	Figure 1-9 (pp. 1-30)
15. Include in the ALP location map the proposed area for crushing plant including its stockyard for limestone products	Already presented in Figure 1-7	Figure 1-7 (pp. 1-18)
Safety Devices and Control Facilities- Engr. Danny Berches		
16. Page 1-31 Safety Devices/Emergency Facilities: clarify the 1st paragraph sentence. It was indicated the implementation of safety control procedures are already currently practiced at the ANLP and mentioning some control procedures such as providing sirens during blasting operation etc. Definitely, such control measures mentioned were not currently practiced by ANLP (ANLP operation never used blasting in nickel operation). Please rectify	Safety control procedures of ALP will adapt the applicable practices from the ANLP operations (e.g. mine, port, and shipping activities). New protocols to be added will be related to blasting and crushing operations.	Sec 1.4.7 (pp. 1-32)
17. Page 1-43 Table 1-28 Annual Materials Movement Schedule: the first 2-years of operation the annual production is beyond the proposed 2 Million MT of limestone. Clarify.	The plant operations are assumed to be active for 15 years. Daily production as shown in Table 1-27 will yield an average annual production rate of two (2) million tons per annum. Production may slightly exceed 2 million tons to exact bench designs by the end of every year.	Table 1-28 (pp.1-45)
18. Will the proponent for the ALP application for ECC plan to supersede the existing ECC of ANLP?	No. The ALP ECC shall take effect upon the termination of the ANLP Mine Life.	
General Comments on the EMP Matrix		
1. Present impacts in relation to the project activity provided. Mitigating measures shall be specific for each identified impact and avoid generic statements.	Specific mitigation measures were provided per impact as recommended by Engr. Maestrocampo	Table E-15 (pp E-26 to E-44)
2. Combine entries and project activities with similar impacts. Double check and combine entries on redundant impacts (i.e. change in soil vegetation, change in soil fertility etc.)	Consolidated mitigating measures per impact to avoid multiple, redundant entries.	Table E-15 (pp E-26 to E-44)