ENVIRONMENTAL PERFORMANCE REPORT AND MANAGEMENT PLAN (EPRMP)

PROPOSED INCREASED IN EXTRACTION VOLUME OF THE CAGAYAN OFFSHORE MAGNETITE MINING PROJECT

Municipalities of Aparri, Buguey, and Gonzaga, Province of Cagayan

JDVC Resources Corporation

Project Proponent

PHILKAIROS INCORPORATED

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ISO 9001
ISO 14001
ISO 45001

November 12, 2021

ENGR. WILLIAM P. CUÑADO
Director
Environmental Management Bureau – Central Office (EMB-CO)
Department of Environment and Natural Resources (DENR)
DENR Compound, Visayas Avenue, Quezon City

Subject: **Proposed Increase in Extraction Volume of the Cagayan Offshore Magnetite Mining Project**
Municipalities of Aparri, Buguey, and Gonzaga, Province of Cagayan

Dear **Director Cuñado:**

We respectfully submits herewith the revised Environmental Performance Report and Management Plan (EPRMP) based on the additional information (AIs) requested by the EIA Review Committed during the 1st Technical Review for the Proposed Increase in Extraction Volume of the Cagayan Offshore Magnetite Mining Project located in the Municipalities of Aparri, Buguey, and Gonzaga in the Province of Cagayan. This is an amendment to the issued ECC last May 20, 2016 with reference number ECC-CO-1409-0021.

Thank you.

Respectfully yours,

NAPOLEON DE LEON, JR.
President

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1. Project Fact Sheet

Project Proponent	JDVC Resources Corporation
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Contact Person	Mr. Louis Santos VP – Engineering, Exploration, Research and Development Mobile Number: 0926.677.0598 Email Address: louistsantos@jdvcresources.com
Authorized Representative for ECC Application	Mr. Joel A. Espineli Philkairos, Inc. JE Business Center, Pinesville Road corner Ortigas Avenue Extension Taytay, Rizal 1920 Telephone Number: (02) 706-4008 / (02) 727-9005 Email Address: admin@philkairos.com
Project Namew	Proposed Increase in Extraction Volume of the Cagayan Offshore Magnetite Mining Project
Project Location	Municipalities of Aparri, Buguey and Gonzaga, Province of Cagayan
Project Type	Resource Extractive Industry (Magnetite Extraction)
MPSA Number	338-2010-II-OMR
Project Area	1,902.5939 hectares (Gonzaga) 3,096.6419 hectares (Buguey and portion of Aparri) **4,999.2358 hectares** (Total)
ECC Reference Number	ECC-CO-1409-0021 (issue date: May 20, 2016)
ECC Application	For ECC Amendment

JDVC Resources Corporation *(hereinafter referred to as the "Company")* holds a Mineral Production Sharing Agreement (MPSA No. OMR 338-2010-II) with the Republic of the Philippines for a 14,240-hectare mining area. The Company has a Partial DMPF mining concession and commercial extraction of minerals like magnetite iron sand, titanium, vanadium, and other valuable minerals with a life of 25 years and renewable for another 25 years.

MPSA-338-2010-II-OMR was approved on June 2010 as a contract between the Republic of the Philippines and Bo GO Resources Mining Corporation (Bo Go). It was transferred to JDVC Resources Corporation by Bo Go on November 25, 2011, by virtue of a Deed of Assignment. The Deed of Assignment was duly registered with MGB Region II, Tuguegarao City, Cagayan on January 27, 2012, and was duly approved by Department of Environment and Natural Resources (DENR) Secretary.

The Environmental Compliance Certificate (ECC-CO-1409-0021) was issued to JDVC for its proposed "Cagayan Offshore Magnetite Mining Project" covering the 4,999.2358-hectare area of MPSA No. 338-2010-II-OMR-Amended A located in Gonzaga, Buguey and Aparri, Cagayan, allowing a maximum production rate of 1.3 million dry metric tons of magnetite iron sand concentrate per annum last May 20, 2016. The proponent, thru the amendment of this ECC, intends to apply for increase in the production rate from 1.3 MMT to 30 MMT. The proposed modifications are shown in the succeeding discussions.

The Mines and Geosciences Bureau (MGB) approved the Declaration of Mining Project Feasibility (DMPF) for the said 4,999.2350-hectare area of MPSA No. 338-2010-II-OMR-Amended A, thereby, authorizing JDVC to proceed to the Development and Operating Periods, including extraction and commercial disposition of magnetite sand and other associated minerals, subject to compliance with certain conditions.

The table below summarizes the proposed modification of the existing project components:

Existing	Proposed
• 1.3 MMT production rate • 1 Siphon vessel (dredge barge) • 3 Separator Barges • 1 Panamax Vessel • Gravity Separator • Magnetic Separator • Hopper / Chute • Generator Set	• 30 MMT production rate • 4 Siphon vessels equipped with generator sets, magnetic and gravity separators and hoppers / chute • 12 LCT / Storage Barges • Anchor handling tugs

2. Process Documentation

The Environmental Performance Report and Management Plans (EPRMP) is a result of the Environmental Impact Assessment (EIA) conducted for the proposed expansion of extraction volume of the Cagayan Offshore Magnetite Mining Project located in the municipalities of Aparri, Buguey, and Gonzaga, Province of Cagayan.

Both primary and secondary data were considered during the conduct of the environmental impacts assessment study. Collection of secondary data were sourced from the following agencies and offices: socio-economic profile and Comprehensive Land Use Plan (CLUP) of the municipalities of Aparri, Buguey, and Gonzaga, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Philippine Institute of Volcanology and Seismology (PHIVOLCS), Mines and Geosciences Bureau (MGB). Aside from these, available data from the 2015 EIA study of the first application were used.

2.1 EIA Team

The proponent, JDVC Resources Corporation, has contracted the services of Philkairos, Inc. as a third-party consultant in the preparation if the EIS. The EIA study team is composed of specialists who have extensive experiences in the conduct of baseline characterization and impact assessments for similar projects.

Joel A. Espineli (IPCO-088)	Project Director
Maria Luisa M. Guiterrez (IPCO-097)	Project Manager
Hillel Cabria	Geology and Geohazards
Raymond Rodolfo	Geology and Geohazards Environmental Impact Assessment
Rodolfo Romarate Jr.	Water Quality Specialist Marine Ecology Specialist
Isabel B. Espineli	Sociologist
Jan Julio A. Espiritu	Environmental Impact Assessment
Deza Mae P. Mondragon	Environmental Impact Assessment
Ana Karmela M. Zamora (IPCO-070)	Research Assistant
Demelyn Macalinao	Research Assistant
Rexadi Roy Zamora	Mapping

2.2 EIA Study Schedule

The overall schedule of activities conducted are presented below:

ACTIVITIES	MONTHS							
	1	2	3	4	5	6	7	8
1. Planning with Technical Experts								
2. Gathering of baseline and secondary information								
3. Interpretation and analysis								
4. EIS Report Preparation								
5. EIS Review and Evaluation								
6. Public Consultations								

2.3 EIA Study Area

The Direct Impact Areas (DIA) of the Project are delineated based on the following guidelines as presented in the table below.

Area Classification	Area Coverage
Direct Impact Areas	**In terms of biophysical impact:** • The 4,999.2358-hectare project area within the municipalities of Aparri, Buguey, and Gonzaga; • Surrounding areas and seabed in the channel where the offshore mining project is located
Indirect Impact Areas	**In terms of biophysical impact and socio-cultural impact:** • The (indirect) impact area is composed of the entire coastline of Aparri, Buguey and Gonzaga municipalities. This area includes eight (8) coastal barangays in Aparri namely: Bulala Sur, Bulala Norte, Linao, Punta, Minanga, San Antonio, Maura, Dodan, Paddaya; thirteen (13) coastal barangays in Buguey to include Paddaya Weste, Paddaya Este, San Isidro, Cabaritan, Centro West, Centro, Santa Maria, Leron, Mala Weste, Mala Este, Villa Leonora, Minanga Weste and Minanga Estes; and eleven (11) coastal barangays in Gonzaga consisting of Caroan, Casitan, Callao, Minanga, Batangan, Tapel, Ipil, Amunitan, Santa Cruz, Baua and San Jose as the primary beneficiaries of the SDMP that will benefit the provincial and regional level from potential revenues and taxes of the project

2.4 EIA Methodology

The preparation of the EPRMP is in accordance with the steps indicated in the Revised Procedural Manual (RPM) for DAO 2003 – 30. The conduct of public participation activities is based on the guidelines as indicated in DAO 2017-15 (Guidelines on Public Participation under the Philippine EIS System).

The EIA Team followed the Participatory Impact Assessment Method (PIAM) wherein the stakeholders were involved in the conduct of the EIA through project briefing, focused group discussions, and formal scoping meeting as prescribed in DAO 2017-15.

Data gathering involved infield surveys for the assessment of the existing physical and biological conditions of the project site. Based on the standard EIA procedures, collection of secondary data was sourced from the concerned government agencies and offices, desktop research and literature review of relevant studies. The succeeding tables show the methodologies employed during the study.

Table ES-1: Data Gathering Matrix

Methodology	Source Person/s	Gathered Data/Activity Conducted
Primary Data		
Meetings	EIA Study Team and Proponent	• Project information, project site boundary, and plans
Consultations Perception Surveys Interviews	EIA Study Team	• Perception of the Project • Level of awareness on the proposed project • Municipal Profiles • Anecdotal accounts of past earthquakes, typhoons, flooding and storm surges in the area
Infield Surveys and Fieldworks using the following methodologies: • Site inspection • Coastal Mapping • Rapid Bioassessment for marine water macroinvertebrate • Transect-quadrat method for marine ecology survey • Grab sampling for water sample collection • Gas Bubbler and Pararosaniline Method for SOx and NOx • High Volume and Gravimetric Method for TSP and PM_{10} • Noise meter for ambient noise level	EIA Study Team	• Marine Ecology Assessment of the Project Site • Marine Water Quality Assessment • Ambient Air Quality and Noise Level Assessment
Secondary Data		
Desktop Research and Literature Review	• Philippine Statistics Authority (PSA) • Municipal Planning and Development Office – Aparri, Buguey, and Gonzaga	• Physical, biological, socio-economic and demographic profiles of the municipalities
Desktop Research	• Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) • Philippine Institute of Volcanology and Seismology (PHIVOLCS) • Mines and Geosciences Bureau (MGB)	• Climatological normal and extremes • Risks and hazards • Geological data and maps
Other Sources	• Feasibility Study of the project • Integrated (Amended) Environmental protection	

Methodology	Source Person/s	Gathered Data/Activity Conducted
	and Enhancement Program of the project • Final Mine Rehabilitation and/or Decommissioning Plan of the project • Final Exploration Report (FER) of the project	

Stakeholders' Engagement / Public Participation

The Information, Education and Communication (IEC) campaign was conducted last November 7 and 29, 2019 with the pre-scoping, perception survey and distribution of IEC materials on the EIA process. A public scoping for the proposed expansion of the project was conducted last January 30 and 31, 2020. Present during the activity were the LGU officials of the affected municipalities, barangay council members and concerned stakeholders from the host coastal barangays, and representatives from other concerned government agencies and NGOs. Representatives of proponent were also present. Below is the matrix of the issues raised per module during the Public Scoping activity.

Below are the summary of concerns per module:

Table ES-2. Summary of Concerns Per Module: Municipalities of Aparri and Gonzaga

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
PROJECT DESCRIPTION		
1. Mr. James Ferrer, CFDEO (DPWH)	Will this affect the infrastructure franchises to be implemented by the DPWH?	**Mr. Louis Santos** (JDVC): First and foremost, the area from the shoreline is 14 kilometers to 15 kilometers so it's far away. We will provide a copy of prevention that this project will not affect any existing project.
2. Mr. Angelito Mape, Punong Barangay – Paddaya, Aparri	Effects of the expansion project to the *"Payao"* project of Brgy. Linao, Aparri. (*payao* – Fishery Aggregating Device)	**Mr. Gerico Gibe** (FIFO/BFAR 2): The public hearing will determine what will be the extent of the effect of the expansion project in the location of "payao" project.
3. Mr. Luis Macalufig, Barangay Chairman – Brgy. Maura, Aparri	Is JDVC a Filipino owned company and there's no foreign investors involved in this project?	**Mr. Louis Santos** (JDVC): This is a 100 percent Filipino owned company. This is a private company, it so happened that the national government is fully supportive of the project.
4. Mr. Crisogono Decena, General Adviser, UNIMUF – Aparri	JDVC should assure the residents that this project is purely Filipino, and no other foreign investors are involved in this project.	**Mr. Jesus Verocel** (JDVC): Technically, this project will be having Chinese consultant since the vessel will come from China. There will be a transfer of knowledge in technology from Chinese to Filipinos.
LAND MODULE		
5. Coun. Cesar Mabaggu, MLGU Aparri	Will the proponent provide a mitigating measure for the safety of the area and mitigating measures on the reduction in area of Aparri?	**Mr. Louis Santos** (JDVC): We can provide a copy of the EPEP prepared for this project. Aparri is an erosional environment, that's already part of nature that we can't control. So maybe, in the coming months, we can build seawalls or anything we could agree on.

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
WATER MODULE		
6. Mr. Crisogono Decena, General Adviser, UNIMUF – Aparri	How will this affect the marine life, particularly its habitat and the fishermen's occupation?	**Mr. Louis Santos** (JDVC): We conducted a side scan and bottom profiling to investigate, the results are that there aren't any corals in the area. Fishermen do not usually catch fish around the area. Instead, they fish 20 kilometers to 25 kilometers away from the shoreline. There is no aquatic life near the shoreline, especially in the north part of luzon.
7. SB Member, Gonzaga	Proof of studies conducted in the project area that will prove there are no detrimental effects on the marine environment.	**Mr. Robert Carreon (**MGB-RO2): We will give you a copy of an evidence that the operation is not invading other parts and that the fishes are not affected by it. **Mr. Gerico Gibe** (FIRO/BFAR 02): We cannot tell that the fish is disturbed during the site activities. **Mr. Louis Santos** (JDVC): We're not denying the fishermen the freedom of navigation. The sea is too wide.
8. SB Member, Gonzaga	Is it possible to put up of artificial corals after the mining operations and updating of SDP funds for the affected communities	**Mr. Louis Santos** (JDVC): After we exhaust a part of an area, we will be putting up artificial corals. That was approved by the national government. Also, when the extraction rate of the project increases, the budget for SDMP will also increase.
Others		
9. Mr. Crisogono Decena, General Adviser, UNIMUF – Aparri	Expansion of the MMT, (multipartite members) they should include the people organizations of fisherfolks and religious organization for us to monitor if the vessel is 14 kilometers to 15 kilometers away from the shoreline.	**Mr. Florentino Lingan Jr.** (EMED): the EMB is prioritizing the active organizations in the area event the barangay officials are well represented. We could also incloud other sectors to be part of the MMT. The purpose of MMT is being transparent to every project and giving priority to the active people organization within the affected area. All sectors are considered. **Ms. Patrisha Torcedo** (MGM): Based on DAO 2010-21 section 185, stated that you can see all the possible member of MMT. **Mr. Louis Santos** (JDVC): all vessels are equipped with GPS to monitor their current location.

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
10. Mr. James Ferrer, DPWH (CFDEO)	Will the DPWH have a chance to be part of MMT members?	**Mr. Florentino Lingan Jr.** (EMED): We have guidelines to follow regarding our membership for the MMT. It is open to everybody.

Table ES-3. Summary of Concerns Per Module: Municipality of Buguey

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
PROJECT DESCRIPTION		
1. Mr. Ricardo Singson, MPDC	Can we request for a copy of the EIA for us to have knowledge and be educated on what will be the effects of project to the resources?	**Mr. Jan Julio Espiritu** (Philkairos, Inc): We're still in the Public Scoping stage, after that we will be doing various study and we will be drafting the EIA study. DPRMT will be subjected to review by the review committee and the final draft DPRMT copy shall now become a public document, which can be access by everyone. Apart from that prior to the finalization of EIA report, we will also constructing a public hearing, wherein we will be presenting the final result of study and you will be guided accordingly.
2. Mr. Carlito Berbano,	How sure that this coming project of JDVC won't have the same bad effects as the previous one? (Black sand is the holder of land in seashore)	**Mr. Louis Santos** (JDVC): In geology there is an erosional environment, which is natural phenomenon, in offshore water of Cagayan especially here in Buguey, this particular area from Abulug going to the parts of Aparri Buguey and Gonzaga. We are very prone to coastal erosion, that is natural phenomenon we cannot predict. Rehabilitation program will be conducted such as coral reefs.
3. Mr. Adolfo Miranda, SB Member- Legislative	How many years is the operation and will there any difference/will there be expansion in the area of coverage of operation?	**Mr. Louis Santos** (JDVC): The project will take years to complete from 87 years down to 45 years and the area coverage for the operation will still be the same. Only the extraction volume will change in this application. *The revised projected mine life of the project is 20.2 years if 30MMT extraction rate is approved.*
	Area of 14km/15km (clarification). If 14km, will it be subject/regulated by the municipality regulation?	**Mr. Louis Santos** (JDVC): The distance varies depending on its distance in the shoreline. From here upon the coastal going to the area, it varies. We said 14km because there's a portion here, especially a part of Gonzaga or a part of Abulug is 14km minimum. In

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
		Buguey, some part here is 15km from the shoreline, some are 16km away.
5. Mr. Randolph Taloza, SB Member- Health	What will be the result if the Sangguniang Bayan (SB) members will not approve or against the proposed expansion?	**Mr. Florentino Llangan Jr.** (Chief, EMED): Why do you against with the project**.** Is there a reason or do you saw a possible reason not to agree to the proposed project? *Attached as **Annexes 1,2, and 3** the Resolution Interposing No Objection to the proposed project issued by different host barangays and Municipalities.*
6. Mr. Abraham Alariao JR., SB Member- NGO	How will we monitor that you will not enter the area?	**Mr. Florentino Llangan Jr.** (Chief, EMED): The MMT team will monitor the area of operation, aside from MMT, there's also MGB and DMP monitoring. The report of MMT could be compliance monitoring or a quality self-reporting, but the higher authorization of MMT is intercepted to the FRMC. Our output is compliance evaluation report. **Mr. Louis Santos** (JDVC): Prior to the operation we sent a survey vessel from Gonzaga to Aparri, we conducted a sea bottom survey and based on the side scan survey. During that precise and scientific endeavor, we saw sand, we have fishes (micro dory), which could be seen in the shallow part. We have a set of documents here and we will furnish a copy of Environmental Protection and Enhancement ProgramFinal Mine rehabilitation decommissioning plan. Big document itself we will furnish a copy a it is very educational for everybody.
6. Mr. Abraham Alariao JR., SB Member- NGO	How deep and wide is the area of operation?	**Mr. Louis Santos** (JDVC): We call this mining, block by block, one (1) block per year. It's 16.3 hectares. For the extraction, we will exhaust for about 10 meters deep. 90 percent of the magnetite will be brought back, and there will be no mineral after that. That's when the rehabilitation will start. There will be planting of artificial reefs in replacement of the destroyed coral

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
		reefs and the sequence of the operation is 1block/ year.
WATER MODULE		
7. Kimberly Mak, MENRO, Peace Corp.	Is there a monitoring aspect of the project and how sure is the proponent that there will be no negative effects in the environment especially to the bottom part of the sea project? Also, for the monitoring of soil erosion to the shoreline (weathering) operations.	**Mr. Louis Santos** (JDVC): Coastal erosion and other environmental impacts of the project were already addressed, it is putted to writing. For the operation phase, the company will be having an ROB, an underwater robot with camera which will be installed at the bottom of ship for monitoring. Also, the EMB and MGB will be there to monitor the operations. **Mr. Florentino Llangan Jr.** Chief (EMED): The MMT will monitor the compliances of the companies for the ECC conditions. **Mr. Robert Carreon** (MGB R2): Part of the mining here is to regulate the company to be responsible and sustainable to the mining operations. The MGB will be part of the MMT and they will have to abide with the proponent said conditions of the contract
PEOPLE MODULE		
8. Kimberly Mak, MENRO, Peace Corp.	Is there any opportunity for the community to have inputs of concern about the report of the EIS?	**Mr. Jan Julio Espiritu** (Philkairos, Inc): The public can input all their suggestion regarding to the result of the EIA during the public hearing. The inputs from the public will incorporated in the final draft of EIA study. *Public participation has been given priority in this EIA process through conduct of IEC activities, public scoping, perception surveys and interviews of affected stakeholders during the conduct of the study. A public hearing will be conducted to present the results of the baseline study conducted for this project. Inputs gathered during this activity will also be incorporated in the study.*
9. Mr. Adolfo Miranda, SB Member- Legislative	Will it help our people to have a work? Our people's nature of work is fisheries and farming. What can we do to help locals to train?	**Mr. Louis Santos** (JDVC): There is allotment training for skilled workers that we can use for the project operations. All the technology and apparatus were not

PARTY WHO RAISED THE ISSUE / SECTOR REPRESENTED	CONCERNS / ISSUES	RESPONSE (Responding party / Response)
		made by the Filipinos, so there will be what we called Technology Transfer. That would be transferred to the Filipinos after a few years. Everybody will be given an opportunity. **Mr. Florentino Llangan Jr.** (Chief, EMED): For the SDMP, the barangays that are within the impact area. Endorse a program for the mayor that would also be for the barangay. One example is a livelihood program and health.
10. Mr. Adolfo Miranda, SB Member- Legislative	Will the training be funded by the SDMP? Is there a chance to give us a floating fund from SDMP?	**Ms. Patrisha Torcedo** (MGB): Actually, the fund from SDMP is at least 1.5 percent for the operating cost. That 1.5 percent will be divided into three (3), for DHMC, IEC, and BMTG. These activities aren't just any activity. There are six (6) activities set on the law, such as for livelihood, capacity building, infrastructure, work, education and health. The more we should appreciate because if this project is finished, you will be sustainable and independent. That is the main purpose of SDMP. **Ms. Patrisha Torcedo** (MGB): The ECC should approve first. If there is ECC, then EPEP and SDMP will follow. Your group knows the allowed accredited activities based on DAO 2010-21.

3. EIA Summary

3.1 Project Alternative

The project considered other alternatives for the current project based on considerations of facility siting, development design, process/technology selection and resource utilization. The consequences of not proceeding with the project were also discussed.

The project is within the area bounded by the coordinates stipulated in the MPSA by virtue of the Deed of Assignment in favor of JDVC Resources Corporation and as approved by the Mines and Geosciences Bureau. No alternative sites were considered inland or within the vicinity of Cagayan River since this will not be practical from economic point of view and in addition, the construction of site facility inland will have greater negative social impacts to the community.

The proponent considered the extraction of magnetite starting only within mine operational area from a distance of 14 – 15 km away from Cagayan shoreline. This is to prevent the negative impact of disturbed sand on the quality of water that was traditionally used by the people for fishing.

The best practical technology that would result to reduced pollution and damage to environment and people.

The extraction for magnetite sand will simply utilize a siphon vessel. The extracted sand will then be temporarily stored, dewatered, and separated from the non-magnetite sands on board barges. All the processes for extraction will be strictly mechanical, no chemicals will be used. In addition, all phases of the operation, from the extraction up to the magnetic separation, will be done offshore. The process is smaller in scale compared to the extraction methods to be used inland.

Only magnetite materials will be extracted. Caution will be practiced by the proponent to keep the edge of the pipe as close as possible to the sea floor to lessen the agitation of the sand, which may cause the deterioration of the quality of the water, which will impact negatively on marine organisms. Such process entails less impact to the environment in general. The method to be used will depend on a number of factors including the depth to the seabed, the degree of consolidation of the sands, ocean weather conditions, capital and operating costs, etc. At this early stage the preferred option is the plain siphon.

The negative environmental impact of the magnetite offshore extraction and recovery process is NIL. The extraction process is via siphon vessel with magnetic separator, and processing apparatuses on board. This system is no hazard at all and no social complication as the siphon vessel is stationed at the ocean far from the shore. The siphoning action of the siphon vessel for magnetite sand offshore based on findings of the experts and specialists does not produce significant sea bottom topography disturbances due to the following reasons:

1. There is no explosive use, hence there is no blasting activities;
2. There is no permanent structure buried to the sea bottom;
3. The siphoning area underneath the sea agitated by the siphon pipe/s, while it can cause localize turbidity, would immediately cave in upon pull out of the siphon pipe/s due to continuing action of the sea under current;
4. The magnetic separator on the siphon vessel would only qualify about 10% average for quality grading required hence, will return back to the same area the 90% of the lesser grade magnetite Iron Sand;
5. The sand mounts with lesser magnetite that can be created by the return after magnetic separation under the sea may even become series of new fishing areas during calm season nearer the shorelines, and
6. The continuing replacement every time it rains allow continuing replacement of the 10% extracted for higher grade as separated for export shipment.

3.2 Summary of Key Impacts and Mitigation

3.2.1 Impacts on Land

There will be no significant impacts on land during all phases of magnetite extraction in the offshore areas of Aparri, Buguey, and Gonzaga. All extraction and mining activities will be done at least 15 km away from the shores of these towns.

Based on the baseline assessment, the host municipalities are highly susceptible to flooding due to the topography and the coastal barangays are considered low-lying flood plains based on the regional and MGB maps. These areas are moderately susceptible to erosion due to poor vegetation and weak soil structure along the river system.

3.2.2 Impacts on Water

Since the project site is located approximately 14-15 km away from the shoreline of the coastal municipalities and from the outfall of the river, the project will not have a significant impact on the depth and drainage of the river. The host municipalities are endowed with deep wells and productive aquifers. But since the project is located approximately 14 – 15 kilometers away from shore, the water supply both for drinking and for utilities, will be sourced and processed on-shore. Estimated daily domestic consumption is 30 cubic meters. No water requirement is needed for the operation.

In terms of marine water quality and ecology, significant impacts would be the loss of benthic types, conversion of substrate/habitat and changes in community structure, siltation, sedimentation, turbidity, and water pollution due to oil spills. Mitigating measures such as, regular monitoring of water quality based on DENR standards for Class SC, provisions of pollution control devices to prevent will be implemented to reduce or prevent negative impacts to the marine environment. Offshore extraction of magnetite sand can increase the water turbidity which, can result to a sedimentation. The crew will keep the edge of the suction pipe as close as possible to the ocean floor to lessen the agitation of the sand which, may cause the deterioration of the quality of water. All offshore mining operation MUST have one (1) tugboat equipped with Oil Spill response equipment, one (1) fast boat and personnel that are adequately trained to address oil spills.

To mitigate impacts on increased turbidity, an accordion type of pollution prevention curtain or screen shall be installed to surround the suction and discharge lines. Also, the pollution prevention curtain or screen can be used to reduce the impact of silts and sand from rivers flowing into the basin.

Residual effects are moderately significant, water pollution may have an adverse effect on marine water quality and ecology if not mitigated.

3.2.3 Impacts on Air

There will not be much impact on air except for the emission of diesel-powered magnetite separator. Pollutants include CO_2, SOx and NOx. The emission will be easily dispersed because of high velocity wind in the sea. All equipment (e.g. Generators) on board are designed as silent types to avoid noise generation exposure even to siphon vessel crew. The Vessel's main engine is housed inside the engine room with sufficient sound absorbing insulation installed. The proponent will comply with the regulations from the MARPOL (Maritime Pollution) 73/78 and those set-forth by the Marine Environmental Protection Rules and Regulations of the Philippine Coast Guard (PCG) will be adopted. Residual effects are temporary and will cease after closure

3.2.4 Impacts on People

The operation of the project may result in several impacts to the communities. The project is located approximately 14 – 15 kilometers away from the shore, likewise, the office of its employees is located in the existing facilities of CEZA. Hence, there will be no displaced settlers and/or properties, ownership of land, and right of way conflict. The effects may include in-migration during development and operation, out-migration upon closure, safety and health risks to the employees and workers and the communities, peace and order in the area.

During Operation, the mining activity will fuel economic growth, safety and health risk employees/workers and the communities. Upon closure, the potential impact will be on the economic aspects and psycho-social concerns on job, livelihood, and opportunities loss because of the seizure of the operation. The implementation of the project will not alter the lifestyle of the resident. On the other hand, improved community services through the company's SDMPs and CSRs are also expected from

the project. The company's community relations officers must conduct regular or annual social functions like sports competition to be able to gain good social relationships among in-migrants and local residents with respect to their ethnicity or culture. The enhancement may remain permanent depending on the cooperation of the communities.

To mitigate potential impacts due to in-migration, the following management measures shall be implemented:

- Implement priority local hiring policy for qualified local workers;
- Coordinate with barangay or/and municipal LGU as to relevant ordinance on providing opportunities for local employment;
- Conduct consultation with barangay LGUs on requirements and process of hiring to maximize employment of local residents;
- Require and monitor contractor commitments on providing local employment;
- Coordination with the municipal and barangay peace and order councils to ensure peace and order; and,
- Coordination meetings shall also be undertaken regularly with the LGUs to identify threats and vulnerabilities in the society as well as to develop programs to prevent foreseen social problems.

Table ES-4: Summary of Main Impacts, Mitigation Measures and Residual Effects

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
Operational Phase				
1. Positioning of the Siphoning vessels with the use of Anchor Handling Tugs	Disturbance to marine biodiversity	• Vessels' movements will be bounded by the marked mining block/grid currently being mined to minimize disturbance to marine environment. Once the first block is exhausted of iron ore, the vessel will then be positioned to the next mining area. • Siphon vessels will be operated in the boundaries of the mining block to enforce a form of progressive mining. This process will give the impacted organisms time to recolonize the previously mined out area.	• 1% to very minimal impact to marine biodiversity. • Reversible effect to the environment.	• Proponent / MMT
2. Use of Siphon vessels in extracting the magnetite iron sand 3. Processing of extracted sand in the magnetic separator with sand and water separation process 3. Transport/loading of magnetite iron sand from Siphon vessels to foreign vessel thru conveyor belt for export	Disturbance of marine biodiversity	• Vessels' movements will be bounded by the marked mining block/grid currently being mined to minimize disturbance to marine environment. Once the first block is exhausted of iron ore, the vessel will then be positioned to the next mining area. • Siphon vessels will be operated in the boundaries of the mining block to enforce a form of progressive mining. This process will give the impacted organisms time to recolonize the previously mined out area.	• 1% very minimal impact to marine biodiversity. • Reversible effect to the environment.	• Proponent / MMT
	Increased water turbidity which can result to sedimentation due to	• Use of suction pipe to extract the sand and return the non-magnetic sand to the seafloor. A pollution prevention curtain or	• 100% Compliance with Clean Water Act and its implementing rules and regulations	• Proponent / MMT

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
	extraction of magnetite sand from the seafloor and non-magnetic sands returned to the sea	screen / silt curtain will be used to lessen the impact of turbidity. - Specifications of a silt curtain: > Tube frame for upper – 60.5mx5.5m > Middle frame – 60.5mx5.5m > Lower weight frame – 76.3mx7m > Belt chat set for ditto – 35mm x 4m > Curtain #800 – 2mx60m > Bracket for curtain – 60.5mx5.5m • Quarterly monitoring of water quality to mitigate and prevent negative impacts of pollution to marine water • The water for disposal should pass the parameters for class SD.		
	Contamination of water body due to oil spills from equipment/vessel	• Daily and/or weekly checking for oil leakage and monthly maintenance of all equipment including vessels will be done. Oil spill kit on standby. • In the event of oil spill accident, immediate clean-up of affected areas will be performed and reported to authorized agencies for assistance. • The company will include strategies to reduce and mitigate the negative impacts of oil spill in water body and marine life. - Institute and implementation of oil spill containment protocols to be followed during development in cases of occurrence. - Oil spills hall be reported, contained, and cleaned up promptly and properly in accordance with the Marine Environment Protection and Policies of PCG.	• 100% implementation of environmental best practices in handling marine vessels including proper management practices in handling fuels for regular maintenance of vessel and equipment. • 100% compliance with MARPOL 73/78 for the prevention of pollution from ships • Separate storage and proper handling and labelling of used oil for identification • In case of oil spill, an oil spill response equipment and qualified personnel will be available on the anchor handling tug or vessel.	• Proponent / MMT

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
		- Oil spill kits will be ready in case there will be accidental spills.	• Short term; Irreversible effect to the environment	
	Emission of CO_2, SO_2 and NO_2	• The vessels will document the its daily, weekly, monthly, every 6 months and yearly maintenance activities of the extraction equipment and the vessel itself. No maintenance work will be conducted offshore to minimize the risk of spillage of oil. • The proponent will ensure that the siphon vessels and suction equipment are in good condition. A preventive or scheduled maintenance system, condition maintenance system, and corrective or breakdown maintenance will be implemented (Chapter 1: Section 1.5.4 Maintenance of Vessels). • International and local rules and regulations on minimizing air pollution will be implemented during operations.	• 100% conduct of assessment, monitoring, and maintenance of all vessels and equipment involved in this project will be strictly implemented. • 100% compliance with MARPOL (Maritime Pollution) 73/78 and Marine Environmental Protection Rules and Regulations of Philippine Coast Guard (PCG) • Long term, Reversible effects to the environment	• Proponent / MMT
	Noise generation	• Use of low noise diesel generator set with enclosure and muffler for the vacuum pump. • Weekly, semi-annual, and yearly maintenance of equipment and vessels to maintain good working condition. • Equipment including vessels will be operated at low speed and/or power whenever practical and switched off when not in use.	• 100% compliance with DENR Air quality standards, noise level set by DENR and EQPL. • Regular inspection and maintenance of vessels and equipment prior to start of daily operations. • Long term, Reversible once operations are done.	• Proponent / MMT
	Disturbance of local/traditional fishing grounds	• Operational area will be set on an annual basis so as to better identify the municipality affected. The proponent and	• 1% to very minimal impact to marine biodiversity.	• Proponent / MMT • Municipal and Barangay LGUs

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
	Disturbance for fish breeding areas	it's CRU in cooperation with the LGU will identify projects that will be included in the SDMP to be implemented by the project. • Buffer zones from the vessels to allowable distance of 500 m for fishing boats.	• Reversible effect to the environment.	• BFAR
	Displacement of Fisherfolks and social unrest of sectors in the community	• Alternative livelihood for days that they can't fish in the area where operations are occurring (please see Tables 5-2a and Table 5-2b on the alternative livelihood). • Proponent to initiate programs that will promote livelihood, skills development, health and nutrition, disaster risk reduction and response, initiate intensive IEC activities to update stakeholders on the status of the project, and other similar activities as part of the proponent's Social Development Plan.	•	•
	Maritime Traffic	• Coordinate with PCG and/or PPA on the traffic routes or schemes that are likely to be used by large vessels	• 100% compliance with the government agencies with jurisdiction in the Philippine waters • Long term, Reversible	• Proponent / MMT • PCG • PPA
	Possible accidents and exposure to occupational hazards	• Provision of PPE to all workers and implementation of strict safety protocols especially when onboard the vessels • Conduct safety orientation prior to employment	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Short term, Irreversible	• Proponent / MMT

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
		• Conduct regular trainings and drills (at least twice a year) in handling and responding to accidents and disasters		
4. Other mine operational activities	Entry of migrant workers with families which might cause health problems due to diseases, overuse of public utilities /services, competition of resources, social conflicts, peace and order, increase in pollution due to solid and liquid wastes	• The company will prioritize employment of qualified local residents. Proponent will coordinate with every barangays in terms of employment • Management of entry of migrant workers by increasing and/or training barangay tanods to be deployed in areas where migrant workers reside. • Proponent provide Health clinic with a Doctor, Nurse and Health workers. Health certificate for workers prior to hiring into the project. • Partner with LGUs in the implementation of the Social Development and Management Program.	• 100% conduct of population survey and monitoring of migrant workers in coordination with LGU • Short term, Reversible	• Proponent / MMT • Municipal and Barangay LGUs
	Possible proliferation of diseases	• Require health examination and submission of health certificate prior to employment • Require fit to work certification for returning workers from illness • Implement proper health and sanitation protocols and facilities	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Short Term, Reversible	• Proponent / MMT
	Possible effects on health and sanitation	• Workforce will be provided with clean and potable water and sanitary toilets • Domestic wastes segregation shall be practiced and strict implementation of solid waste management	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Short term, Reversible	• Proponent / MMT • LGUs

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
	Generation of Solid/Domestic Wastes	• Proper segregation and disposal of domestic wastes shall be coordinated with CSEZF in Port of Sta. Ana and LGU • The company will promote the 3R's of solid waste management • Color-coded garbage bins/trash bins placed in relevant areas	• 100% compliance with RA 9003 • Collected wastes shall be weighed to monitor volume of generated wastes • Long term, Reversible	• Proponent / MMT • LGUs
	Domestic solid wastes maybe indiscriminately disposed in adjacent areas	• A solid waste management plan will be strictly enforced;	• 100% compliance and implementation of management plan • Long term, Reversible	• Proponent / MMT • DENR-EMB
	Generation of Hazardous wastes – generation of waste oil during maintenance activity of the vessels and the equipment	• The proper storage and documentation of the used oil and oily rags will be implemented as stated in RA 6969. The waste will then be properly disposed of using PPA or DENR accredited waste handlers/ transporters. • Grease traps installed to prevent discharge of oily material	• 100% in compliance with RA 6969 in proper handling and management • Long term, Reversible	• Proponent / MMT • DENR-EMB
	Generation of sewage	• Vessels to be engaged for the operation shall be provided with either holding tanks, a marine sanitation device or a sewage treatment plant with fecal coliform count not exceeding 250 thermotolerant coliforms per 100mL/MPN. To enable the connection of reception facility pipes to the ship's discharge pipeline, both lines shall be fitted with standard discharge connection in accordance with minimum requirement stated in the Philippine	• 100% compliance and implementation of RA 9275 • 100% compliance with MARPOL (Maritime Pollution) 73/78 and of Philippine Coast Guard (PCG) • Long term, Reversible	• Proponent / MMT • DENR-EMB

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
		Coast Guard's Marine Environment Protection Implementing Rules. • Provision of septic vaults and usable toilets for the workers/staffs for infectious wastes		
	Generation of employment opportunities	• Prioritizing qualified residents from affected Municipalities • Only qualified locals will be hired for operation phase • Conduct of training programs to develop and enhance skills of residents for a high chance of employment	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Long term, Reversible	• Proponent / MMT • LGUs
	Increase in government revenues	• As part of the proponent's corporate social responsibility, the local government together with the affected communities will benefit from the project by hiring of local workers, remit taxes to the LGU, and implement Social Development Programs (SDP). While the national government will benefit from to the high demand and use of magnetite sand in steel manufacturing industry.	• 100% assurance that due and fair benefits shall be given to the LGU	• Proponent / MMT • LGUs
Abandonment Phase				
1. Pulling out of marine vessels from the mining area	Marine water pollution from oil and grease, etc.	• The proper storage and documentation of the used oil and oily rags will be implemented as stated in RA 6969. The waste will then be properly disposed of using PPA or DENR accredited waste handlers/ transporters.	• 100% compliance and implementation of RA 9275 • 100% implementation of environmental best practices in handling marine vessels including proper management practices in handling fuels for	• Proponent / MMT • LGUs • DENR • PCG • PPA

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
			regular maintenance of vessels and equipment. • Separate storage and proper handling and labelling of used oil for identification • In case of oil spill, an oil spill response equipment and qualified personnel will be available on the anchor handling tug or vessel. • 100% compliance with MARPOL 73/78 • Long term, Reversible	
	Maritime traffic congestion	• Coordinate with PCG and/or PPA on the traffic routes or schemes that are likely to be used by large vessels	• 100% compliance with the government agencies with jurisdiction in the Philippine waters	• Proponent / MMT • PCG • PPA

Table ES-5. Summary Matrix of the Environmental Monitoring Plan

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
Operational Phase													
Water	Degradation of water quality in the mining area	- pH - TSS - Color - Oil and Grease	Grab sampling	Quarterly	Identified water quality and control stations within and near the mine operational area	Pollution Control Officer or Environmental Officer	Included in the project cost	pH level (6.5-8.0) Increase in TSS levels by 15mg/L com-pared to baseline value. Change in the apparent color (PCU) of the surface water. Increase in Oil and Grease levels by 2 mg/L com-pared to baseline value.	pH level (6.2-8.3) Increase in TSS levels by 20mg/L com-pared to baseline value. Change in the apparent color (PCU) of the surface water. Increase in Oil and Grease levels by 2.5 mg/L com-pared to baseline value.	pH level (6.0-8.5) Increase in TSS levels by 25mg/L com-pared to baseline value. Change in the apparent color (PCU) of the surface water. Increase in Oil and Grease levels by 3 mg/L com-pared to baseline value.	Investigate possible cause of pollution.	Investigate cause of pollution in parameters monitored and coordinate with MMT the possible causes of pollution.	Investigate cause of decline in parameters monitored; Increase frequency in monitoring parameters to be measured; Coordinate with MMT the possible causes of pollution.
Water	Disturbance to marine and coastal organisms and/or ecosystem	- Planktons - Fish catch - Conditions of coastal habitats	Grab sampling, visual inspection, fish catch monitoring in fish landing stations	Semi-annually for the first year and will be adjusted as necessary for the succeeding years	Within the primary and secondary impact areas (identified stations for planktons, etc.)	Pollution Control Officer or Environmental Officer / third party consultant	Included in the project cost	Decline (~25%) in the abundance, frequency, and distribution.	Evident decline (≥30%) in the abundance, frequency, and distribution.	Highly evident decline (≥50%) in the abundance, frequency, and distribution.	Investigate possible cause of decline in the parameters measured	Investigate cause of decline in parameters monitored and coordinate with MMT the possible causes of decline;	Investigate cause of decline in parameters monitored; Check success rate of rehabilitation programs;

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
												Check success rate of rehabilitation.	Increase frequency in monitoring parameters to be measured; Coordinate with MMT the possible causes of pollution
Water	Domestic wastewater discharges	- Total Coliforms (MPN/100mL) - BOD 5	Grab sampling and Multiple Tube Fermentation Technique (MTFT) (analysis)	Monthly or as deem necessary	Inside the vessel	Pollution Control Officer or Environmental Officer	Included in the project cost	2,000 ** no standard limit set for BOD 5 in Class SC water*	2,500	3,000	Report actual status on a periodic basis, document results. Investigate possible cause of pollution.	Prepare statistical report highlighting the findings. Investigate cause of pollution in parameters monitored and coordinate with MMT and the management the possible causes of pollution. Increase the frequency of effluent monitoring.	Investigate cause of pollution in parameters monitored and coordinate with MMT and the management the possible causes of pollution. Check the efficiency of the STP / holding tanks / marine sanitation device. Implement good house-keeping practices / measures in the vessel.
Water	Generation of hazardous wastes from the operations (e.g. used oil)	Volume of wastes	Inspection	Daily	Inside the vessel	Pollution Control Officer or Environmental Officer	Included in the project cost	3 tons	5 tons	7 tons	Provision of a temporary container within the vessel.	Strict implementation of proper housekeep-ping and waste	Strict implementation of proper housekeep-ping and waste management

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
											Strict implementation of proper housekeep-ping and waste management measures as stated in RA 6969.	management measures as stated in RA 6969. Coordinate with PCG on the proposal disposal of hazardous wastes.	measures as stated in RA 6969. Coordinate with PCG on the proposal disposal of hazardous wastes.
Water	Generation of solid wastes from the workers	Volume of wastes	Inspection	Daily	Inside the vessels and project site	Pollution Control Officer or Environmental Officer	Included in the project cost	300 kg	400 kg	500 kg	Strict implementation of proper housekeep-ping and waste management measures.		
Air	Increased in noise level from naval mining operations and in the community	Noise level, dB	Direct reading / sound level meter	Quarterly	Inside the vessel Identified sampling stations during baseline sampling.	Safety Officer	Included in the project cost	70	73	75	Immediately fix broken equipment or machine, as necessary. Regularly maintain equipment to keep these working at their optimum and minimize noise generation. Continue noise level monitoring and increase frequency	Investigate cause of complaint, determine and address the root cause.	Conduct vessel-wide noise audit of equipment and machineries.

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
											as necessary		
Air	Possible degradation of ambient air quality in the area due to source emission from generator sets	CO, mg/Ncm	Instrumental Analyzer Method	Semi-annually for the first year and will be adjusted as necessary for the succeeding years.	Exhaust pipes of generator sets	Pollution Control Officer or Environmental Officer	Included in the project cost	40	45	50	Regular maintenance of generator sets. Report actual status on a periodic basis, document results. Regular maintenance of the generator sets.	Prepare statistical report highlighting the findings, for the information of Management. Provide recommend-dations if necessary.	Prepare statistical report highlighting the findings, for the information of Management. Provide recommend-dations if necessary.
		NO_2, mg/Ncm	Griess – Saltzman Reaction Method					130	140	150			
		PM, mg/Ncm	High Volume Sampler – Gravimetric Method					130	140	150			
		SO_2, mg/Ncm	Pararosanilin e Method					160	170	180			
People	Potential accidents and adverse impacts on the health and safety of employees, contractors and the communities.	Safe man-hours	Incident reporting, regular monitoring integrated in the Health and Safety Plan of the proponent	Daily inspection of work conditions, PPEs and compliance to proponent's Health and Safety Plan	Project site	Safety Officer	Part of operation cost	Negative feedback to the Proponent by the communities and workers	Formal complaint lodged by the communities and workers	Multiple complaints feed to local media organizations	Proponent to investigate/ inspect subject of negative feedback; Improvement of health and safety measures to address negative feedback	Investigate reason for complaint and address complaint immediately through consultations with employers, contractors or affected stakeholders; Improvement of health and safety measures to address	Immediately conduct consultations or dialogues with complainants and affected stakeholders to determine reason for complaints. Address the complaints and document the responses and actions that will be done; Release an

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
												negative feedback	official statement to media to clarify the issue; Make improvements on health and safety plan to reflect the actions that were conducted so a repeat of the incident or complaints will not happen.
People	Condition of the affected communities vis-à-vis the project operations Community benefits from the project due to taxes, employment, and social development and management plan (SDMP) Complaints management	SDMP programs, employment generation and tax revenues Number of beneficiaries and other parameters required under SDMP reporting by MGB	Coordination with the affected barangays	Quarterly	Affected barangays	Proponent / third party consultant	Included in the SDPMP fund	Negative feedback to the Proponent	Formal complaint lodged by the communities	Multiple complaints feed to local media organizations	Proponent to investigate/ inspect subject of negative feedback; Coordinate with the barangay and MMT	Investigate the subject of negative feedback; Coordinate with the concerned municipalities and MMT	Regular consultations with the concerned stakeholders; Release an official statement to clarify the issue; Coordinate with MMT
People	(Naval) Traffic congestion	Flow and number of vessels passing	Coordination with the PCG, affected LGUs and	Daily	Project site and vicinity	Proponent	Included in the project cost	Negative feedback to the Proponent	Formal complaint lodged by the	Multiple complaints feed to local media	Implement a naval traffic scheme	Investigate the subject of negative feedback;	Prepare statistical report highlighting the

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
		through the project site and its vicinity	other concerned government agencies						communities	organizations	Coordinate with the concerned municipalities, MMT and government agencies	Coordinate with the concerned municipalities, MMT and government agencies	findings, for the information of Management. Provide recommendations if necessary. Coordinate with MMT.

3.3 Risks and Uncertainties

Risks associated with offshore mining are water pollution, increase in turbidity, disturbance to marine biodiversity, occupational health and safety hazards, weather conditions, and natural hazards.

Water pollution may occur at any time during the project operation. This includes oil spill contamination, unregulated and improper solid waste and hazardous waste management, and sedimentation due to increase in turbidity when the non-magnetic sands were returned to the seafloor. Occupational safety hazards may occur during the project operation. This may result to death, injuries, impairment or disability due to accidents.

In terms of climate change, weather condition is more unpredictable making it hard to determine a clear dry season. It also poses hazards to safe mining operations. Natural hazards such as typhoons, storm surge, and tsunamis are major threat to offshore mining because it can cause maritime accidents and danger/distress to crew onboard the ship. The project area is far from the active fault lines but is still vulnerable to tsunamis as it is exposed to Pacific Ocean. In addition, it is very proximate to the Didicas Volcano in the Municipality of Calayan which is found to be active. Earthquake-induced movement of the ocean floor often generates tsunamis and can strike anywhere and can be formed and reach land even before a warning is issued. One of the major hazards due to tsunamis, even of small amplitudes, are the very strong currents that can be generated, that can rip the tie lines and moorings of vessels and cause serious damage to piers and docks. Tsunamis can cause great loss of life and property damage especially when they come ashore.

1. PROJECT DESCRIPTION

MPSA-338-2010-II-OMR was approved on June 9, 2010, as a contract between the Republic of the Philippines and Bo Go Resources Mining Corporation (Bo Go). The MPSA Contract ownership was transferred to JDVC Resources Corporation (JDVC) by Bo Go on November 25, 2011, by virtue of a Deed of Assignment duly approved and confirmed by both company's Board of Directors Resolutions and Corporate Secretary's Certifications. The same Deed of Assignment was duly registered with the MGB Region II in Tuguegarao City, Cagayan on January 27, 2012, and was duly approved a year after, January 25, 2013, by the Department of Environment and Natural Resources (DENR) Secretary.

The proponent, JDVC Resources Corporation, has been issued an Environmental Compliance Certificate (ECC) by DENR Central Office on May 26, 2016, with reference number ECC-CO-1409-0021 for its Cagayan Offshore Magnetite Mining Project. The company, through this application, proposes an amendment to its current ECC. This entails the increase in production rate of its existing offshore mining project from 1.3 MMT to 30 MMT iron concentrate per annum.

1.1 Project Location and Area

MPSA Number 338-2010-II-OMR containing an area of 14,240 hectares is located 14 – 15 kilometers away from the shore of the municipalities of Sanchez Mira, Pamplona, Abulug, Ballesteros, Aparri, Buguey, and Gonzaga in the Province of Cagayan (as shown in **Figure 1-1**). **Table 1-1** shows the technical description of the whole MPSA area. Out of the 14,240 hectares, JDVC Resources Corporation has decided to take a portion of the mining tenement located within the municipal waters of Aparri, Buguey, and Gonzaga as its operational area having an approximate area of 4,999.2358 hectares. **Table 1-2** shows the technical description of the partial DMPF area of the company (as shown in **Figure 1-2**). Also shown in the succeeding pages are the maps of each municipality and boundaries of the affected coastal communities **(Figures 1-4, 1-5, and 1-6)**

Table 1-1: Technical Description of the whole MPSA Area

Corner	Northing	Easting
1	18° 42' 34.56"	121° 13' 26.76"
2	18° 33' 39.60"	121° 29' 45.96"
3	18° 31' 01.20"	121° 40' 18.48"
4	18° 26' 36.24"	121° 53' 32.28"
5	18° 27' 42.84"	121° 58' 06.24"
6	18° 26' 57.48"	121° 58' 31.44"
7	18° 25' 35.04"	121° 53' 36.96"
8	18° 30' 14.40"	121° 40' 04.44"
9	18° 32' 53.16"	121° 29' 37.68"
10	18° 36' 30.96"	121° 22' 01.20"
11	18° 41' 51.36"	121° 13' 14.52"
Area = 14,240.0000 Hectares		

Table 1-2: Technical Description of JDVC's Partial DMPF Area*

Corner	Northing	Easting
Parcel A: Gonzaga		
1	18° 26' 03.97"	121° 52' 12.97"
2	18° 27' 02.73"	121° 52' 13.07"
3	18° 26' 36.24"	121° 53' 32.28"
4	18° 26' 42.84"	121° 58' 06.24"
5	18° 26' 57.48"	121° 58' 31.33"
6	18° 26' 35.04"	121° 53' 36.96"
Area = 1,902.5939 Hectares		
Parcel B: Buguey & Aparri (Portion)		
1	18° 31' 18.52"	121° 35' 51.60"
2	18° 31' 33.40"	121° 35' 51.60"
3	18° 30' 27.90"	121° 40' 08.49"
4	18° 29' 03.79"	121° 44' 23.28"
5	18° 29' 36.56"	121° 44' 33.07"
6	18° 27' 02.73"	121° 52' 13.07"
7	18° 26' 03.97"	121° 52' 12.97"
8	18° 30' 14.40"	121° 40' 04.44"
Area = 3,096.6419 Hectares		

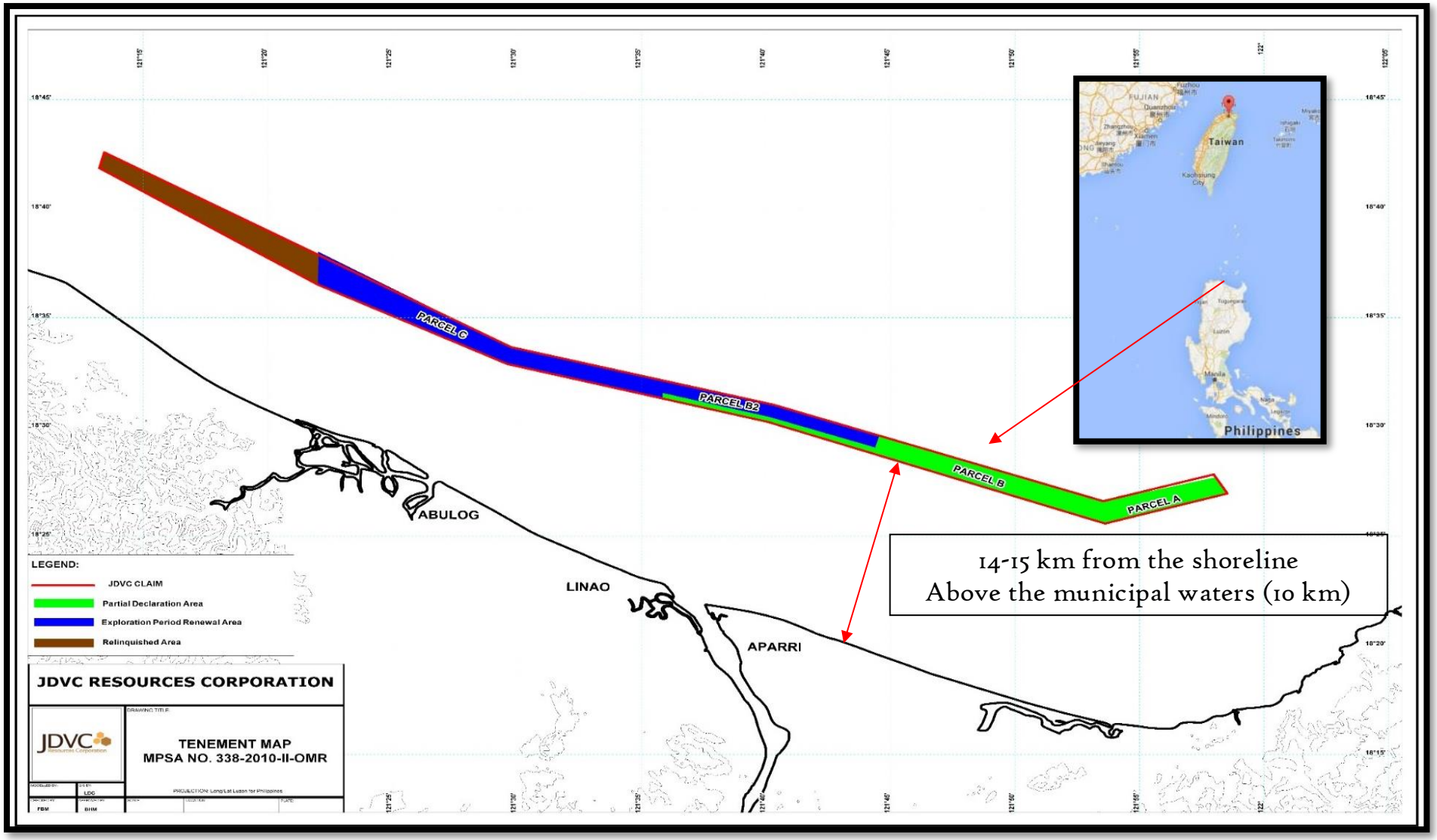


Figure 1-1: Location of the MPSA Area

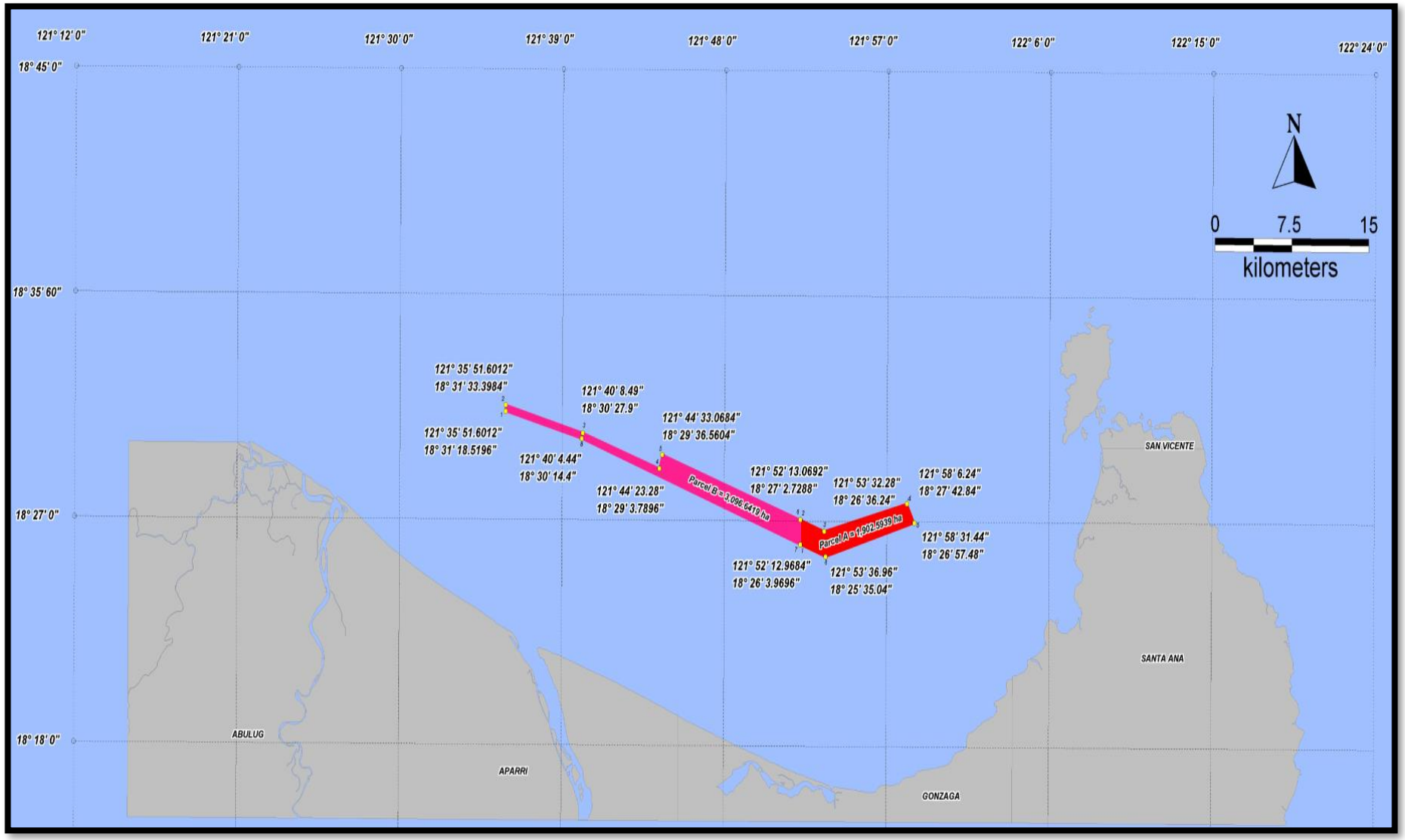


Figure 1-2: Location of JDVC's partial DMPF Area

Figure 1-3: Satellite Image of the whole MPSA area and partial DMPF area (in yellow)

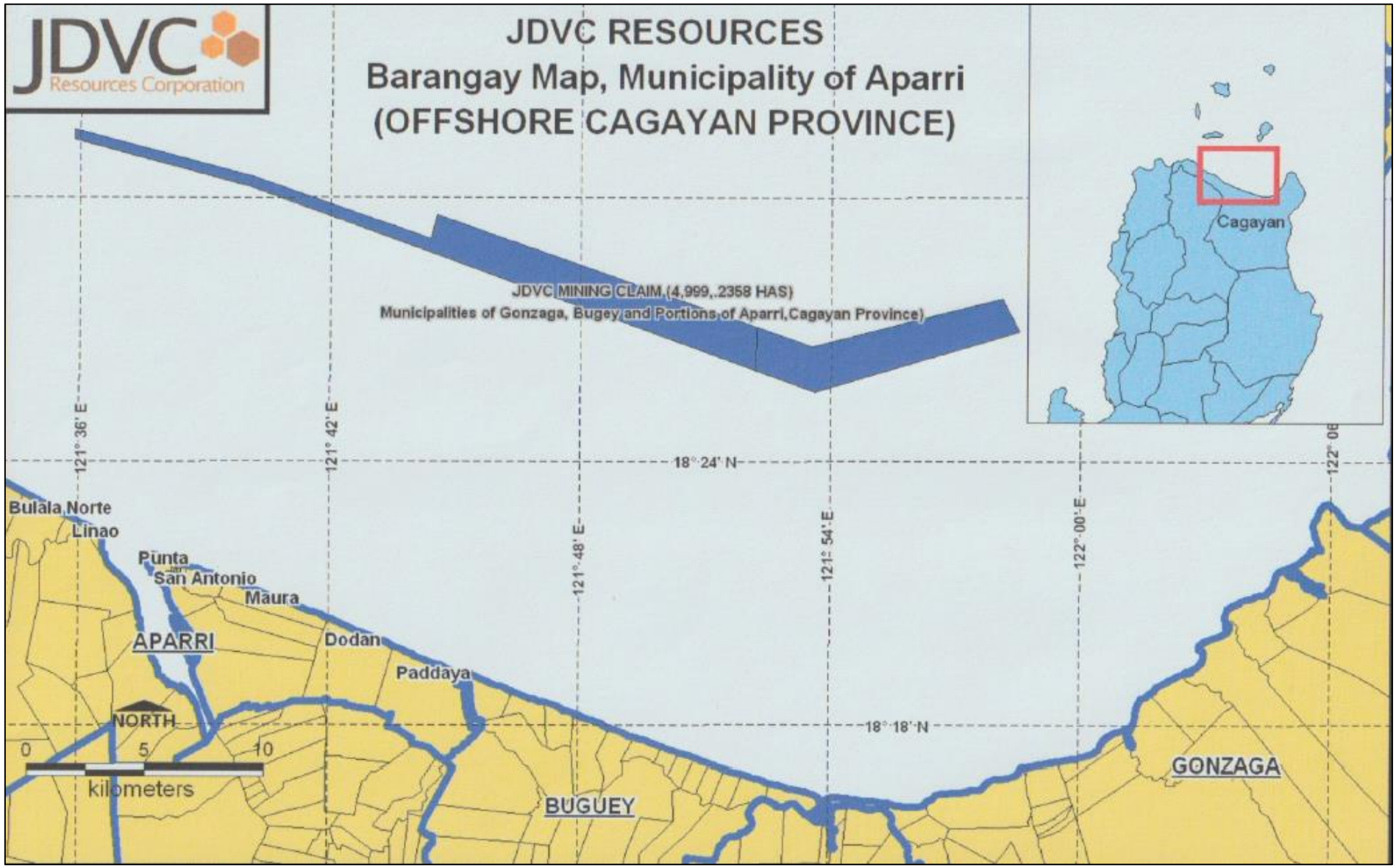


Figure 1-4: Map showing the affected Coastal Barangays in the Municipality of Aparri

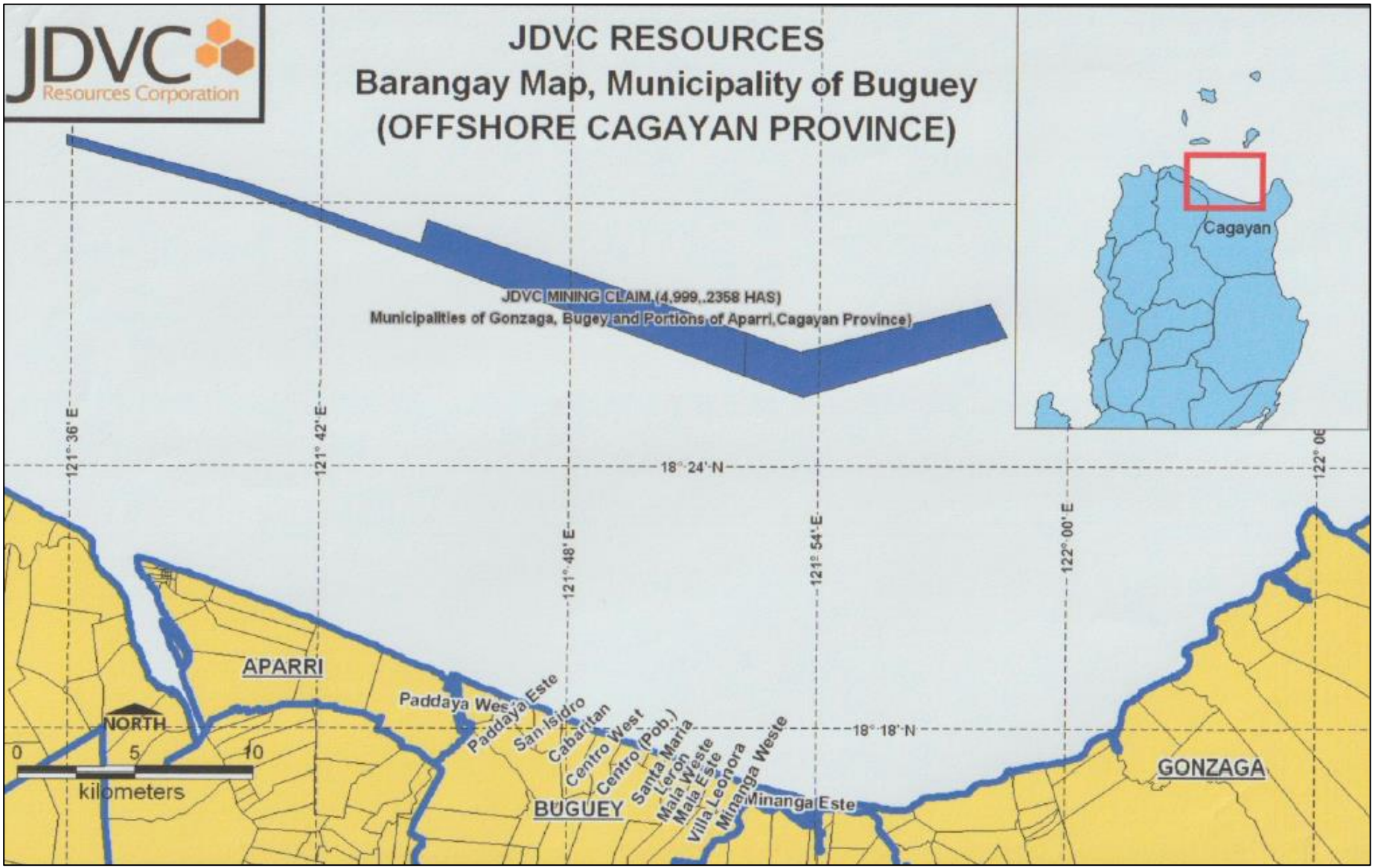


Figure 1-5: Map showing the affected Coastal Barangays in the Municipality of Buguey

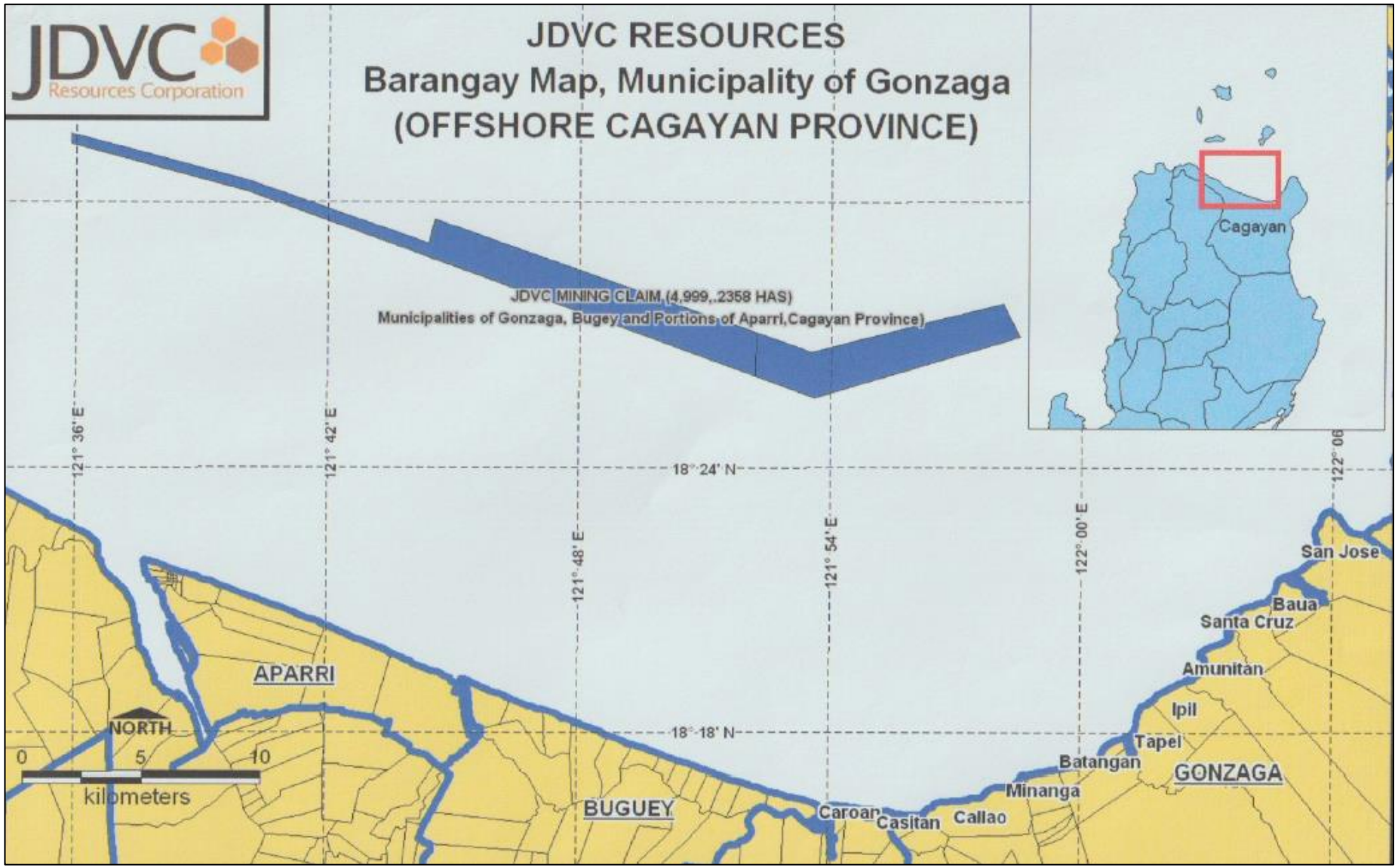


Figure 1-6: Map showing the affected Coastal Barangays in the Municipality of Gonzaga

Accessibility to the Project Area

The MPSA area embracing 14,240 hectares is situated within the municipal waters of the Municipalities of Sanchez Mira, Pamplona, Abulug, Ballesteros, Aparri, Buguey, and Gonzaga in the Province of Cagayan. Tuguegarao City is about 485 kilometers north of Manila via the Maharlika Highway and can be accessed through air transport by Air Philippines and Cebu Pacific and through land by different bus transports, i.e., Victory Liner, Dalin Liner, RCJ Lines, Florida Transport Inc., etc. The Municipality of Gonzaga is in northwest of Tuguegarao City and can be reached from Tuguegarao via Pan-Philippine Highway passing thru Iguig-Alcala-Gattaran-Lallo National Road. Municipality of Buguey is 1 and a half hour away from the Municipality of Gonzaga via land. Municipality of Aparri is accessible from Manila via commercial airlines to Tuguegarao City and by land travel via private cars or buses (2-3 hours), thereafter. Public buses also travel directly from Manila to Gonzaga on a regular basis. Land travel from Manila usually takes 12 to 14 hours.

The Province of Cagayan has one national port and several municipal ports. Republic Act 7922 created the Cagayan Special Economic Zone and Free Port (CSEZFP) at Sta. Ana, Cagayan to be managed by the Cagayan Economic Zone Authority (CEZA). The Port of Irene, which will be the main port of entry for all the vessels and equipment that will be used during the offshore mining operations, is located in Sta. Ana, Cagayan. It can be reached by plane (1 hour) and by bus (11 hours) via Tuguegarao, and then by bus or van (2-3 hours) from Tuguegarao. If by private car, it would take about 12-14 hours depending on the number of stopovers.

The project area is located about 14 kilometers offshore and parallel to the coast of the said coastal municipalities, can be reached by motorized boat (*banca*) or any marine vessel. Travel to the portion of the tenement area directly north of the Cagayan River mouth using a motorized boat usually takes 1.5 to 2 hours.

Direct and Indirect Impact Areas

In accordance with Annex 2-2 of the Revised Procedural Manual (RPM), Sec 3.a, the Direct Impact Area (DIA) is initially delimited at the pre-EIA stage as “the area where ALL project facilities are proposed to be situated and where all operations are proposed to be undertaken.” Based on that definition, the DIA is the 4,999.2358-hectare project area in Gonzaga, Buguey and Aparri.

Potential Indirect Impact Areas (IIA) at the pre-EIA stage, on the other hand, generally refers to the influenced area that could be indirectly affected by the proposed exploration and operation activities. The (indirect) impact area is composed of the entire coastline of Aparri, Buguey and Gonzaga municipalities. This area includes eight (8) coastal barangays in Aparri namely: Bulala Sur, Bulala Norte, Linao, Punta, Minanga, San Antonio, Maura, Dodan, Paddaya; thirteen (13) coastal barangays in Buguey to include Paddaya Weste, Paddaya Este, San Isidro, Cabaritan, Centro West, Centro, Santa Maria, Leron, Mala Weste, Mala Este, Villa Leonora, Minanga Weste and Minanga Estes; and eleven (11) coastal barangays in Gonzaga consisting of Caroan, Casitan, Callao, Minanga, Batangan, Tapel, Ipil, Amunitan, Santa Cruz, Baua and San Jose.

1.2 Project Rationale

The increase in production capacity aims contribute to the increasing demand of iron and steel due to the rapid development of the Philippines and global market demand on steel. The construction sector is a major contributor driven by demand for private residential and office buildings and infrastructure spending by the government, which led to an upswing in demand for steel products. Philippine-based iron and steel manufacturers have expanded their production capacities in the long products sector, but still fall short of domestic demand, mainly because of the absence of an integrated steel mill.

Based on the article released by Board Of Investments (BOI) Philippines last December 2018, A Memorandum of Understanding (MOU) was signed between HBIS Group Co.,Ltd., Huili Investment Fund Management Co.,Ltd., Steel Asia Manufacturing Corporation, and PHIVIDEC Industrial Authority that will jointly implement the Philippine Iron and Steel Project in Misamis Oriental amounting to USD 4.4 billion-worth of investments, the biggest industrial investment from China to date.

The Department of Trade and Industry (DTI) Secretary Ramon Lopez shared that the project will allow the country to substantially produce basic iron and steel products that will also further supply downstream steel products, like metal sheets and bars, including nails, staple wires, and paperclips as well as construction-grade products steel products such as wire rod and wire mesh. It will also support the Philippine's bid to be a major producer of high-quality and safe steel products by 2030.

According to the Board of Investments (BOI), the Philippine Iron and Steel Project will reduce trade deficit as total domestic and export sales of slabs and hot rolled coils (HRCs) from the project would amount to Php 144.279 billion. Iron and steel is the country's 5th import by commodity group valued at USD 4.91 billion from January to October 2018, a growth of 39.4% from 2017.

Magnetite sand is composed of a high percentage of magnetite, which is ferromagnetic with chemical formula Fe_3O_4 (ferrous, ferric oxide) and one of the several iron oxides found in the world. It is a source of iron ore and is currently and widely regarded as an important source of iron. There is a high demand and use of magnetite sand in the steel manufacturing industry. It can be used to produce crude steel, billet and reinforcement bars, especially suitable for piping products, and can be used as well to make steel plates. Currently, over 620 million tons a year are being used to manufacture steel. Compared to traditional iron ore mining, magnetite sand is cost competitive about 40% cheaper.

The mineral is often mined as an ore of iron, and lately, through the use of magnetic separator / processing plant and chemical intervention, magnetite iron sand became a primary source of raw material like iron ore for steel and cast-iron manufacturer when they are developed in the form of Iron Lumps, Iron Balls, Iron Fines, and Iron Pellets. When formed as such, they are technically called Direct Reduced Iron (DRI) that are used to feed electric blast furnaces in the iron and steel making process.

Currently, the demand for this DRI feed stock is very high and fetching as high as US $ 82.50 per dry metric ton, to a low of US $42 in China, depending on the demand and inventory situation. Hence, these recent validated phenomena in the Steel Industry have led to the upsurge in demand in the global steel-manufacturing sector for Magnetite Iron Sand. When properly processed, high value vanadium and titanium can also be effectively obtained from magnetite iron sand.

The Philippines is a country that is rich in mineral resources where it is touted to be fifth largest resources of mineral reserves, following the countries like United States, Australia, Brazil and Peru. However, these vast mineral reserves have not been effectively tapped due to socio-economic reasons, legal entanglement, environmental concerns, and lack of capital, and lack of governmental push to make it happen. Last December 13, 2018, a Memorandum of Understanding (MOU) was signed between HBIS Group Co.,Ltd., Huili Investment Fund Management Co.,Ltd., Steel Asia Manufacturing Corporation, and PHIVIDEC Industrial Authority that will jointly implement the Philippine Iron and Steel Project in Misamis Oriental amounting to billions-of-dollars-worth of investments. This will be comprised of two phases which will generate over 20,000 additional job opportunities. This will also allow the country to substantially produce basic iron and steel products that will also further supply downstream steel products, like metal sheets and bars, including nails, staple wires, and paperclips as well as construction-grade products steel products such as wire rod

and wire mesh. It will also support the Philippine's bid to be a major producer of high-quality and safe steel products by 2030.

Per existing record of Mines and Geo-Sciences Bureau (MGB) of the Department of Environmental and Natural Resources (DENR), the mineral reserve of the country stood at 6.67 billion Metric Tons of Metallic Minerals and 78.74 Billion Metric Tons of Non-Metallic Minerals, excepting Magnetite Iron Sand that has heavy deposit concentration along the coasts in the Provinces of Pangasinan, La Union, Ilocos Sur, Ilocos Norte, and Cagayan.

1.3 Project Alternatives

The proposed modification focuses on the increase in production rate of iron concentrate per annum, from 1.3 MMT to 30 MMT, additional siphon vessels, storage barges, and handling tugs, hence, no changes were considered for the facility siting, technology selection, operation processes, design selection, and alternative resources.

Facility Siting

The project is within the area bounded by the coordinates stipulated in the MPSA by virtue of the Deed of Assignment in favor of JDVC Resources Corporation and as approved by the Mines and Geosciences Bureau.

No alternative sites were considered inland or within the vicinity of Cagayan River since this will not be practical from economic point of view and in addition, the construction of site facility inland will have greater negative social impacts to the community.

Development Design

The proponent considered the extraction of magnetite starting only within mine operational area from a distance of 14 – 15 km away from Cagayan shoreline. This is to prevent the negative impact of disturbed sand on the quality of water that was traditionally used by the people for fishing.

Process/ Technology Selection - The best practical technology that would result to reduced pollution and damage to environment and people.

The extraction for magnetite sand will simply utilize a siphon vessel. The extracted sand will then be temporarily stored, dewatered, and separated from the non-magnetite sands on board barges. All the processes for extraction will be strictly mechanical, no chemicals will be used. In addition, all phases of the operation, from the extraction up to the magnetic separation, will be done offshore. The process is smaller in scale compared to the extraction methods to be used inland.

Only magnetite materials will be extracted. Caution will be practiced by the proponent to keep the edge of the pipe as close as possible to the sea floor to lessen the agitation of the sand, which may cause the deterioration of the quality of the water, which will impact negatively on marine organisms. Such process entails less impact to the environment in general. The method to be used will depend on several factors including the depth to the seabed, the degree of consolidation of the sands, ocean weather conditions, capital and operating costs, etc. At this early stage the preferred option is the plain siphon.

The negative environmental impact of the magnetite offshore extraction and recovery process is NIL. The extraction process is via siphon vessel with magnetic separator, and processing apparatuses on board. This system is no hazard at all and no social complication as the siphon vessel is stationed at

the ocean far from the shore. The siphoning action of the Siphon Vessel for Magnetite Sand Offshore based on findings of the experts and specialists does not produce significant sea bottom topography disturbances due to the following reasons:

1. There is no explosive use, hence there is no blasting activities.
2. There is no permanent structure buried to the sea bottom.
3. The siphoning area underneath the sea agitated by the siphon pipe/s, while it can cause localize turbidity, would immediately cave in upon pull out of the siphon pipe/s due to continuing action of the sea under current.
4. The magnetic separator on the siphon vessel would only qualify about 10% average for quality grading required hence, will return back to the same area the 90% of the lesser grade magnetite Iron Sand.
5. The sand mounts with lesser magnetite that can be created by the return after magnetic separation under the sea may even become series of new fishing areas during calm season nearer the shorelines, and
6. The continuing replacement every time it rains allow continuing replacement of the 10% extracted for higher grade as separated for export shipment.

Resource utilization - A rationalized utilization of the resources by optimizing the socioeconomic benefits with a sustained environmental protection / rehabilitation mechanism.

Based on exploration activities conducted by the proponent, magnetite deposit was found to be of significant amount in the municipal waters of the towns of Aparri, Buguey and Gonzaga.

As may be required by the LGU and the DENR, the proponent as part of their corporate responsibility, is committed to contribute to the community by hiring of local workers, remit taxes to the LGU, and implement Social Development Programs (SDP). The SDP will be designed by the proponent in cooperation with the LGUs, and also through the mechanisms of the Multipartite Monitoring Team (MMT), which will be established as a compliance of ECC conditions.

Table 1-3: Summary of Comparative Environmental Impacts of Each Alternative

Parameters	Proponent's Plan	Environmental Impacts
Facility Siting	Will confine the operation in marine vessel, also called siphon vessel.	If caution will be observed during suction and dumping of sand, there will only be minimal impact on water and marine organisms.
Development Design	Extraction of magnetite will be confined to marine waters starting from 14 – 15 km offshore. Dredging of sand in Cagayan River was never an option for the proponent.	Typical impacts of the activities include increase in turbidity of marine waters. The proponent will observe utmost caution to lessen the impacts of its operation.
Process / Technology Selection	The extraction for magnetite sand will utilize suction pump. The extracted sand will be stored, dewatered, and separated from the non-magnetite sands in a marine vessel.	The discussion on impacts of the process / technology selection is already mentioned in the discussion above.
Resource Utilization	Extraction of magnetite deposit will be done in the municipal	To lessen the impacts to the community, extraction

Parameters	Proponent's Plan	Environmental Impacts
	waters of Aparri, Buguey, and Gonzaga.	will be confined 14 – 15 km away from the shore to lessen its impacts on the community and marine organisms.

No-Project Option

The Philippines is situated along a well-defined belt of volcanoes called the Circum – Pacific Rim of Fire, where the processes of volcanism and plate convergence resulted in the formation of abundant and important metallic mineral deposit. It is richly endowed with metallic resources, and it has the potential to be among the top 10 largest mineral powers in the world. In terms of occurrence per unit area, it ranks third in gold, fourth in copper, fifth in nickel and sixth in chromite.

With nearly a trillion dollars' worth of mineral potential for copper, gold, nickel and iron, the Philippines stands head and shoulders above other mineralized countries in the world. Given the country's impressive mineral legacy, this can be a way to uplift the lives of marginalized local people living in the countryside. Cagayan Valley have significant mineral potential specifically iron sand deposits, which to date remain largely unexplored and untapped. If the province mineral resources are properly harnessed the economic growth will make the province grow more. If the iron sand will be left out, the minerals contribute nothing to economic growth.

Directly and indirectly through economic multipliers, mining will add employment and jobs. It will add businesses and commerce to the country, in addition to the social development to local and surrounding communities, such as additional health/hospitals, schools and livelihood projects. As per DOLE data, about 250,000 workers were directly employed by the mining industry in 2012. More importantly, large scale mining companies willingly take on unskilled workers and give them technical training in welding, drilling, heavy equipment operation and mechanics, which they can turn them as skilled workers. The mining industry pumps billions of pesos in local economies – buying goods and services and raising the community standard of living.

This project will have a substantial impact on the regional and National economy during construction, operation and on the basic principle of converting natural resources into currency. Given the mine life of 20.2 years, the project is an excellent prospect for long term development and operations.

Taxes to be paid by this project to the government per year has a direct impact to the national economy, by providing employment to the locals, taxes, and social development projects specially the local where the project is located.

1.4 Project Components

The extraction component of the proposed project will all be operating offshore, or beyond 14 – 15 kilometers from the shoreline and there will be no permanent structures to be built in the project area. There will be no ore / mineral processing on board the siphon vessel, only extraction of magnetite sands will be involved in the mining operation with the use of magnetic separator. The operation of the siphon vessels will be subcontracted to local shipping company that can provide the required services of the Proponent. **Table 1-4** shows the proposed modification of the project expansion in terms of its components.

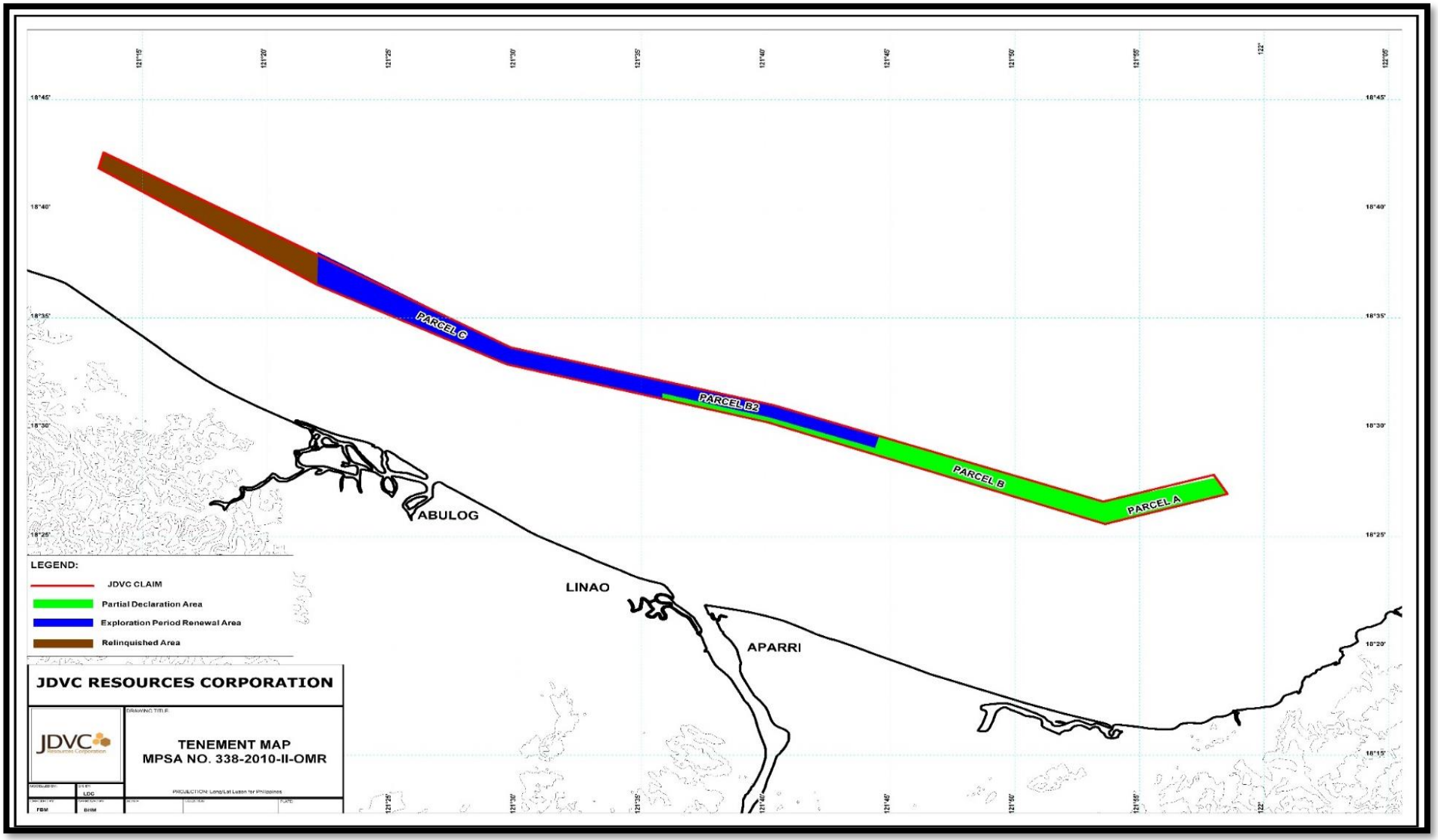


Figure 1-7: Location of the MPSA Area

Table 1-4: Proposed Modification

Existing	Proposed
• 1.3 MMT production rate • 1 Siphon vessel (dredge barge) • 3 Separator Barges • 1 Panamax Vessel • Gravity Separator • Magnetic Separator • Hopper / Chute • Generator Set	• 30 MMT production rate • 4 Siphon vessels equipped with generator sets, magnetic and gravity separators and hoppers / chute • 12 LCT / Storage Barges • 4 Anchor handling tugs • 4 Support Tugboats

Siphon Vessel (Cape Size Vessel)

The Siphon Vessel will act as the offshore floating production and storage vessel. It uses its differential pressure suction system to suck the sand and water from the sea bottom to vessel deck where the equipment (e.g., Differential Suction Systems with airlift system, arrays of Magnetic Separators and Distributors, Transport Conveyor, etc.) are located. The proprietary suction system with air lift capability will suck gross sand from sea bottom to be directed to our rotary slurry distributor and onwards to our array of magnetic separators. The tables below show the description and itemized layout of the siphon vessel.

Table 1-5: Description of the Siphon Vessel

Length Over All (LOA)	100.548 M (330 Feet)
Beam	36.576 (120 Feet)
Depth MLD	7.620 M (25 Feet)
Design Draft	abt. 6M
Deck Loading	25 T/M^2
Equipment	• 2 cranes; • 12 sets (1 x 3 or 36 magnetic separator), and; • Anchor Handling tug filled with oil spill response system

Table 1-5a: Itemized Table of Siphon Vessel Layout

Name	Purpose	Qty/ Train	UOM	No. of Trains	Total
Siphon Vessel	S.I. Magnetite vessel – Boat processing plant	1	Unit	1	1
Ejector Assembly	Suction of magnetite sand from the bottom of the sea	1	Unit	3	3
Pipeline – 600 MM Flexible Hose	For ejector discharge pipeline going to distributor	1	Lots	3	3
Ejector Pumps	Prime mover to pump the water and sand from the bottom of the sea through ejector	4	Units	3	12
Suction Pipeline	Seawater pipeline that on the suction side of the pump	1	Lot	3	3
150 MM Discharge Pipeline	Seawater pipeline that on the discharge side of the pump	1	Lot	3	3
Rough Signed Magnetic Separator	Partially separate the magnetite for bulk sand and seawater. It will take approximately 80% of the sand	12	Sets	3	36
Final Double	Final stage of separation in which output is at	12	Sets	3	36

Name	Purpose	Qty/ Train	UOM	No. of Trains	Total
Magnetic Separator	least 99% magnetite				
Vertical Conveyor Belt Type – 20M HT.	Used to transfer magnetite from hatch to horizontal pipe conveyor to other hatch to maximized the capacity and to balance the load of the vessel	1	Unit	3	3
Horizontal Pipe Conveyor – 15M	To catch the magnetite load from vertical conveyor and transfer to the designated hatch to maximized or to balance the load of the boat	1	Unit	3	3
Vertical Conveyor Belt Type – 25M HT.	Transfer magnetite to the receiving horizontal pipe conveyor going to transportation vessel	2	Units	3	6
Horizontal Pipe Conveyor – 30M	Receiving horizontal pipe conveyor to the other boat to mobilize the magnetite to inland for final processing	2	Units	3	6
Desalination System SWRO System – 12,000 CMD	Fresh desalinated is use in the wet drum in the final process of the separation	1	Lot	For all train	1
Freshwater Pipeline	Pipeline for magnetic separator (installation)	1	Lot	3	3
Vertical Bucket Conveyor – 25M	Transfer magnetite to small carrying boat/vessel	2	Units	2	4
Horizontal Conveyor Belt type – 25M	Receiving horizontal conveyor to transfer to small vessel	2	Units	2	4
Magnetic Separator / Distributor Flatform	For magnetic separator and distributor support	1	Lot	3	3
Ejector Assy. Flatform	For ejector assy. support	1	Lot	3	3
Post Support Crane	For ejector assy. and pipe conveyor lift support	11	Sets	For all train	11
Hatch	For magnetic storage	9	Units	1	9
Control Office	To control the machine and engine for the operation	1	Lot	1	1
Pipe Lifter Roller	For ejector pipeline flexible hose lift support	6	Sets	For all train	6
Distributor	Distributor is storage tank with continuous flow for SMS	2	Units	3	8
Pipe	From distributor receive by pipe going to SMS	12	Units	3	36
Engine Room	To control the ship propeller and its different utilities	1	Lot	1	1
Hatch Horizontal Pipe Conveyor – 30M	To catch the magnetite load from horizontal pipe conveyor and transfer to the designated hatch to maximize or to balance the load of the boat	1	Unit	3	3
Motorized	Valving support for distributor	2	units	3	6

Name	Purpose	Qty/ Train	UOM	No. of Trains	Total
Butterfly Valve					

Magnetic Separator

Magnetic Separators are arranged in three (3) stages. One (1) Roughing Single Magnetic Separator (RSMS) and Two (2) Final Stage Magnetic Separator (FTMS) for every set will separate the magnetite sand from the slurry. Magnetite content of sand suction from the seabed is 10 percent by weight.

Anchor Handling Tugs

Anchor Handling Tug is part of the complement for the offshore mining operations which sole responsibility is to move and position anchor blocks used in securing the Siphon Vessel and Drill Barge. The tugboat will assist in Foreign Vessels to load Magnetically separated Iron Ore from siphon vessel, and it will also be used to retain the Oil Spill Response Equipment to be used in case of emergencies (Oil Spills, Etc.)

Landing Craft (LCT) / Storage Barges

Landing Craft or LCT is part of the complement for the offshore mining operations which will be alongside the Siphon Vessel to receive Magnetite Iron Sand. It will also be used as transport magnetite iron sand from vessel to foreign vessel for onward foreign delivery.

Existing Facilities (Onshore)

The admin office and staff house which are already existing, used during the exploration drilling activities has been established in CEZA. Power is supplied by CAGELCO and communication facilities by mobile phones and internet are also pre-existing. This onshore facility is not covered by this application.

1.4.1 Energy / Power Requirement

All vessels involved will power the suction pumps and other auxiliary equipment using generator sets. The generator set is the low noise diesel type, which has insulation materials as part of the cover of the unit.

1.4.2 Water Supply

Water supply, both for drinking and for utilities, will be sourced and processed onshore. Estimated domestic consumption is 5 cubic meters daily which is used for bathing, cleaning, washing of clothes and dishes. Drinking water for employees are delivered onboard in a water gallon container. No water requirement is needed for the operation.

1.4.3 Fuel Supply

The fuel and oil requirements of the equipment, ships will be sourced out from the locally available fuel-oil supplier on-shore. No refueling stations will be constructed at the project area.

1.4.4 Pollution Control Devices

The equipment will include the pipe and suction pump, which will be the primary tool for extracting the sand. All support facilities such as separator, holding compartment and other mobile and fixed equipment for the mineral processing will all be located offshore on board the siphon vessel. The process is projected to have at least 10% recovery rate for the extracted sands. The non-commercially sand will be returned to the area of extraction through a pipe to minimize the suspension of the finer sediments. No chemical additives will be used in the whole processing to minimize the impact on the benthic organisms that might be disturbed.

All vessels in the area will abide by the laws of the Philippines Coast Guard (PCG) and Philippine Ports Authority (PPA) regarding the discharge of domestic and liquid waste for vessels. This will include but not limited to proper segregation of all domestic waste in the vessel. Disposal will be through the PPA accredited facilities. To avoid any accidental spills, all maintenance activities of the ship and auxiliary equipment will be conducted on-shore at the shipping docks of the subcontracted company. The vessel will also comply with the contingency or mitigating measures for accidental oil spills as required by the PCG. During siphoning activity, the proponent will install a silt curtain (barricade) within the excavation/mining site to eliminate turbid waters from spreading to the adjacent water bodies.

Vessels to be used will also include in their contingency plans the rescue plan for the workers, nearest hospitals, and organizations or local and national government agencies to contact in case of emergency. The vessel will also provide the appropriate number of life jackets and life rafts based on the number of workers in the vessel.

Vessels to be engaged for the operation shall be provided with either holding tanks, a marine sanitation device or a sewage treatment plant with fecal coliform count not exceeding 250 thermotolerant coliforms per 100 milliliters MPN (most probable number) as determined by filter membrane, multiple tube fermentation analysis or any equivalent analytical procedure. The devices shall be designed in such a manner that the geometric means of the 5-day Biochemical Oxygen Demand (BOD5) of the effluent samples taken during the test period do not exceed 50 mg/l. To enable the connection of reception facility pipes to the ship's discharge pipeline, both lines shall be fitted with standard discharge connection in accordance with minimum requirement stated in the Philippine Coast Guard's Marine Environment Protection Implementing Rules.

1.5 Process / Technology

1.5.1 Method and Technology of Offshore Mining

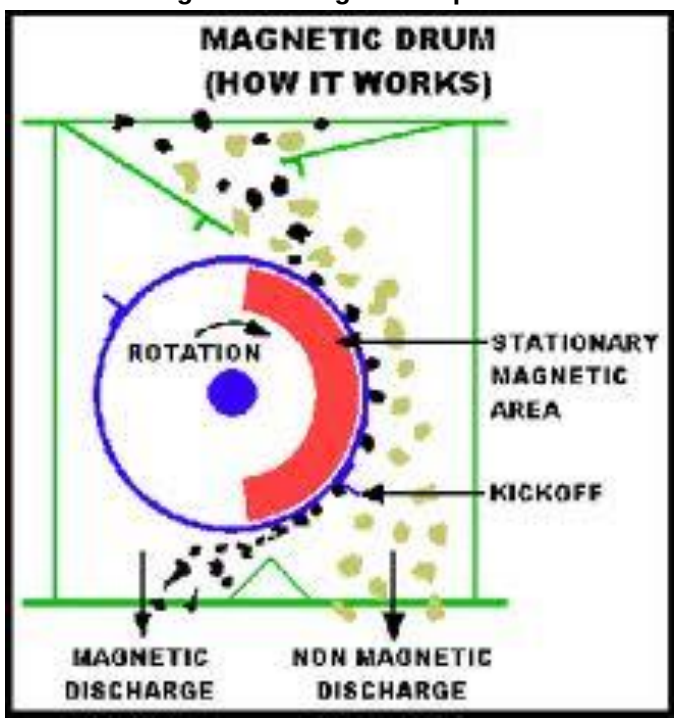
The process of magnetic separation is a mechanical process where the iron sand will be attracted to the magnet and will separate it from the pure sand (waste materials) using magnetic separator on board the siphon vessel. The main processes for the project are mineral extraction, sand and water separation, magnetic separation, and storage before importation. There will be no chemical process involved in the operations.

The sand extraction process will be conducted using the main facility of the project. Siphon Vessel are vessels that extract materials through a suction hose connected to the vacuum pump. The pump produces a vacuum, which pulls the materials into the suction hose. For extraction of compacted materials, dredgers have a cutter head at the end of the suction tube. The cutter head is used to loosen the materials and feed it to the opening of the suction tube.

The extracted sand will then be properly stored in the ship's holding compartments for processing in the magnetic separator. The sand and water separation process will be conducted on the piling barges. The materials will be transferred from the suction vessel to the piling barge through a hopper or chute. The denser materials are then processed in the magnetic separator. It will pass through a two-stage magnetic separation process. The non-commercially important sand will then be returned to the seabed using a separate pipe and pump. The discarded sand shall be brought as close as possible to the sea bottom, to minimize the suspension of the fine sediments during operations.

The denser materials are then separated using a magnetic separator. This process will separate the magnetic sand, those that are attracted by a magnet, from those that are not. Magnetite is the most magnetic mineral on earth based on published records. **Figure 1-7** is a diagram of the magnetic separation process.

Figure 1-7: Magnetic Separator



As discussed above, the project will utilize mechanical processes in extracting the commercially viable sand. All activities, as shown in **Figure 1-8**, from the extraction using the siphon vessel, to the processing which will use magnetic separators, up to the storage and exportation of the sand, will be done offshore.

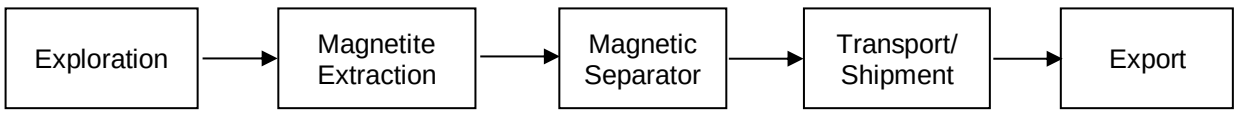


Figure 1-8: Flowchart of Mining Operation

1.5.2 Pollution Control Devices

Please see Section **1.4.4 Pollution Control Devices.**

1.5.3 Waste Management System

Each vessel is equipped with waste or garbage management plans which are formulated for complete guidance which comprises of procedures in collecting, storing, and disposal of waste generated onboard the vessel as per the regulations provided in Annex V of MARPOL 73/78.

Management

- The wastes or garbage generated by the shipboard would be collected and stored after separation and processed and handled following the requirements concerned.
- The wastes on shipboards would be delivered to the port reception facilities whenever practical to minimize amount of garbage discharging at sea.
- The vessel should comply with the requirements of Annex V of MARPOL 73/78 and amendments to this annex when discharge garbage at sea.
- Filling in the Record Book for Shipboard-generated Garbage as per the requirements when processing or handling garbage on shipboard.
- All crew members are encouraged to minimize the taking aboard of potential garbage and on-board generation of garbage.
- Whenever practical, use of reusable packaging and containers would be encouraged to decrease the amount of garbage being generated.
- Whenever practiced options exist, consider stowage systems and methods that reuse covering, dunnage, and shoring, lining and packing materials;
- Dunnage, lining and packing materials generated in port during cargo discharge and garbage generated during ship repairing would preferably be disposed of to the port reception facilities and not retained on board for discharge at sea.

Collection

- There are seven colors of distinctively marked on the cans, drums, bags, bins or other receptables to collect garbage categorically.
- Collection: The person involved should collect the garbage and deliver to storage base on the following requirement, Chief Officer / Chief Engineer should arrange staff to classify and deliver the garbage from short-term storage to long-term storage daily.
    - Plastic garbage may be kept in short-term storage and then transferred to the Poop Deck, placed at the location of long-term storage and delivered to the port reception facilities.
    - Food wastes may temporarily be stored in the kitchen, if it cannot be discharged at sea or incinerated on-board, which should be transferred to Poop Deck and placed at the location of long-term storage and disposed by the port reception facilities in accordance with the laws of the receiving country.
    - Domestic wastes (i.e., as paper products, rags, glass, metal, crockery, etc.), incinerator ashes, operational wastes, and cargo residue should be stored in Poop Deck long-term storage and delivered to the port reception facilities for disposal.
    - Cooking Oil should be stored in Galley long-term storage then delivered to the port facilities for disposal.
    - Expired medicine, used battery, fluorescent lamp and oily and contaminated rags should be properly stowed and separated with above-mentioned garbage.
    - Prior to sailing, the Chief Officer is responsible for arranging the collection of wastes generated from the vessel and deliver to the nearest port reception facilities.

Storage

- Galley, engine room, bridge and cabin have been designated as short-term storage location, Poop Deck have been designated as long-term storage location.
- Garbage from short-term and long-term storage facilities must be disposed by the port reception facilities.
- Garbage shall be contained in cans, drums, boxes, bags or other containers categorically at storage locations.
- In dischargeable areas, Boatswain arranges the crew to discharge the garbage.

- Disinfection / sterilizing would be applied regularly at short/long term garbage storage location.
- Boatswain is responsible for lashing / securing the garbage receptacle.

Procedure of Garbage Discharge

- In port or areas where discharging is prohibited, dischargeable garbage should be delivered to the storage location and stored in receptables for delivering to the port/shore reception facilities or discharged at sea when in dischargeable areas.
- When discharging garbage at sea, all dischargeable areas have to be confirmed and determined whether the garbage can be disposed into the sea according to the requirements related to the category of garbage, voyage area, and distance from the nearest land.
- No garbage shall be disposed into the sea without the Chief Officer or Master's permission.
- Wastes generated in port during cargo discharge should be delivered to the port/shore reception facilities prior to sailing.
- Chief Officer should arrange the garbage reception in port prior to arrival, deliver the garbage to the port reception facilities in time and ask for the receipt or attestation which stating the quantities estimates of garbage received and the receipt or the attestation associated with the Record Book should be kept on board at least two (2) years.

1.5.4. Maintenance of Vessels

There are main types of equipment/machinery maintenance:

1. Preventive or Scheduled Maintenance System

In this type of system, the maintenance is carried out as per the running hours or by the calendar intervals (i.e. every week, 6 months, yearly, etc.) of the equipment. The maintenance is carried out irrespective of the condition of the equipment. The parts that must be replaced if it is written in the schedule, even if they can be still used. The purpose of the schedule maintenance is:

a. To ensure that all maintenance is carried out with adequate intervals and under the planned maintenance system's schedule.
b. To maintain and keep all engines, machinery, and technical components in good working order at all times, avoid stoppages and maintain charter party speed and consumption requirements.
c. To avoid interruption and oversight of work by covering all the work.
d. To make clear demarcation between onboard and shore maintenance work.

2. Condition Maintenance System

In this system the machinery parts are checked regularly. With the help of sensors etc., the condition of the equipment is accessed regularly, and the maintenance is done accordingly. This system requires experience and knowledge as wrong interpretation may damage the machinery and lead to costly repairs which may not be acceptable by the company.

3. Corrective or Breakdown Maintenance

In this system the maintenance is carried out when the equipment breaks down. This is not a suitable and good method as situations may occur wherein the equipment is required in emergency. The advantage of this system is that the working of machinery parts is used to its full life or until it breaks.

All maintenance works of the vessels shall be supervised by the Chief Engineer, Chief Officer or First Engineer. The vessel is equipped with maintenance checklist for the frequency (i.e., daily, weekly, every 3 months, etc.) of the equipment's maintenance and for monitoring of actions taken when repair/maintenance occurred.

1.6 Project Size

Mineral Resource Estimate

The project will cover an area of 4,999.2358 hectares of the 14,240-hectare MPSA area as its operational area and an approved annual extraction rate of 1.3 million DMT in its previous ECC. The following tables show the proposed modification in terms of the project's extraction capacity **(Table 1-7 and 1-8)**.

The mineral resource categories used are indicated and inferred. The Indicated Resource is based on drill holes with 2,000-meter spacing, while the Inferred Resource is based on 4,000-meter drill hole spacing. The indicated resources are those within Parcel A (Gonzaga area) which has been prioritized for mining, while the inferred resources are those within Parcel B-1 (Buguey area and portion of Aparri) of the 4,999.2358-hectare area.

Results of estimation show a combined indicated resource of 606,457,972.52 DMT with an average grade of 25.47% MF, which at 100% recovery, is equivalent to 154,466,259.02 DMT of magnetite concentrate; and an inferred resource of 63,179,310.69 DMT with an average grade of 47.71% MF, which at 100% recovery is equivalent to 30,140,910.80 DMT of magnetite concentrate. The summary of the resources is tabulated in detail by resource category in **Table 1-6**.

Table 1-6: PMRC Validation Mineral Resource

Level	Tonnage (DMT)	Grade (%MF)	DMT Conc.
INDICATED RESOURCE			
0 – 5 meters	114,167,560.95	23.16	26,445,391.99
5 – 10 meters	158,146,240.41	41.55	65,708,816.19
10 – 15 meters	164,786,486.19	24.68	40,668,170.45
15 – 20 meters	153,893,321.90	12.17	18,727,301.51
20 – 25 meters	15,464,363.07	18.86	2,916,578.87
Total	606,457,972.52	25.47	154,466,259.02
INFERRED RESOURCES			
0 – 5 meters	63,179,310.69	47.71	30,140,910.80

Table 1-7: Current Production Estimates

Indicated Reserve (MMt)	Yearly Production (Raw), MMt	Rate of Recovery (%)	Number of Production Lines	Iron Concentrate Production per Annum (MMt)
606.458	6.91	95	3	1.3

Table 1-8: Proposed Production Estimates

Indicated Reserve (MMt)	Yearly Production (Raw), MMt	Rate of Recovery (%)	Number of Production Lines	Iron Concentrate Production per Annum (MMt)
606.458	159.46	95	7	30

The annual iron concentrate production in MMT of the existing ECC of the project is 1,300,000 metric tons, this proposed modification intends to increase its annual production capacity to 30,000,000 metric tons to cater the increasing global demand of iron.

The only process of the project's operation will be the magnetic separation. This is a mechanical process where the iron sand will be attracted to the magnet and will separate it from the pure sand

(waste materials) using magnetic separator on board the siphon vessel. The main processes for the project are mineral extraction, sand and water separation, magnetic separation, and storage before importation. There will be no chemical process involved in the operations.

1.7 Project Development Phase

1.7.1 Pre-Operations Phase

- *Exploration Phase*

The exploration activities conducted in the area consisted mainly of bathymetric survey / seabed profiling, initial diamond drilling and sampling, physical and chemical analysis of core samples, initial resource estimation and confirmation / infill drilling and final resource evaluation.

- *Bathymetric Survey / Seabed Profiling*

The bathymetric survey is usually the first activity that must be done when exploring for ore minerals that are located on offshore waters or seas. The objective is to measure the depth of water with respect to the location of seabed to establish the topographic configuration of the seabed.

Fastrock Mineral Resources (Fastrock) was engaged by JDVC Resources Corporation to conduct this activity. Fastrock used a very simple method yet effective approach to measure the depth of water within the vicinity of the project area. The basic tools used by Fastrock for this activity were handheld GPS, Eco Sounder, and rope. Fastrock also simultaneously took samples by using a series of large magnets to have an idea on the presence of magnetite sand on the seabed.

To further confirm the bathymetry result, the company has also conducted a marine geophysical survey consisting of high-resolution seismic profiling and bathymetric measurements. In this activity, the water depth was again conducted. The actual bathymetry study conducted by the company on two occasions has confirmed the data from British Oceanographic Data Centre. It shows that the areas subject of the DMPF has a depth of 50 to 75 meters for Parcel A and 55 to 200 meters for Parcel B.

- *Side Scan Survey and Sea Bottom Profiling Survey*

The survey vessel conducted Side Scan Survey and Sea Bottom Profiling to check the presence of aquamarine life, sunken ships, buried pipelines and other relevant structures that will have impact on the mining area of JDVC Resources. Side-scan sonar (also sometimes called, side imaging sonar, and bottom classification sonar) is a category of sonar system that is used to efficiently create an image of large areas of the sea floor.

- *Drilling Programs*

The plan of JDVC was to drill holes on the offshore waters covering the project area in order to validate the presence of magnetite at depth and to locate the magnetite occurrences which are of economic value for commercial mining operations in future.

- *Pre-development Activities*

The activity is specifically for the conduct of information education campaign (IEC) to the stakeholders on the upcoming project on the mining activity and schedule of the company. The environmental impact of the project will also be discussed as committed by the company in their environmental

impact assessment. Project presentation will be done to discuss the schedule of the extraction and the setting up of siphoning vessel and anchor vessel with the local government units (LGUs) prior to the start of the project even such activity has been previously acquired by the company resulting to the endorsement from LGUs without posing any objection to the company's project.

1.7.2 Offshore Operations

The project involves the offshore mining of magnetite iron sand thru siphoning activity. It involves the use of a siphon vessel with built-in seven (7) production lines magnetic separator on board. The offshore mining platform will be positioned to the designated area for mining operation. Once the platform is in position, the anchor handling tugboats will position the anchors and will secure the platform to the designated position. The siphon vessel will now deploy the pollution prevention curtains which will minimize the effects of siltation and turbidity. The only affected portion will be disturbed during commercial operations. Once the suction pipes are connected and reached the bottom, sea bottom sand suction operation begins. Sea sand that was sucked is directed to be discharged into distributor to reduce the pressure and ensure the volume of heavier iron ore to settle in the bottom of the distributor. The sand and water will be on the top level of the distributor. The non-magnetic materials will be returned to the sea bottom or seabed using small pollution type accordion curtains confined within the sea bottom to prevent siltation dissemination and make the system environmentally controlled. The magnetite iron sand concentrate will be stockpiled onboard the vessel for shipment to prospective buyers. The waste or the non-magnetite materials (low magnetite content) will be returned to the sea floor. The siphoning vessel has 2,000 tons/hr. capacity.

During operations, the siphoning vessel will siphon about 606 million tons of raw sand with yearly feed to the siphoning vessel of 159.46 million tons of raw sand and will produce a yearly production of 30 million tons of iron concentrate. The average magnetic fraction (Mf) during the entire mine life is 19.79% (passing 2 stages of magnetic separation) which will produce an average concentrate grade of <60% Fe. The magnetic separator efficiency is assumed at 95%.

The offshore mining area were cut into grids or block of 327m by 500m and the entire mining tenements have a 50-meter buffer zone **(Figure 1-10)**. The process of mining begins on the first block or grid. Disposal of tailings or sea sand after magnetic separation are channeled through a series of pipes which in turn directed into the 50-meter buffer zone for disposal. Once the first grid/block was exhausted of iron ore, the offshore mining platform will be positioned to the next mining area. At the start of operations in the next mining block, all tailings will then be directed by pipes to the first mining grid/block for disposal and for cultivation of new benthic environment for aquamarine life.

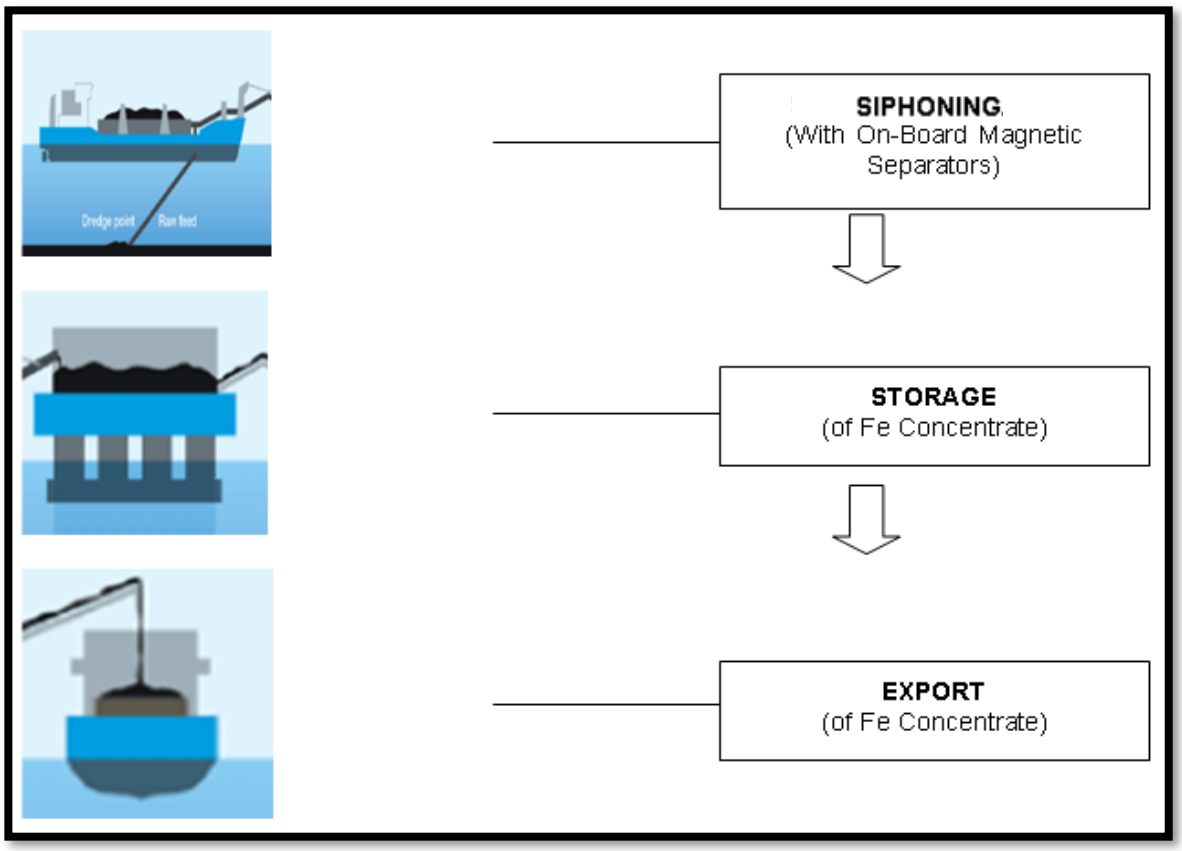


Figure 1-9: Offshore Mining Process Flowchart

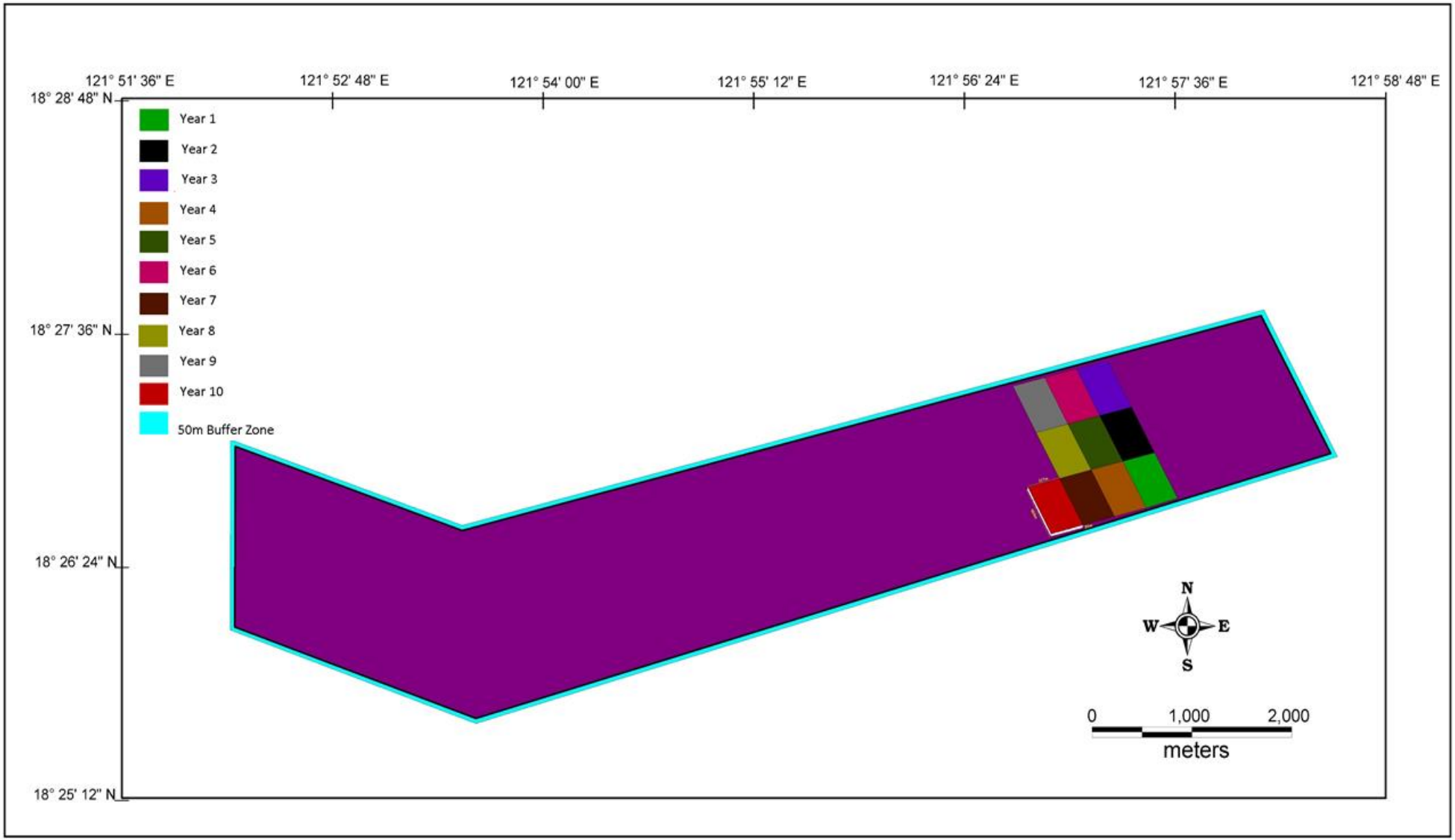


Figure 1-10: 1st 10 – year Sequence of Offshore Mining / Siphoning

1.7.3 Decommissioning/Abandonment/Rehabilitation

Since the project will have minimal impact on the bathymetry of the project area, no chemicals will be utilized, and no facility will be constructed offshore, the abandonment phase for the proposed project will be limited to the removal of the anchors of the anchoring vessel and demobilization of the siphoning vessel. The project closure occurs when the mineral reserves have been completely exhausted and processed.

The mine's decommissioning plan should be included in the operation and rehabilitation/reforestation plan. In this case, there are no rehabilitation to be conducted since the mining is located in offshore areas or at the bottom of the sea. Replenishment and restoration of the deposit will occur naturally through the sediments brought in by the Cagayan River, which continuously discharges freshwater at a rate of 53,943 million cubic meters per year to the sea along with sediments such as sand, silt and clay. Factors contribute to the decommissioning or mine closure are depletion of mineral reserves, change in metal market value, financial viability of the project, detrimental environmental mishaps or non-compliance to environmental regulation. Further, the proponent will abide to MGB in case there are new practices being imposed on rehabilitating an offshore mining site.

Environmental Management and Protection Measures

- *Noise Pollution*

All equipment (e.g. Generators) on board are designed as silent types to avoid noise generation exposure even to siphon vessel crew. The Vessel's main engine is housed inside the engine room with sufficient sound absorbing insulation installed.

- *Oil and Water Pollution*

Offshore extraction of magnetite sand can increase the water turbidity which, can result to a sedimentation. The crew will keep the edge of the suction pipe as close as possible to the ocean floor to lessen the agitation of the sand which, may cause the deterioration of the quality of water. All offshore mining operation MUST have one (1) tugboat equipped with Oil Spill response equipment, one (1) fast boat and personnel that are adequately trained to address oil spills.

To mitigate impacts on increased turbidity, an accordion type of pollution prevention curtain or screen shall be installed to surround the suction and discharge lines. Also, the pollution prevention curtain or screen can be used to reduce the impact of silts and sand from rivers flowing into the basin.

Photo 1-1: (Accordion Type) Pollution Prevention Curtain or Screen

1.8 Manpower Requirements

The project is estimated to employ before was not less than 140 workers. After the expansion, the project will be needing not less than 200 workers once operational, and an additional manpower will also be needed for the implementation of the Social Development Programs and Environmental Protection and Management projects once these are finalized. Table below represents the manpower needed for each project phases and vessel. The company is committed on implementing equal employment opportunity and will hire the most suitable and qualified person for the position and will not tolerate any form of unlawful discrimination. Each person is evaluated based on personal skill and merit.

Further, it shall be the policy of JDVC to hire qualified local applicants based on the following order of priority:

- First Priority: Residents of any barangays within the affected municipalities.
- Second Priority: Residents from other adjacent municipalities; and
- Third Priority: Applicants from other provinces and regions.

Listed below are few of the manpower requirements of the project:

Table 1-9a: Manpower Requirement for Administration

Position	Manpower Requirement
President	1
Executive Secretary	1
Finance/Accounting	1

Position	Manpower Requirement
Marketing	1
Operations Manager	1
Administrative Staff	5
Liason/Helper/Driver	5
Ship Management (Tech'l)	3
Geologist	3
Mining Consultant	1
Vessel Process Consultant	1
Pollution Control Officer	1
Port Captain	1
Marine Engineer	1
Marine Technician	1
Environmental Safety Engr.	1
Community Dev't Officer	1
TOTAL	**29**

Table 1-9b: Manpower Requirement during Operation and Maintenance (Per Vessel)

Position	Manpower Requirement
Vessel Operations	
Captain	1
Chief Officer	1
2nd Officer	1
3rd Officer	1
4th Officer	1
Chief Engineer	1
2nd Engineer	1
3rd Engineer	1
4th Engineer	1
Cook	1
Bosun	1
Able Seaman	4
Oiler	4
Payloader/Crane Operator	15
TOTAL	**34**
Anchor Handling Operation	
Tug Master	1
Chief Engineer	1
Chief Officer	1
2nd Officer	1
2nd Engineer	1
Able Seaman	2
Oiler	2
Fast Boat Operator	2
TOTAL	**11**

Below are onshore manpower requirement of the project that will be hired from the hosts and neighboring communities:

Table 1-9c: Manpower Requirement from the Community

Office/Division/ Section	Beneficiary	Manpower Requirements			Remarks
		Gender			
		Male	Female	Total	
ENVIRONMENT *Support to the National Greening Program of the Government*	Host barangays and Neighboring Communities	45	44	89	1 forester with 4 laborers hired from each barangay to establish and maintain a barangay nursery including planting, protection and maintenance of seedling in the reforestation/NGP areas.
SOCIAL *Livelihood/Projects (Post fishing /fish drying, micro-financing*	Host Barangays and Neighboring Communities	44 2	44 2	88 4	
Feeding Program		0	11	11	Hiring of barangay health workers
TOTAL:				**192**	

1.9 Indicative Project Investment Cost

For the commercial production, the company is setting aside an annual budget of Php 7,500,000.00 on their previous extraction rate. On the proposed increase in volume, the company have allotted an annual budget of Php 6,023,625,006.00. The Social Development component will be based on the agreements with concerned LGUs and will be finalized during the MMT formation prior to operationalization of the project.

2. BASELINE ENVIRONMENTAL CONDITIONS, ASSESSMENT AND MITIGATION OF ENVIRONMENTAL IMPACTS

2.1 LAND

The Province of Cagayan is located in the Northeastern most part of Luzon with an approximate location of 17° 30' 121¨ North and 121° 15' East, occupying the lower basin of Cagayan River. The province is bounded on the east by the northern portion of the Sierra Madre Mountain ranges; on the south by Isabela; on the west by the Cordillera Mountains of Kalinga-Apayao; and on the north by the Balintang Channel and the China Sea.

The topography of the coastal municipalities of the province is generally flat with elevation less than 100 meters above sea level **(Figure 2.1-1)** and slope gradient ranging from 0-3% **(Figure 2.1-2)**. The province's known reserves of both metallic and non-metallic minerals include gold, iron ore, magnetite sand, and manganese.

2.1.1 Geology / Geomorphology

2.1.1.1 Change in surface/landform/geomorphology/terrain/slope

Cagayan is a vast expanse of plains and valleys, bordered by mountains, running north to south both on its east and west ramparts. Beyond the Sierra Madre to the east, the coast fronting the Philippine Sea has strips of level land that could be utilized for economic activities. The northeastern and northwestern parts of Cagayan are strips of level land, hemmed in by the sea on the north and by the mountains and hills on the south.

Of its total land area, 28.19% or 253,831 hectares are flat to nearly level land. This consists of alluvial plains, river deltas, low wetlands, mangroves, and beaches. Most of these are found contiguous to the bodies of water, especially along the Cagayan, Pared, Dummun, Pinacanauan, Abulug, and Chico rivers. These areas are planted to rice and corn, subjected to frequent floods during the wet season.

The gentle and moderate slopes of the province, which constitute 6.08% and 13.48%, respectively of the total land area of the province are mostly contiguous to the level land, enclosing the plains of the meandering rivers and creeks. This arrangement forms the various dales or valleys found in between the hills of the province.

Majority of the rolling land to moderately steep areas which account for 17.07% of the province's total area are found at the foothills of the Sierra Madre and Cordillera mountains, separating the valleys and the mighty ranges. Steep and very steep land which constitute 10.44% and 24.73%, respectively, of the total land area, or 94,030 hectares and 222,595 hectares, respectively, are found along the Cordilleras, in some parts of Sta. Praxedes, Claveria, Sanchez Mira, Pamplona, Lasam, Sto. Niño, and Rizal; and in the eastern parts of Santa Ana, Gonzaga, Lal-lo, Gattaran, Baggao and Peñablanca, as the northern mountains of the Sierra Madre range.

The Babuyan group of islands, which include the islands of Calayan, Babuyan, Dalupiri, Balintang and Camiguin, has a mixture of flat to nearly level land, and steep to very steep slopes. These islands have extensive coral reefs. There are two volcanoes in the Babuyan Islands: Mount Didicas off Camiguin Island, which has a symmetrical cinder cone, about 215 meters above sea level, and Mount Pangasun in Babuyan Island, which is about 840 meters above sea level and has two craters. Another volcano that will be found in Cagayan is Mount Kagua in Gonzaga in the northeast. It is being considered as a potential source of geothermal energy.

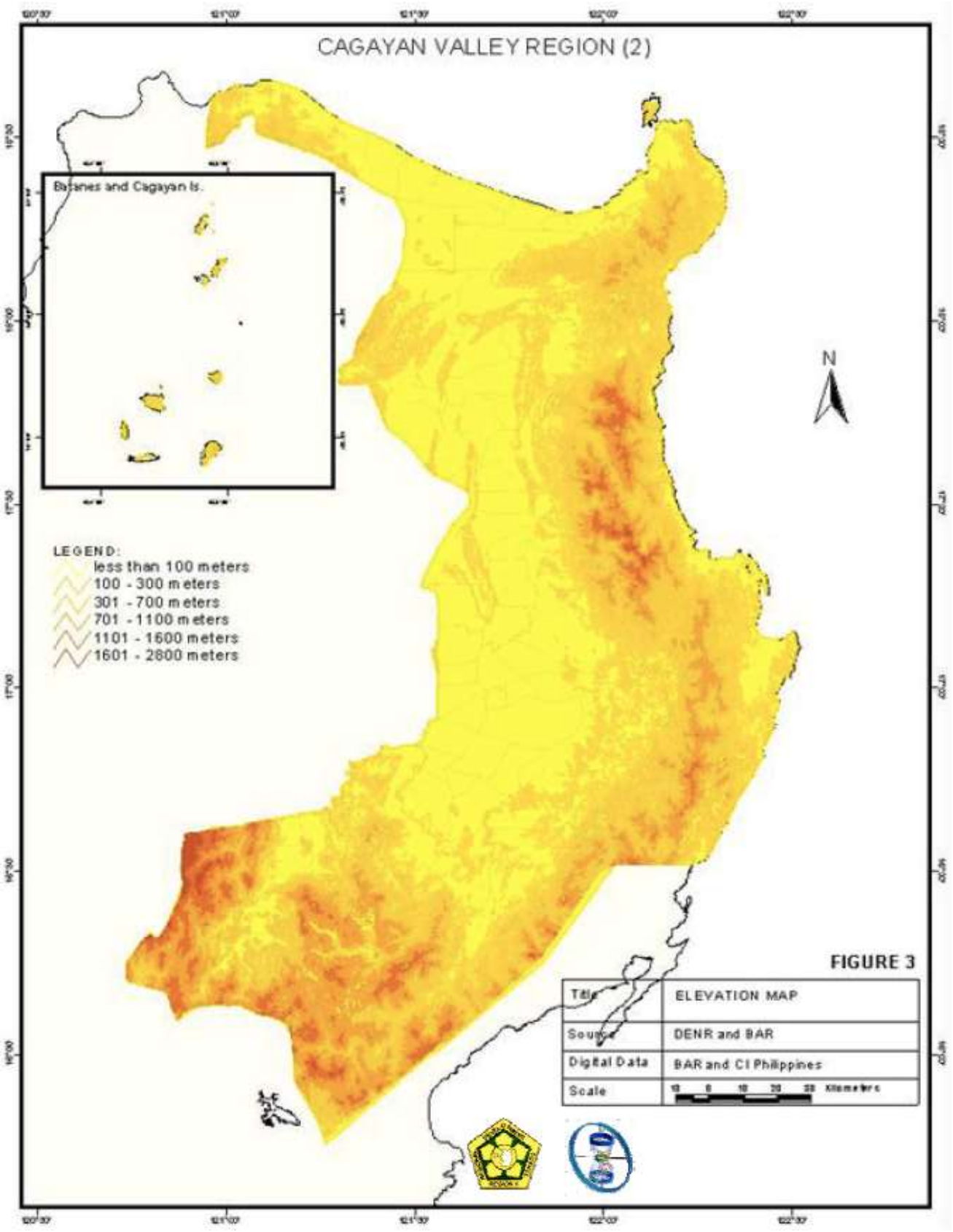


Figure 2.1-1: Elevation Map of Cagayan Valley
(Source: Cagayan Valley RDP, 2011-2016)

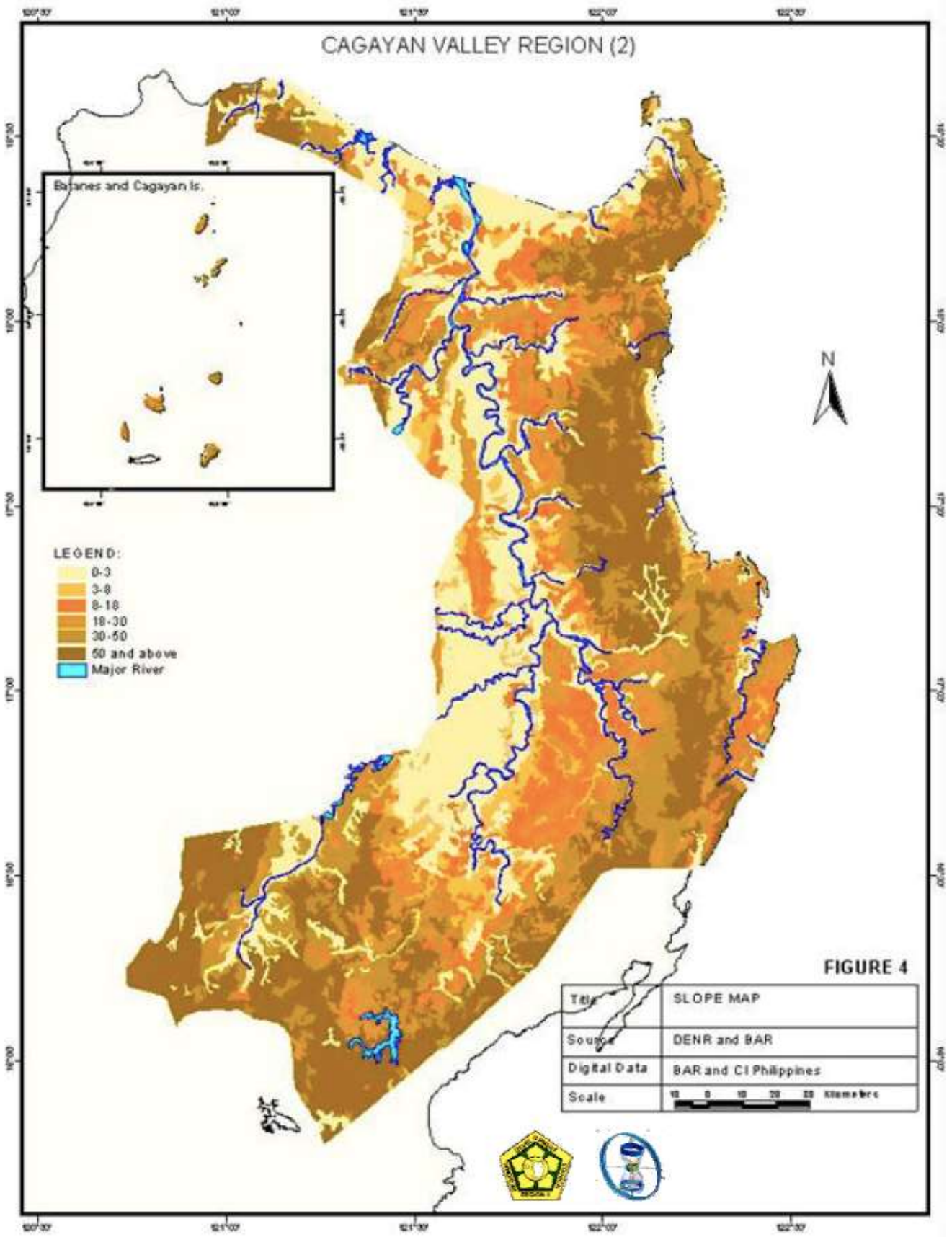


Figure 2.1-2: Slope Map of Cagayan Valley

(Source: Cagayan Valley RDP, 2011-2016)

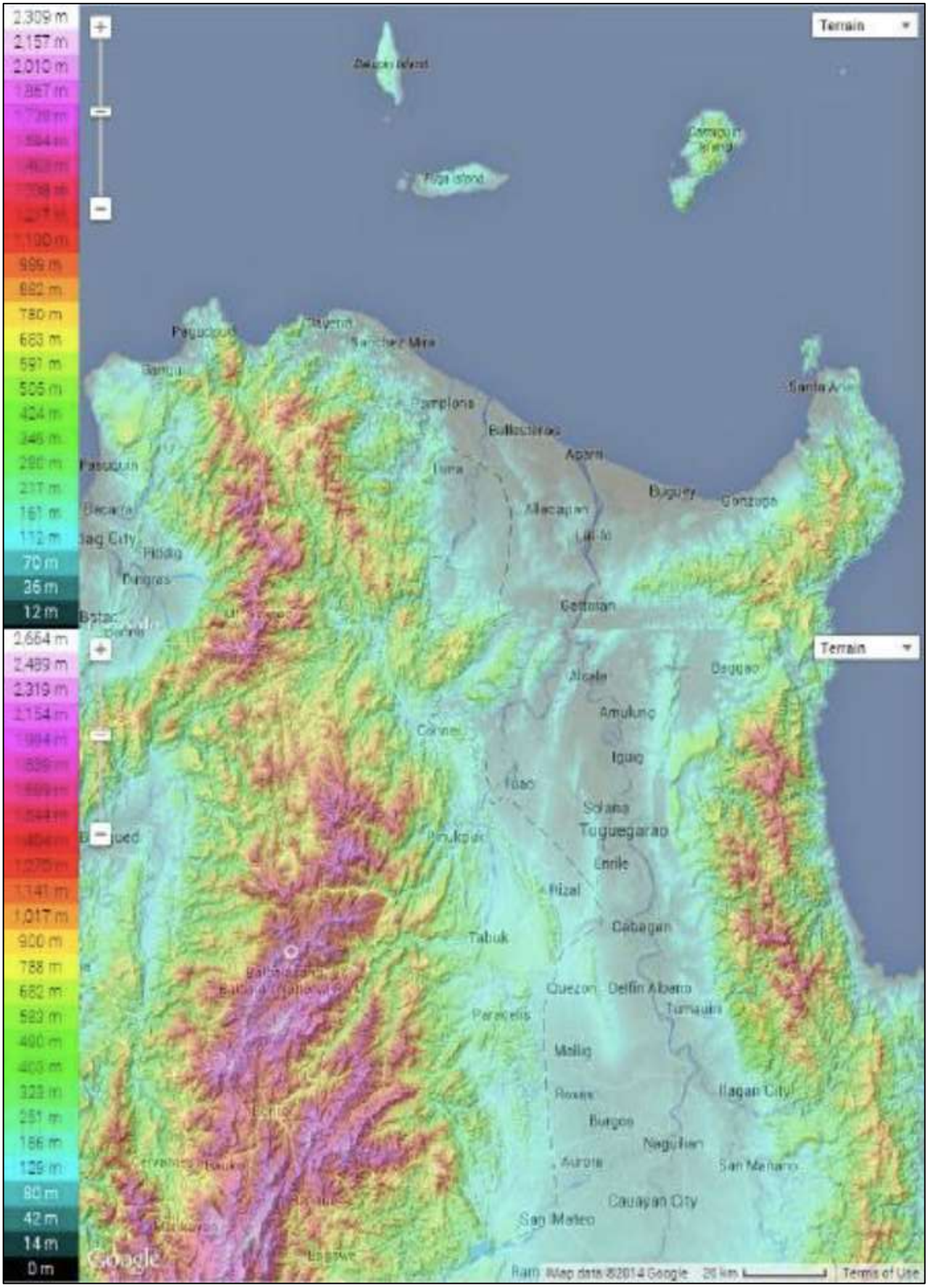


Figure 2.1-3: Terrain Map showing northern portions of Cagayan Valley, Sierra Madre and the Cordilleras on the western side
(*Reference: http://en-ph.topographic-map.com/places/Cagayan-Valley-2706705/)*

2.1.1.2 Change in Sub-surface Geology / Underground Conditions

2.1.1.2.1 Regional Geology Setting

The Philippines is comprised of an active island arc system where active and inactive subduction zones, mountain ridges, volcanoes, rift and fault systems are prevalent. The Philippines lies in the West Pacific Ocean, just north of the complex junction of three major tectonic plates (**Figure 2.1-4**), the Eurasian Plate, the Pacific Plate and Indo-Australian Plate. It is characterized by several rapidly evolving subduction zones. Morphologically, the Philippines may be described as a composite of linear, sub-parallel ridges, alternating with basins and troughs following the trend of bordering trenches. The Philippine Archipelago is defined by a main arc of islands facing the Pacific.

The Philippines is composed of a series of mobile belts and stable blocks as shown in **Figure 2.1-4**. The mobile belts are characterized by the frequent activities of earthquakes and volcanic eruptions. The stable or the continental block is represented by northern Palawan, southern Mindoro, Romblon Island Group and Buruanga Peninsula in Panay Island. Rock suites in this block include schists that are characteristically rich in quartz and chert formations that have been dated Late Permian to Jurassic.

The N-S trending Cordillera Central, a 300 km-long and 90 km wide, is one of the major tectonic unit of Northern Luzon. Acid plutonic rocks form the core of the mountain chain, the outer shell of which consists of shallow to deep sea sedimentary rock formations with intercalated volcanics. The uplift of the Central Cordillera batholith started during the Miocene. The Sierra Madre Range likewise consists of the acidic plutonic intrusive bodies. The third morpho-tectonic unit is the Caraballo Mountains, which serve as the connection of the southern segment of the Central Cordillera and the Sierra Madre. These three morpho-tectonic units form the catchment basin of the N-S oriented Cagayan River Valley. The fault-bounded Cagayan Valley, 200 km long and about 50 km wide, is surrounded by these mountains, except on the northern side.

The rest of the Archipelago is considered as the Philippine mobile belt. Many areas of the mobile belt are underlain by ophiolitic complexes. Ultramafic rocks of these ophiolites are hosts to significant deposits of chromite and nickel. Massive sulphide and manganese deposits are associated with the volcanic and sedimentary carapace of the ophiolite. Ancient magmatic arcs in the mobile belt are characterized by thick volcanic flows intercalated with pyroclastic and sedimentary rocks and intrusions of diorite, quartz diorite and andesitic to dacitic rocks. Younger volcanic rocks, occurring as flows, intrusions and volcanic edifices disposed in linear belts are associated with active subduction zones, best exemplified by the Negros Volcanic belt, Bataan volcanic belt and Bicol volcanic chain. These volcanic flows intercalated with pyroclastic and sedimentary rocks and intrusions of diorite, quartz diorite and andesitic to dacitic rocks commonly have specks of magnetite that were disintegrated from the host rocks during weathering process and eventually transported and concentrated through river systems and through the winnowing actions of waves tides and currents.

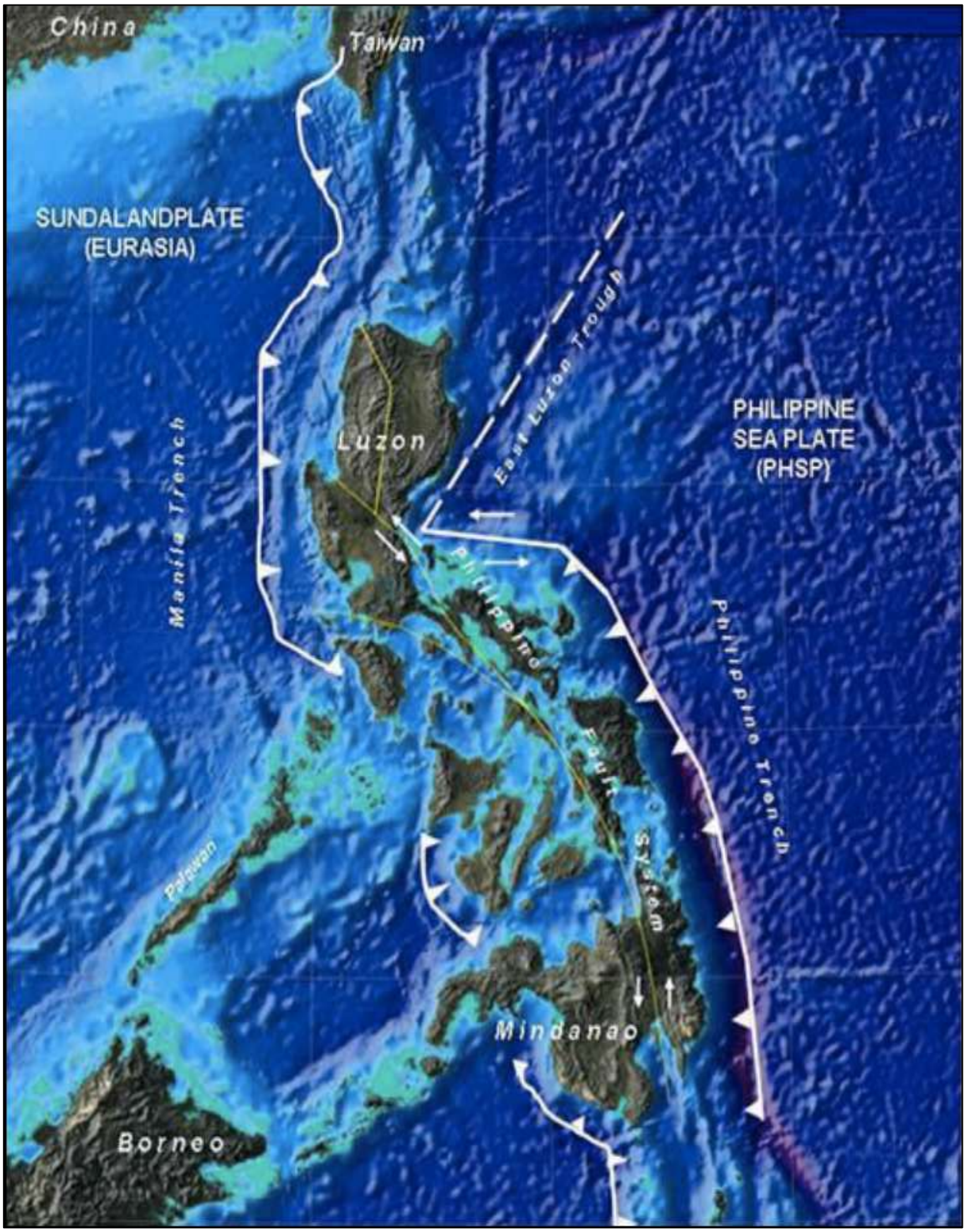


Figure 2.1-4: Major Tectonic Features of the Philippines (Geodynamic Map)
(Source: JDVC Exploration Report, August 2015)

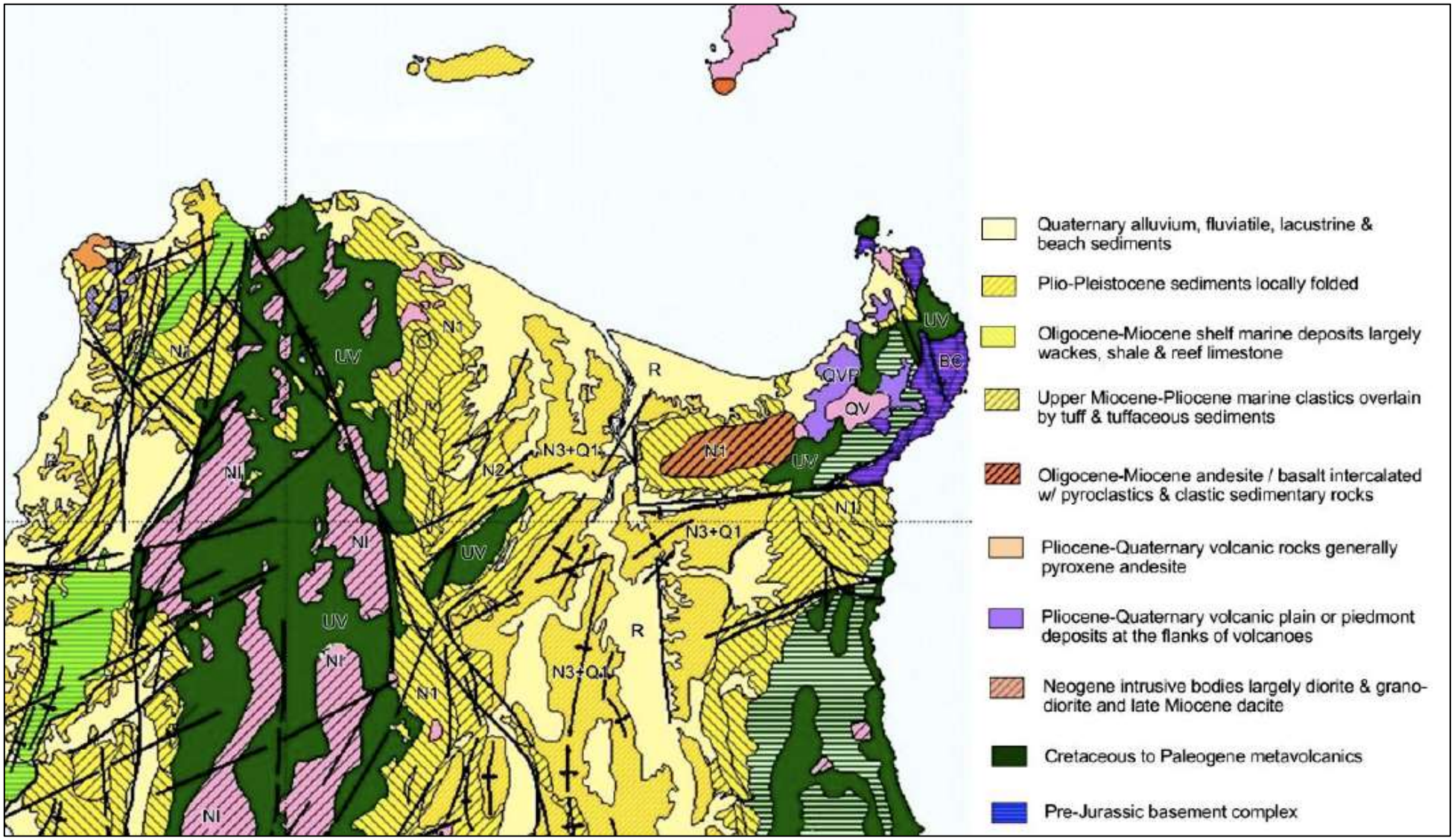


Figure 2.1-5: Regional Geologic Map of Northern
(Source: Geology of the Philippines Vol. 1, 2004)

Structural and physiographic elements of northern Luzon include (from east to west) the Sierra Madre Range and the Central Cordillera mountains. The Sierra Madre Range is a volcanic arc composed of sialic basement (DeBoer et al., 1980) intermediate (andesitic) igneous rocks, diorite intrusive, metavolcanics, metasediments, and ophiolites that consist of spilite and associated chert (Caagusan, N., 1980). **Figure 2.1-5** shows the geologic map of Northern Luzon.

The Cagayan valley is a major intermontane structural basin containing folded and faulted late Tertiary eugeosynclinal deposits measuring 250 kilometers long and 80 kilometers wide. The oldest sedimentary rock in the basin is the Oligocene to Miocene marine sediments consisting of shale, chalk, turbidites and limestone. Regional uplift in the Plio-Pleistocene resulted in the deposition of transitional marine and fluvial sediments of the Ilagan and Awidon Mesa Formations. The latter is a thick sequence of pyroclastic and fluvial sediments that conformably overlies the Ilagan Formation but unconformably overlies the folded Miocene and Pliocene strata in the foothills of the Cordillera.

The coastal municipalities of Cagayan is part of the so called Aparri Basin. It consists mainly of recent beach deposits that had been formed and reworked by a continuous wave action along the coastline fronting the Babuyan Channel. According to the report written by Mr. M.C. Leggy, BMG, 1996, *"these sandy deposits overlie and veneer (sic) a yellow brown, slightly consolidated and roughly bedded magnetite-bearing sandstone which is similar mineralogically and physically to the sandstone interbed of a formation that contains iron deposits in Camalaniugan.* Report also indicated *"in Paddaya, Buguey in the same coastline but southeast of the claims towards Gonzaga, this sandstone at the base of the beach ridge. It is believed that the sandstone underlies and seemingly constitute the floor and part of the marshy ground, swamps and the alluvial plain."*

2.1.1.2.2 Local Geology

The area of interest has a good potential for magnetite mineralization due to the presence of rock units/lithology that are good source of heavy minerals such as magnetite which are of products of continuous weathering and erosion from the mountains particularly at the northern Sierra Madre. Below are the geologic rock formations in the area and their position in the stratigraphic column as shown in **Figure 2.1-6**.

Abuan Formation

The Abuan Formation, which was formed as Abuan River Formation by MMAJ-JICA (1989), is the oldest formation in the western part of the Northern Sierra Madre and presumably comprises part of the basement of the Cagayan Valley sedimentary sequence. It is a heterogeneous mixture of basaltic andesitic flows, pyroclastic and sedimentary rocks widely distributed in the southwest portion of Divilaca River and northern and western part of Maconacon River. The age deposition of the Abuan Formation is inferred to be before Early Oligocene, probably Eocene. The thickness of this formation was not indicated by MMAJ-JICA (1989).

The abut is probably partly equivalent to the Caraballo Group, which was named by MMAJ-JICA (1977) for the volcanic and sedimentary rocks comprising the basement of northern Sierra Madre. This was later renamed by Ringenbach (1992) as Caraballo Formation. Its age was previously presumed by MMAJ-JICA (1977) to be Cretaceous-Eocene, but it was later found to be Middle-Late Eocene (Ringenbach, 1992)

The Abuan Formation may be correlated with the Mt. Cresta Formation, which is exposed typically on the slopes of the Mt. Crest and lies scattered on the ridges of the Northern Sierra Madre Range, as mapped by MMAJ-JICA (1989). It is a dacitic of lava flows, intrusive rocks, pyroclastic rocks and

sedimentary deposits, conformably overlain by the well-bedded Oligocene Masipi Green Tuff of Northern Sierra Madre.

The Dumatata Formation of Huth (1962), which was considered as the basement of the Cagayan Valley sedimentary sequence in BMG (1981), may be regarded as partly equivalent to the Abuan Formation. The Dumatata Formation is composed of an alteration of basic lava flows, partly metamorphosed pyroclastic braces and tuffaceous sandstones and siltstone. It is about 500 m thick.

Dibuluan Formation

This formation, named by MMAJ-JICA (1989) as Dibuluan River Formation, is found along the western flanks of the Northern Sierra Madre range. It embodies the principal position of the westward-dipping monoclinic structure of the Cagayan Basin. It unconformably overlies the Abuan Formation and is unconformably overlain by the Ibulao Limestone along Dibuluan River and elsewhere in the southwestern end of the Cagayan Valley Basin (Aurelio and Billed, 1987). The Dibuluan Formation consists mainly of basic volcanic flows, volcanic braces and pyroclastic rocks, with interbeds of clastic rocks.

The clastic rocks in the lower portions generally consist of well-indurated browsing grat to greenish grey feldspar wake with minor intercalated intraformational conglomerate, while the upper portions are marked by thin to medium beds of green siltstone and light green to red, well-indurated mudstone. Radiometric K-Ar dating of a sample of Basic lava flow of the Dibuluan Formation gave na average of 29 Ma, equivalent to late early Oligocene (Billedo, 1994).

This formation is partly equivalent to the Dumatata Formation of Huth (1962) in the southwestern part of the Cagayan valley basin. The Dibuluan could also be correlated with the Oligocene Masipi Green Tuff of MMAJ-JICA (1989) in Northern Sierra Madre. The Masipi Green Tuff represents a sequence of parallel-bedded greenish tuff, tuffaceous sandstone and some pyroclastic rocks found at the type of locality, Masipi River, in Cabagan, Isabela. The nannofossils contained in tuffaceous sandstone indicate a Middle to late Oligocene age (MMAJ-JICA, 1987). Likewise, it could be correlated with the Mamparang Formation of MMAJ-JICA (1977) in the eastern fringe of the Northern Sierra Madre range. The Dibuluan Formation may also be considered as partly equivalent to the Lower Zigzag Formation of BED (1986) and Caagusan (1978), which is estimated to be around 1,800 meters thick.

Quaternary Alluvium and Magnetite Deposition

The Cagayan Valley basin is overlain by various assemblages of Quaternary alluvium resulting from weathering and erosion of the older rocks and natural transport of minerals by rivers, wind and current. These are accumulations of detrital minerals or placer minerals that compose most of the Quaternary alluvium within the Cagayan River Valley and the Cagayan Basin.

Weathering and erosion from the older rocks and natural deposition of minerals by rivers, wind and current brought forth deposition and accumulation of detrital minerals or pacer minerals that compose most of the Quaternary alluvium within the Cagayan River Valley and the Cagayan Basin. Beach and offshore placer mineral deposits are formed and concentrated through the winnowing action of waves, tides and currents. Placer minerals should have high density, mechanical durability and chemically resistant in order to accumulate on high energy depositional environment. Heavy metals deposits accumulate within the beach face and further inland during unusually high wave as in during typhoons.

As the waves, tides and currents approach the shore, they bring with them both the heavy and light minerals. Upon their retreat, they leave behind denser materials while carrying lighter ones. This process continues for years and decades and results in the natural accumulation of placer heavy minerals including magnetite sand. The rock formations that may have contributed as source of

magnetite and other associated placer minerals include the volcanic, diorite intrusive and sedimentary derivatives of Abuan Formation and Dibuluan Formation.

These volcanic flows intercalated with pyroclastic and sedimentary rocks and intrusions of diorite and andesitic to dacitic rocks commonly have specks of magnetite that were disintegrated from the host rocks during weather process and eventually transported and concentrated through river systems and through the winnowing actions of waves tides and currents. Encouraging onshore showings of magnetite-bearing sand deposits are observed along the coastal areas of San Miguel Bay. This indicates that river systems have been transporting the detrital heavy minerals since geologic time. The major drainage and tributaries draining the area traverse a greater portion of the volcanic rocks.

The magnetite sand may also have been derived from younger sedimentary rocks as reworked derivatives. The rivers that bring down detritus from upstream may also deposit their load within the river mouths where their velocity is considerably reduced.

2.1.1.3 Inducement of Subsidence, Liquefaction, Landslides, Mud / Debris Flow

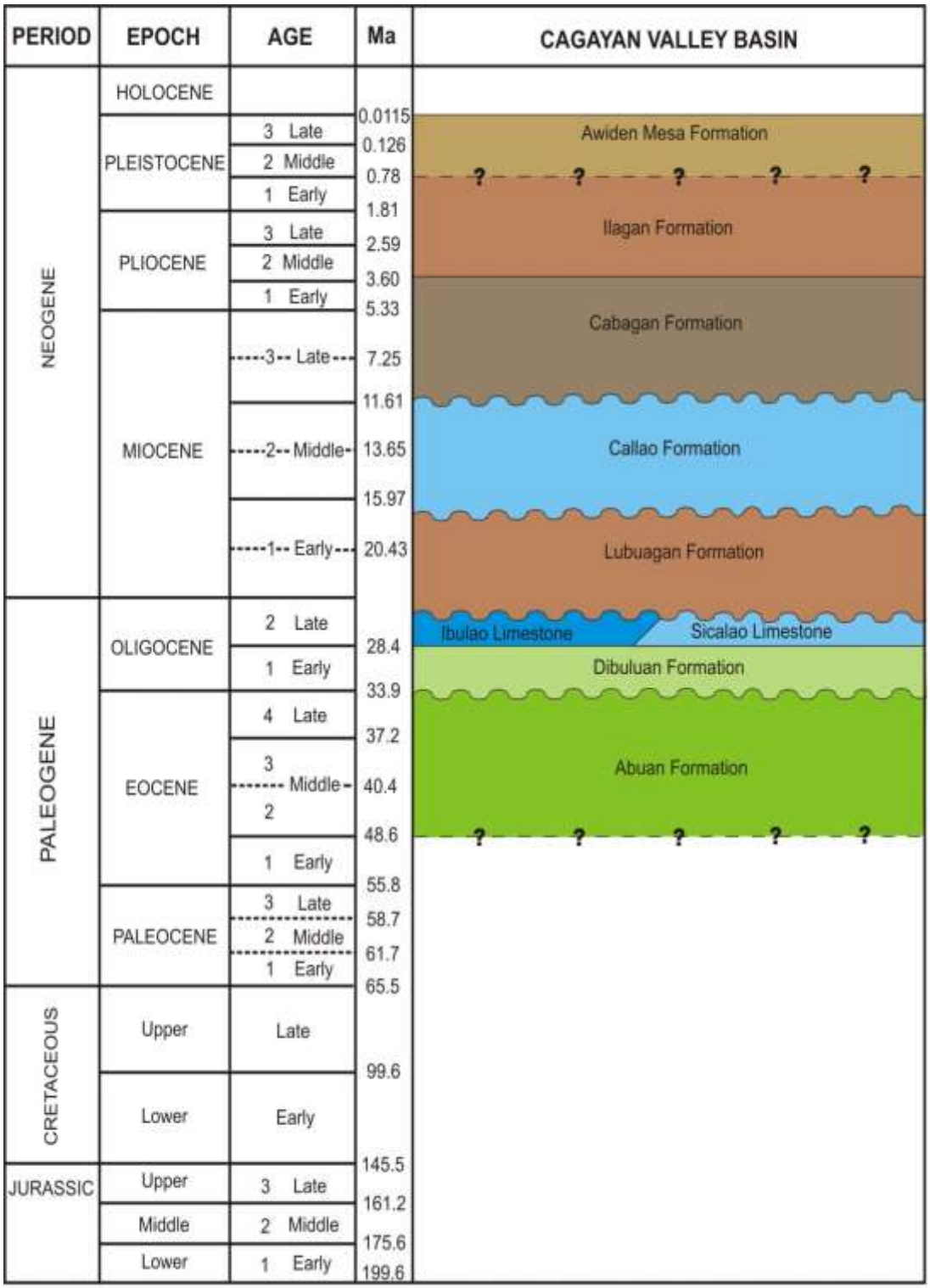
Based on the Geohazard mapping conducted by the Mines and Geosciences Bureau Central Office (MGB-CO), the coastal barangays covering the municipalities are mainly impacted by the hazard of flooding due to the topography and the area is considered low lying flood plains **(Figures 2.1-7 & 2.1-8).** The topography of the coastal municipalities of the province is generally flat with elevation less than 100 meters above sea level and slope gradient ranging from 0-3%.

The northeastern coastal portion of Gonzaga is high susceptible to flooding, areas with greater than 1-meter flood height are usually flooded for several hours during heavy rains. Included landforms of topographic lows such as active river channels, abandoned river channels, and areas along river banks, also prone to flash floods. This is very evident due to the presence of river and creeks such as the Cuitabang creek, Amunitan creek, Danac river, Malamnay creek, Tapel river, Cabatagan creek, and Cabatagan creek. The central part going to Santa Teresita is characterized by low to moderate susceptibility to flooding (areas with less than 1-meter flood height). These are usually inundated during prolonged and extensive heavy rainfall or extreme weather condition during the months of May to November. The major portion of the coastal area of Buguey is highly susceptible to flooding due to the presence of Buguey lagoon and other small creeks of water. The coastal area of Aparri, particularly at the eastern portion (eastern side of Cagayan river), is low susceptible to flooding while the western part (west side of Cagayan River) is highly susceptible to flooding.

Based on available data from NEDA Region 2, areas located near the Cagayan River and its tributaries are highly vulnerable to flood **(Figure 2.1-9).** About 40% of the total land area of the region is susceptible to flooding. High-risk areas to flood have about 250,000 hectares and 650,000 hectares are moderately susceptible. Flood risk areas are usually located near the Cagayan river system. Relatively, highly susceptible areas to landslide in the region, as indicated by prominent red patches in the map, are commonly situated in hilly and mountainous parts of the region. The high susceptibility of these areas depends on factors such as land cover, soil type and slope gradient (NEDA Region 2 RDP, 2011-2016). The coastal areas as shown in the figure below are susceptible to flooding.

Soil erosion, as shown in **Figure 2.1-10,** reflects different levels of erosion in the region. Areas with poor vegetation, weak soil structure along the river systems have severe to moderate erosion. The average erosion rate for open grasslands is about 268 tons per hectare per year. Densely vegetated areas like the Sierra Madre is likely to have slight or no apparent erosion. Secondary forest has an average soil erosion of 3 tons per hectare per year (NEDA Region 2 RDP, 2011-2016). The coastal areas as shown in the figure above are moderately susceptible to erosion.

Active fault lines in the region as shown in **Figures 2.1-11 & 2.1-12,** pose another threat together with the liquefaction as a possible effect of earthquake occurrence. Some of the prominent fault lines in the region include the Digdig fault in Nueva Vizcaya, Divilacan fault in Isabela and Dummun River fault in Cagayan. The alluvial plains of the province was spared from major fault lines which minimize the destructive effect of ground shaking to its existing infrastructures (NEDA Region 2 RDP, 2011-2016). Based on the figure, there are no known active faults that traverse the project site and the coastal municipalities. As shown in **Figure 2.1-12**, the host municipalities and other coastal municipalities in Cagayan Province are highly susceptible to liquefaction. It is phenomenon wherein the ground, especially near e river, lake and coasts, behaves like liquid similar to quicksand due to very strong shaking.



Equivalent Ma values for boundaries of periods and epochs and age age boundaries adopted from Geologic Time Scale 2004 (Gradstein and others, 2004)

Figure 2.1-6. Geologic Rock Formations in the area and Stratigraphic Column for Cagayan Valley Basin

(Source: Geology of the Philippines, 2nd Ed. 2010)

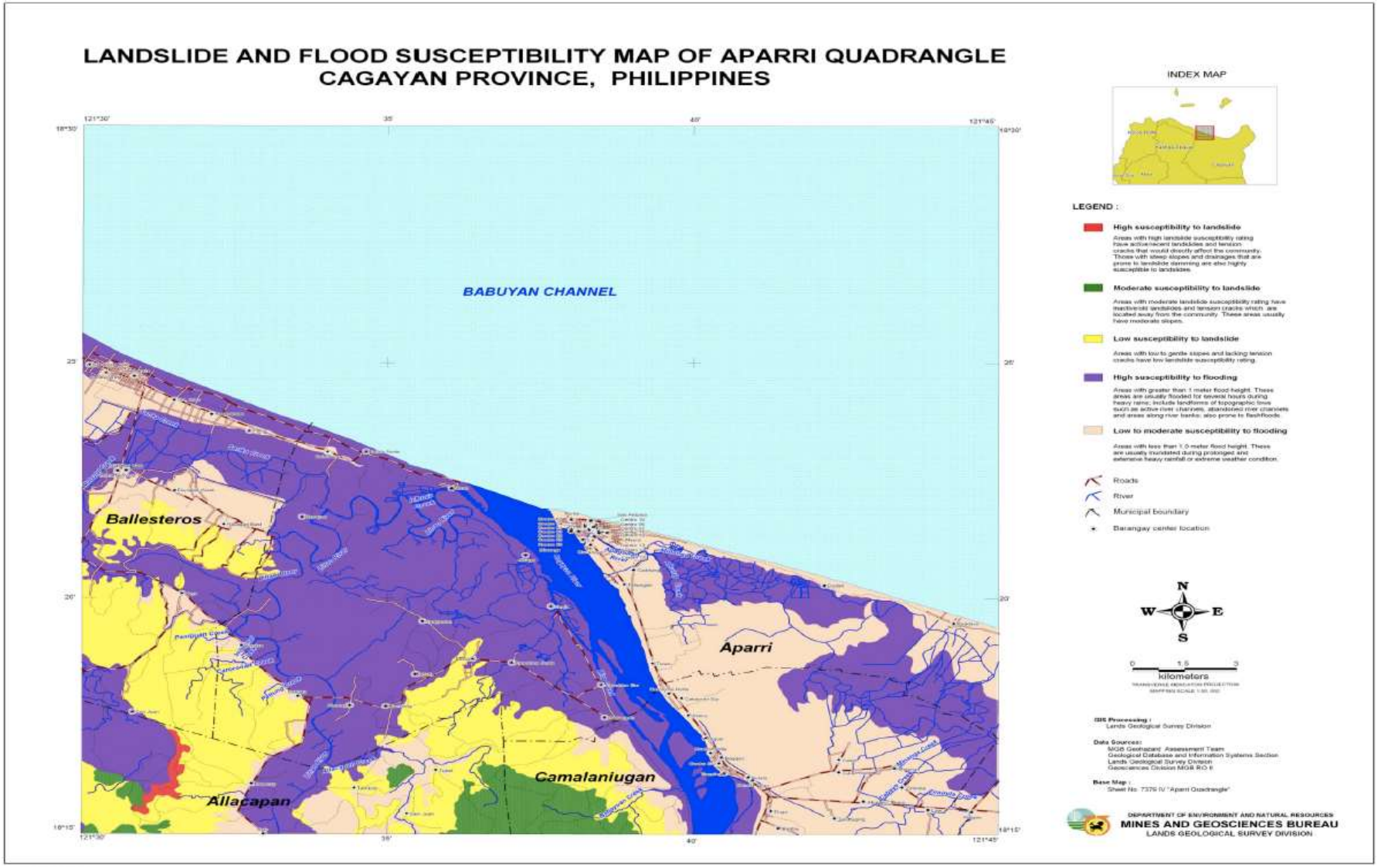


Figure 2.1-7: Landslide and Flood Susceptibility Map of Aparri Quadrangle Cagayan Province
(adopted after MGB Central Office, 2008)

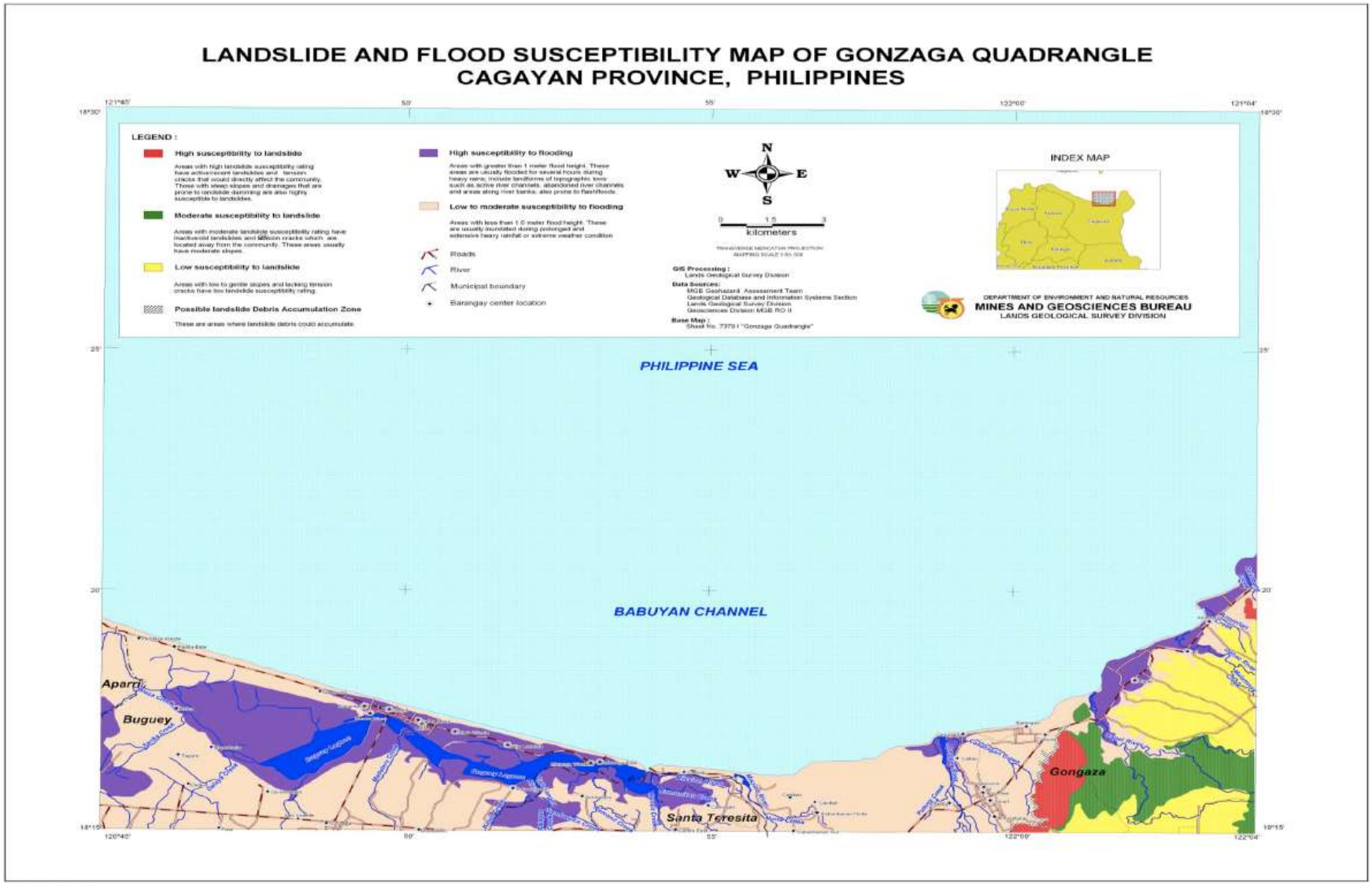


Figure 2.1-8: Landslide and Flood Susceptibility Map of Aparri Quadrangle Cagayan Province
(adopted after MGB Central Office, 2008)

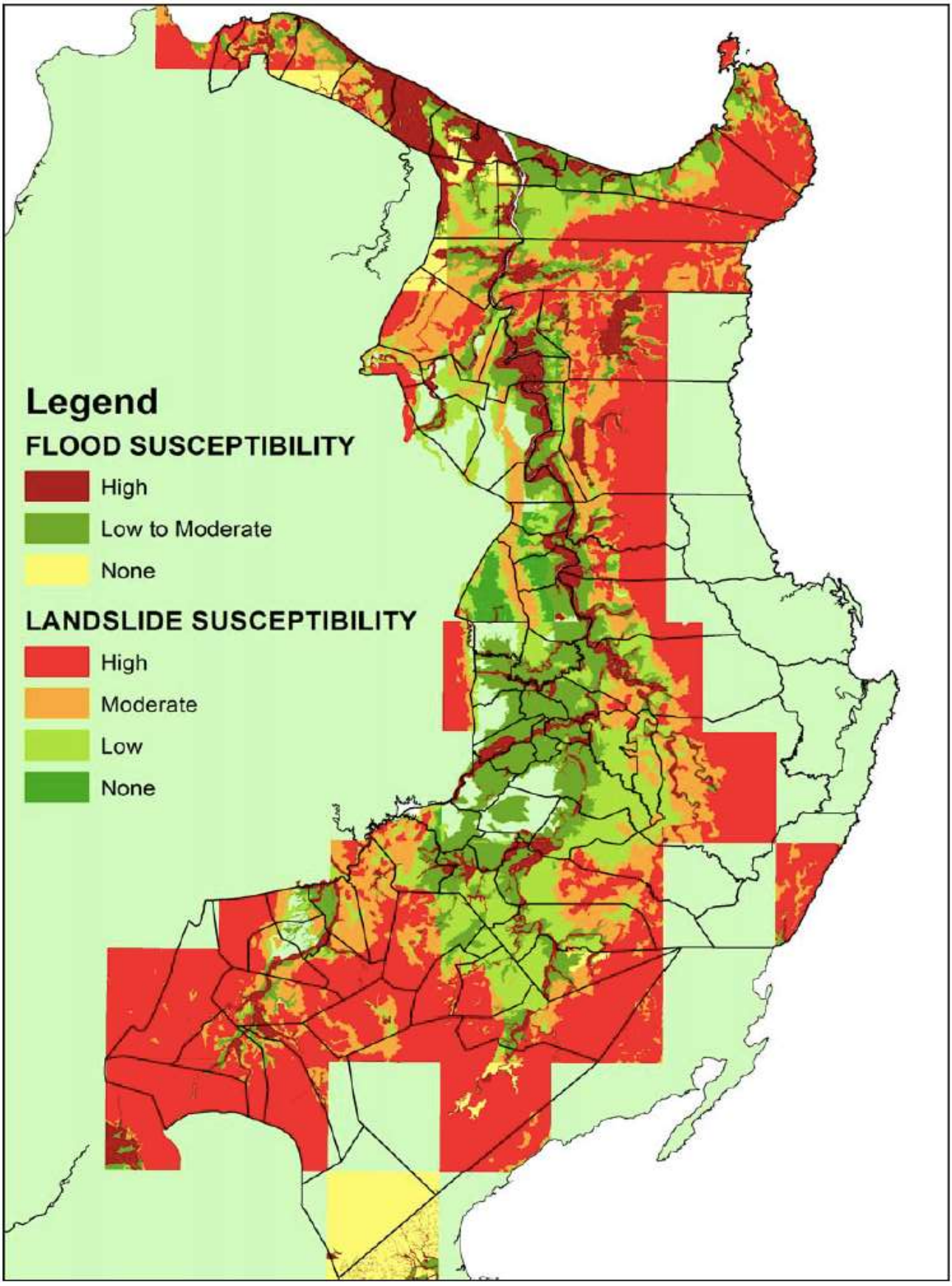


Figure 2.1-9: Flood and Landslide Susceptibility Map of Region 2
(Source: RDC2 RGIN, NEDA Region 2 RDP, 2011-2016)

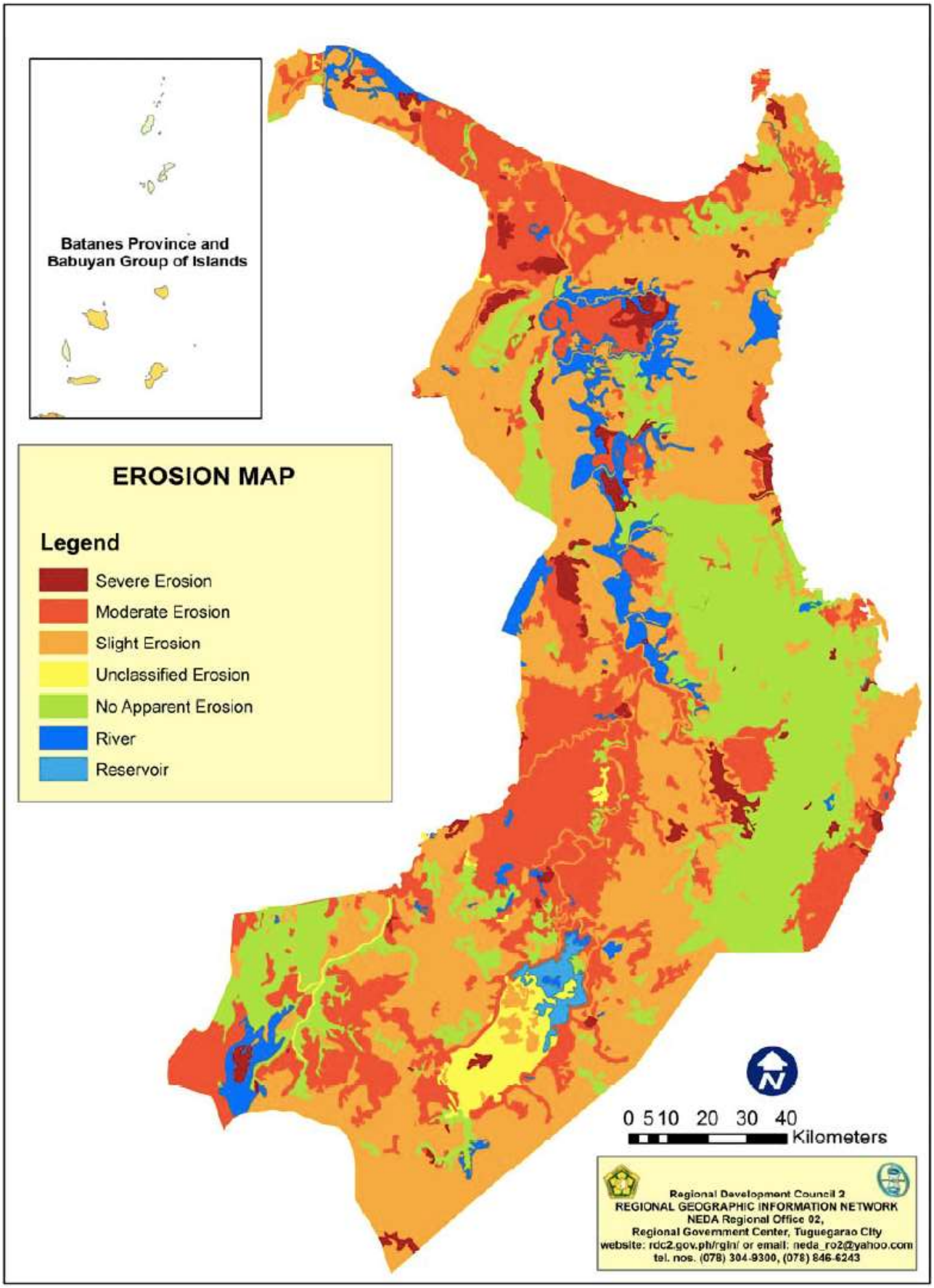


Figure 2.1-10: Flood and Landslide Susceptibility Map of Region 2
(Source: RDC2 RGIN, NEDA Region 2 RDP, 2011-2016)

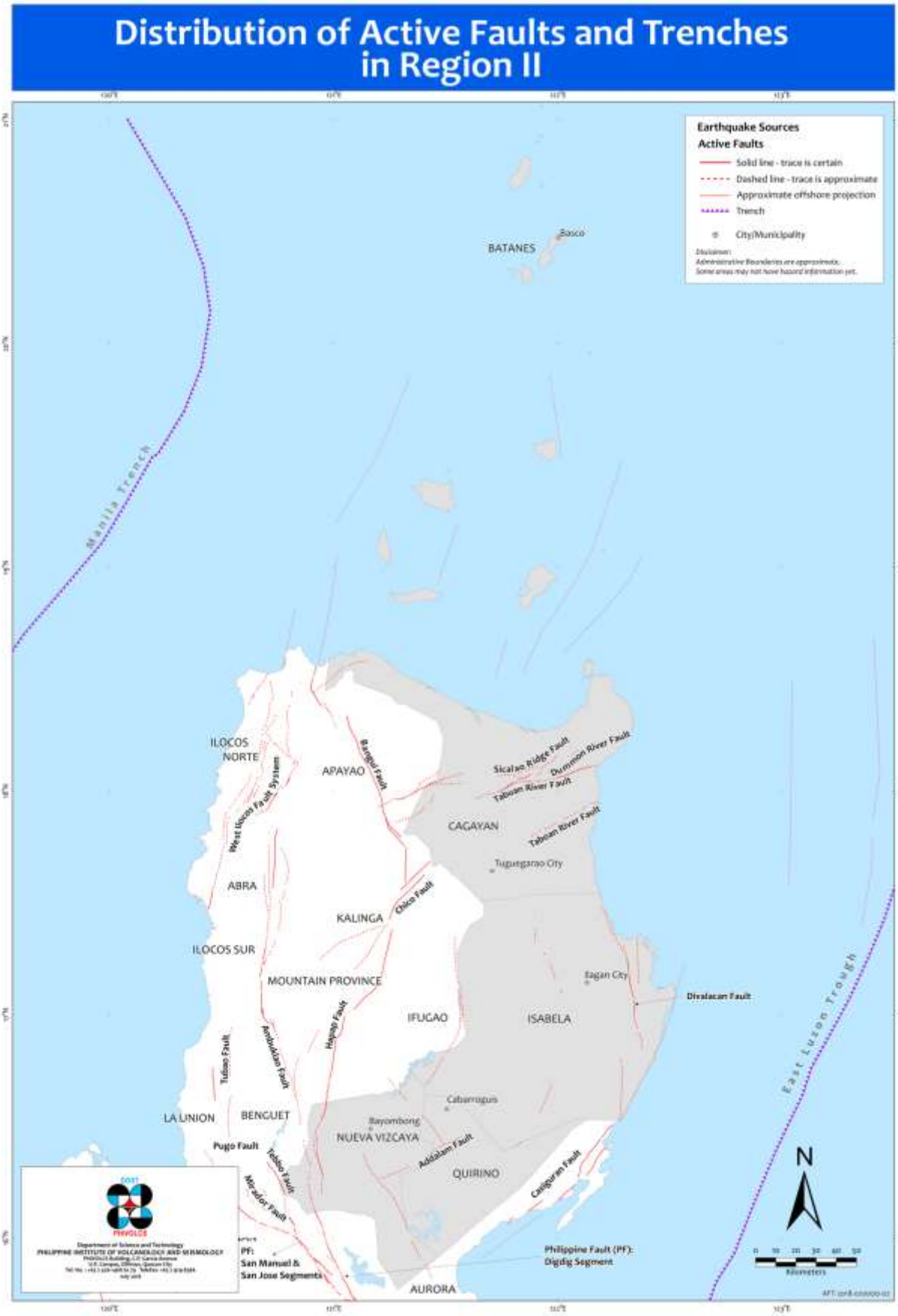


Figure 2.1-11:Distribution of Active Faults and Trenches in Region 2
(*Source: PHIVOLCS 2018)*

Figure 2.1-12: Liquefaction Susceptibility Map of Region 2
(Source: PHIVOLCS 2018)

2.1.2 Impact Assessment and Mitigation

Potential Hazards/Impacts	Impact Analysis	Options for Prevention or Mitigation or Enhancement
Susceptibility to natural hazards	The coastal barangays covering the municipalities are mainly impacted by the hazard of flooding due to the topography and the area is considered low lying flood plains. The coastal areas as shown in the figures above are moderately susceptible to erosion. Areas with poor vegetation, weak soil structure along the river systems have severe to moderate erosion.	The project operation will be located approximately 14-15 kilometers from the shore, thus will have negligible impact on land.

2.2 WATER MODULE

2.2.1 Hydrology / Hydrogeology

2.2.1.1 Change in Drainage morphology / Inducement of flooding / Reduction in stream volumetric flow

Cagayan Valley lies in the Northeastern tip of the Philippines. It is bounded by three big mountain ranges namely, Cordillera on the west, Caraballo on the south and Sierra Madre on the east. On the north is the Babuyan channel where the Cagayan River drains. The Cagayan River flows through the four mainland provinces, namely: Cagayan, Isabela, Nueva Vizcaya and Quirino, and is the largest river system in the country.

The Cagayan Valley region has the largest possible dam and reservoir sites among all regions in the country. It also has the biggest river basin, the Cagayan River Basin, with a drainage area of about 2,730,00 hectares and groundwater reserve of 47,895 MCM. The Cagayan River has three major tributaries: Ilagan River, which drains a major portion of the eastern watersheds, Magat River that draws water from the southern portions and Chico River covering northwest areas. In Cagayan Province, two (2) watersheds have been proclaimed and these are in the municipalities of Lallo and Gonzaga, having a total area of 15,987.0 hectares.

Cagayan River, which originates from the Province of Nueva Vizcaya with a drainage area of about 27,300 square kilometers and a groundwater reserve of 47,895 cubic meters per minute and headwaters are at the Caraballo Mountains of the Central Luzon at an elevation of approximately 1,524 meters. The river flows north for some 350 kilometers to its mouth at the Babuyan Channel near the town of Aparri, Cagayan. The larger tributaries of the Cagayan River are the Pinacanauan River in Peñablanca in the southeast; the Dummun River in Gattaran and the Pared River in Alcala, both in central Cagayan; and the Zinundungan River in Lasam and the Matalag River in Rizal, both in the west. **Figure 2.2-1** shows the drainage system from a slope map of Region 2. Other rivers in the province are the Chico River in southwest Cagayan at Tuao, the Pata River and Abulug River in the northwest, Buguey River in the north, and the Cabicungan River in the northeast. These rivers drain the plains and valleys of the province, and provide water for domestic and irrigation purposes, as well. The river from the stretch of Cagayan River form a network of streams that meander, branch out, braid and interconnect with each other. This river system meanders along their courses in ricefields, swamps and marches while some flow in a direction almost parallel to the coastline.

Cagayan River and its tributaries have deposited sediments of Tertiary and Quaternary origin, mostly limestone sands and clays throughout the relatively flat Cagayan Valley which is surrounded by the Cordillera Mountains in the west, Sierra Madre in the east and the Caraballo Mountains in the south. Iron sands are deposited offshore of Sanchez Mira, Pamplona, Abulug, Ballesteros, Aparri, Buguey and Gonzaga, all in the province of Cagayan.

The Municipality of Aparri is endowed with five (5) creeks and river as minor water tributaries. These are the Appagonan, Linao, and Zinarag rivers and Batuna, and Kalintaan creeks. Hence, they are used as drainage canal, irrigation canal, source of small water impounding projects and small farm reservoirs. These surface water resources are classified under C and D type of classification of water bodies. This means that waters are contaminated and not fit for domestic use but fit for fish production, industrial use, drinking water for ruminants and fowls, for recreation and navigation. Its contamination most likely is attributed by environmental degradation such as loss of forest cover, soil erosion due to floods and other effects of disaster occurrence and mal practice of farmers and fisher folks on the use of chemical farm inputs. The improper disposal of liquid and solid waste by the population are another contributory factor.

Water bodies in the Municipality of Buguey includes its vast coastal fishing grounds of about 21,750 hectares and its inland bodies of water such as the Buguey lagoon, rivers and creeks, fishponds and marshland/swamps. Major tributaries that drain into the Buguey lagoon are the Pacac creek, Birao creek, Maddalero creek, Sanka creek, Papira creek, Dalaya creek and Balza creek. The inland bodies of water occupy an aggregate area of approximately 1,961 hectares or 11.92% of the total land area of the municipality.

The Municipality of Gonzaga is endowed with various water bodies as attributed by its mixture terrain and good vegetation. These water bodies are rivulets, creeks, streams and rivers whose main source is from the forested areas of the municipality. Presently there are 2 major rivers with great watershed; these are the Wangag and Baua rivers. These rivers supply the water demand of the municipality in terms of irrigation and domestic uses; the same maintain the availability of potable underground water sources which can be reached to a depth of less than 3 meters up to 35 meters.

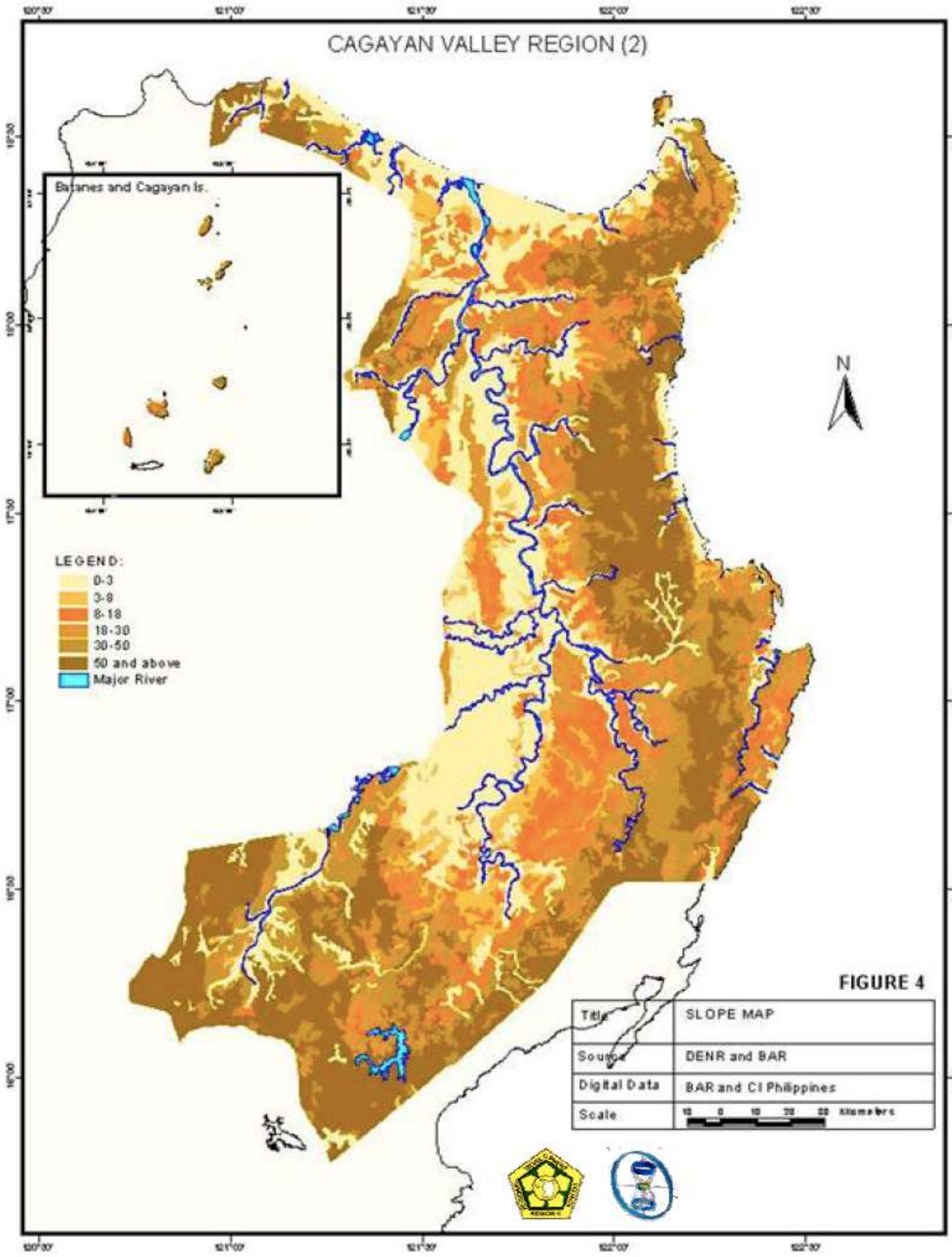


Figure 2.2-1. Slope Map of Cagayan Valley showing the Drainage System (in blue)

Source: Cagayan Valley Regional Development Plan, 2011-2016

2.2.1.2 Change in stream, lake water depth

The project site is part of Babuyan Island in the shoreline of Aparri, Buguey and Gonzaga with a total project area of 4,999.2358-hectare and is 14 – 15 kilometers away from the shoreline of the affected coastal municipalities.

In Cagayan Province, two (2) watersheds have been proclaimed and these are in the municipalities of Lallo and Gonzaga, having a total area of 15,987.0 hectares. The nearest river in the project site is the Cagayan River Basin, the biggest river basin in Cagayan Valley with three major tributaries: Ilagan River, which drains a major portion of the eastern watersheds, Magat River that draws water from the southern portions and Chico River covering northwest areas. This river traverses the whole region from south to north. The larger tributaries of the Cagayan River are the Pinacanauan River in Peñablanca in the southeast; the Dummun River in Gattaran and the Pared River in Alcala, both in central Cagayan; and the Zinundungan River in Lasam and the Matalag River in Rizal, both in the west.

Since the project site is located approximately 14-15 km away from the shoreline of the coastal municipalities and from the outfall of the river, the project will not have a significant impact on the depth and drainage of the river.

2.2.1.3 Depletion of Water Resources / Competition in Water Use

Based on **Figure 2.2-2,** the areas of Aparri, Buguey, and Gonzaga are classified on a deep well area with extensive and highly productive aquifers. According to the Philippine Groundwater Data Bank, Province of Cagayan has 4,291 deep wells recorded in which Aparri has a total of 7 **(Figure 2.2-4)** while Gonzaga has a total of 32 deep wells. The rural area uses shallow wells and water stations except Barangay Gaddang that use level 2 water source distributed in fifty faucets located at various strategic places that benefit 202 households. There are no recorded data of deep well in the municipality of Buguey.

The Municipality of Gonzaga is endowed with various water bodies as attributed by its mixture terrain and good vegetation. These water bodies are rivulets, creeks, streams and rivers whose main source is from the forested areas of the municipality. Presently there are 2 major rivers with great watershed, these are the Wangag and Baua rivers. These rivers supply the water demand of the municipality in terms of irrigation and domestic uses. The same maintain the availability of potable underground water sources which can be reached to a depth of less than 3 meters up to 35 meters. **Figure 2.2-3** shows the groundwater resource map of Gonzaga.

No water requirement is needed for the operation. The primary water utility will be for domestic use like bathing, cleaning, washing of clothes and dishes. It will be sourced and processed onshore. An estimate of 100 cubic meters of water is delivered to the vessel once a month (or as needed) for domestic use. A tugboat will deliver it from Cagayan Special Economic Zone and Freeport (CSEZF) going to the vessel and it will be transferred via tube connected to the main water storage. Their estimated daily water consumption is 5 cubic meters. Drinking water for employees are delivered onboard in a water gallon container. Water conservation measures will be in placed to ensure that resources are conserved and utilized efficiently such as signages posted in strategic areas, inspection of water pipes to ensure no leakage, and controlled and monitored water tank refilling in the vessel.

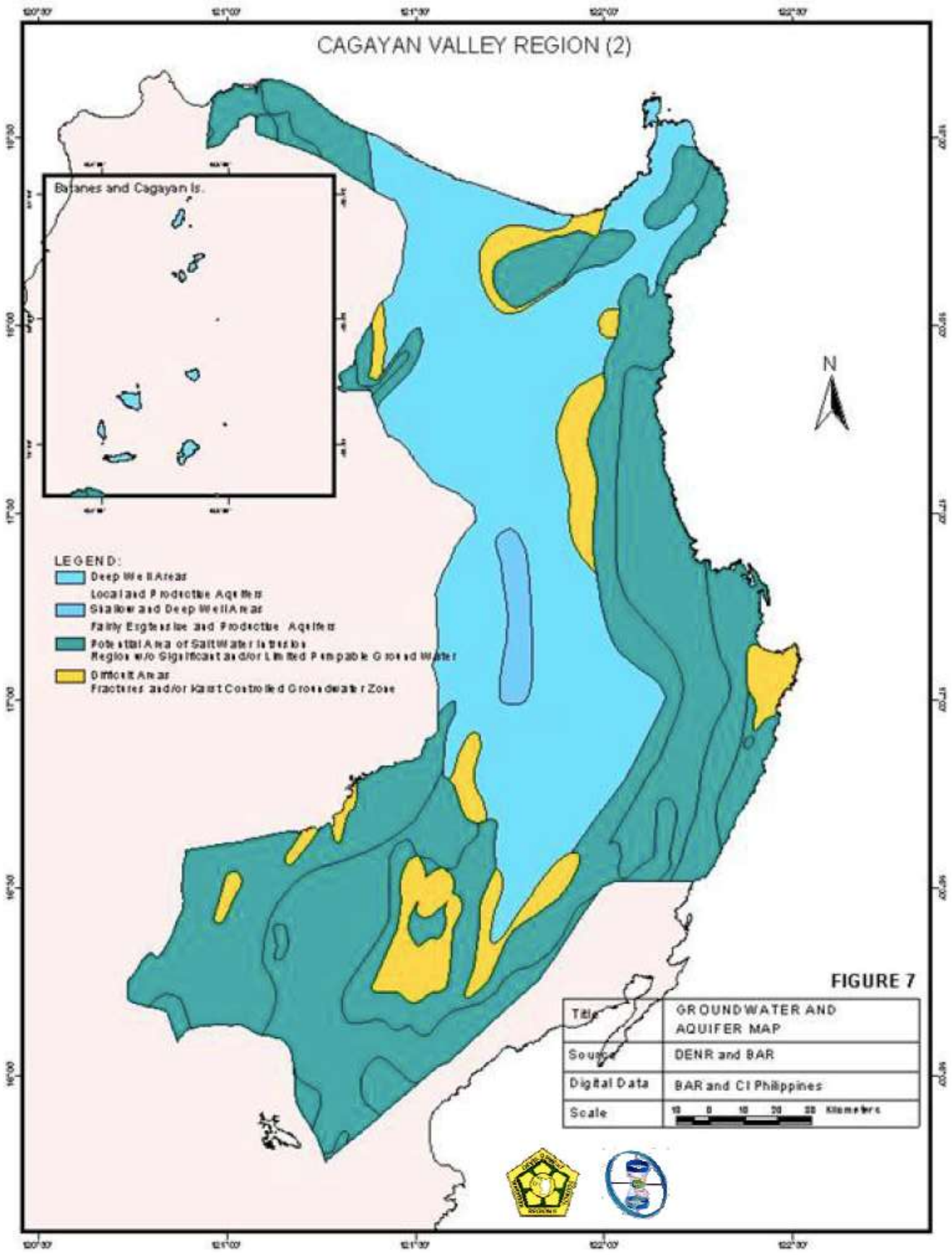


Figure 2.2-2. Groundwater and Aquifer Map of Cagayan Valley
Source: Cagayan Valley Regional Development Plan, 2011-2016

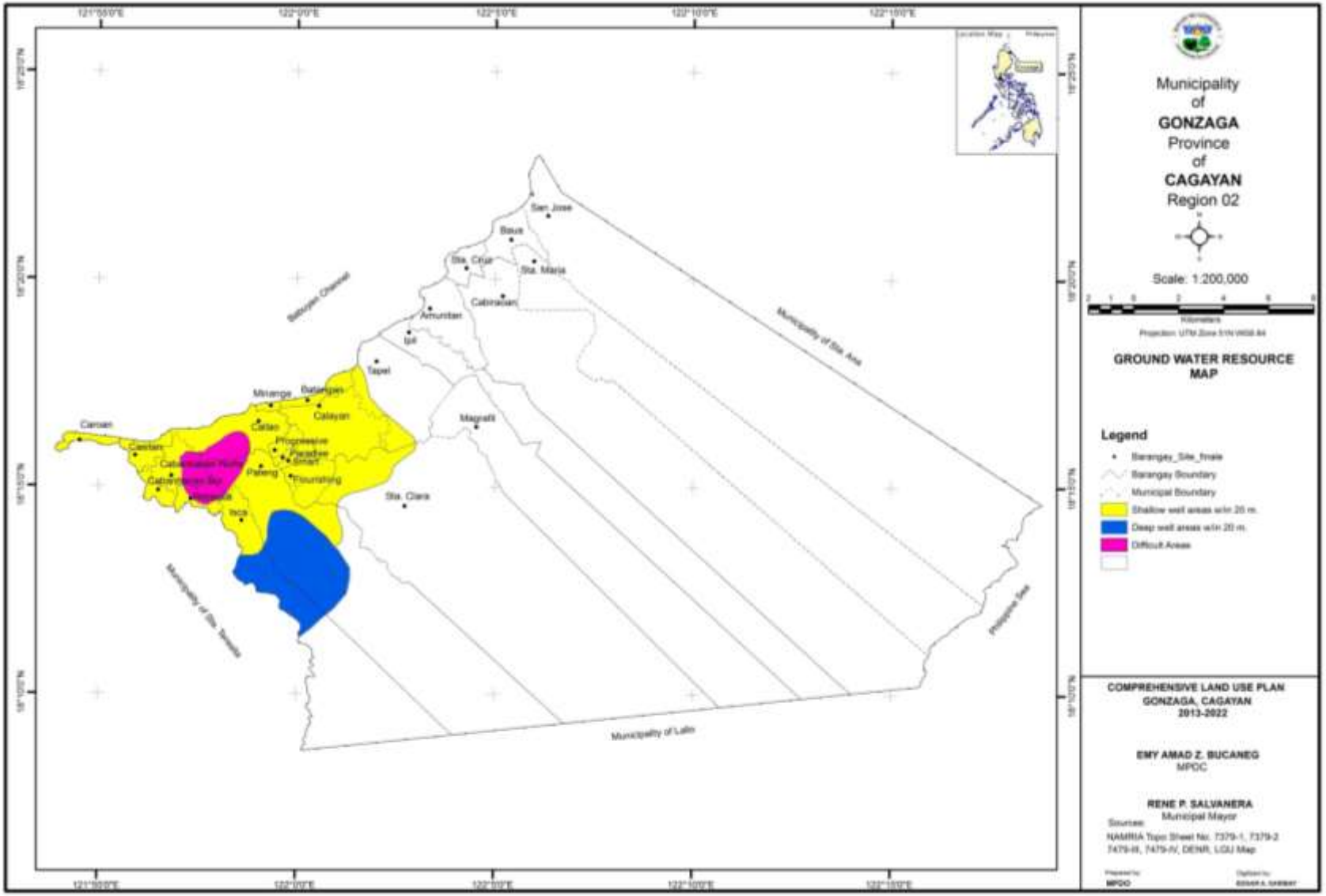


Figure 2.2-3. Groundwater Resource Map of Municipality of Gonzaga *Source: Gonzaga CLUP, 2013*

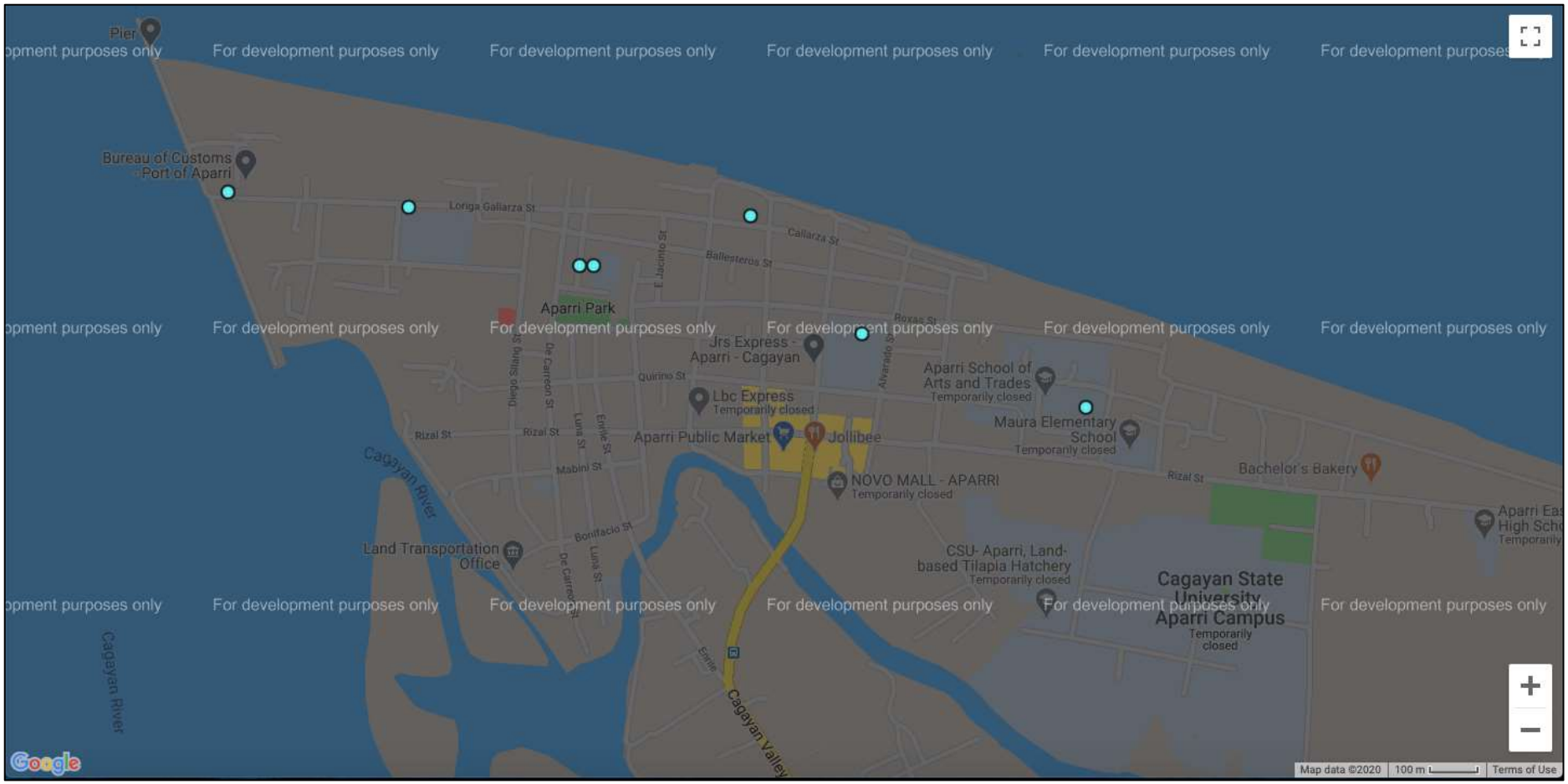


Figure 2.2-4. Location of Deep Wells in the Municipality of Aparri *Source: Philippine Groundwater Databank*

2.2.2 Oceanography

2.2.2.1 Change/Disruption in Water Circulation Pattern, Littoral Current, and Coastal Erosion and Deposition

Shoreline Characteristics

Shoreline fronting Cagayan Province is fairly uniform and the beaches are relatively wide. Along the shoreline stretch, the seashore is characterized by gradually dropping bathymetric profile which allows giant waves from the rough sea to break continuously into the beaches. Waves most turbulent during storms and northeast monsoon periods.

The shoreline from Sanchez Mira on the west to Abulug and Ballesteros on the east prevents a uniform, continuous and almost straight strip occasionally cut by intervening (sic) drainage (Cesar V. Ramos, BMG, 1971). There are no gravel, rock or coral reef observed. The surface layer mainly consists of black sand (magnetite sand) and has a gentle slope from the coastline about 1.5 kilometers offshore. Highly elevated sand bars of about 15 meters high characterize the land from along the beaches. The beach deposit of mostly of black sand materials extends further inland merging with the alluvial deposits of major waterways.

Waves, Seabed Depths and Tidal Currents

The direction of the maximum fetch is northeast. This is a long narrow corridor bounded by Fuga Island and Camiguin Island and may run up to more than 200 kilometers. From the east, the fetch is only about 100 kilometers. Based on the above-mentioned fetch lengths that may control wave lengths within the study area, the significant wave heights were calculated using nomograms of deep-water significant wave prediction curves as functions of wind speed, fetch length and duration. Waves are most turbulent during storms and northeast monsoon periods. Specifically, the topographic map of the seabed from bathymetric survey reveals that the project area in the coastal waters of Gonzaga Municipality has depth that ranges from 35 to 71 meters.

The tide within the channel flows in a constant direction without turbulence and the velocity of the current is relatively high in the 2 to 2.5-knot range, which would not affect the mining activities. As for water depth, the depth to the seabed and direction of tidal current was investigated through ballasts, and the depth of water was measured to be below 30 – 45 m from maximum 23 km to minimum of 11 km offshore, followed by sudden slope of more than 90 m thereafter.

Table 2.2-1. Sea Level Tidal Data: Hourly Heights of San Vicente Port, Santa Ana, Cagayan

Hourly Heights of San Vicente Port																										
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DD	MM	YY
84	71	73	89	115	144	169	183	183	171	150	126	106	96	98	112	135	161	184	196	197	184	160	131	1	1	17
102	82	75	83	103	131	159	179	187	181	166	143	120	103	98	105	122	143	166	184	192	188	170	145	2	1	17
117	93	78	77	90	114	142	165	180	183	176	159	137	117	103	98	104	121	145	167	183	188	181	163	3	1	17
139	113	92	83	87	104	126	150	170	181	182	171	153	133	115	104	102	112	129	150	168	179	181	174	4	1	17
159	137	116	99	94	100	116	137	158	175	185	184	174	157	137	117	104	102	112	127	145	161	172	175	5	1	17
169	154	135	117	105	101	107	121	140	161	177	184	183	174	159	140	121	109	107	114	128	146	163	175	6	1	17
177	171	158	141	125	113	108	113	125	141	159	175	183	184	177	163	144	124	110	105	109	120	137	155	7	1	17
170	178	176	166	150	133	121	115	117	127	144	163	181	193	197	191	174	151	128	110	101	101	111	130	8	1	17
152	171	181	182	173	158	141	125	117	118	129	147	168	188	203	209	202	181	153	125	101	88	88	100	9	1	17
123	149	172	186	189	181	165	145	127	115	114	124	143	168	192	209	215	206	182	150	116	88	74	75	10	1	17
92	119	149	174	188	191	181	162	138	117	105	106	119	141	170	197	215	218	204	176	140	104	77	64	11	1	17
67	87	118	151	179	194	194	181	157	130	107	96	100	118	145	177	205	224	225	206	173	134	97	71	12	1	17
61	70	95	129	164	190	202	197	177	149	122	101	92	100	122	155	189	217	231	225	199	161	120	86	13	1	17
65	61	76	106	142	173	193	198	187	165	137	111	95	94	108	134	167	199	220	226	212	184	148	111	14	1	17
80	64	67	89	122	155	182	195	194	178	154	127	104	92	94	110	136	166	192	207	207	191	163	129	15	1	17
95	72	64	73	97	129	159	180	187	183	170	150	127	107	99	105	122	144	169	190	201	199	182	156	16	1	17
126	99	82	80	94	119	147	172	187	190	181	163	140	119	104	101	110	129	152	174	190	196	189	172	17	1	17
147	122	101	92	96	112	135	158	176	188	188	178	159	137	118	107	106	116	133	152	169	182	185	178	18	1	17
162	141	122	109	105	112	128	149	168	183	189	185	174	157	138	123	115	117	126	140	155	169	177	177	19	1	17
169	155	139	125	117	117	126	140	156	171	180	183	180	171	158	144	132	125	125	131	141	152	161	168	20	1	17
169	163	153	141	131	126	126	133	145	159	172	180	183	180	171	158	144	132	125	124	129	136	145	155	21	1	17
161	162	159	153	144	134	127	125	129	138	149	160	170	175	174	168	156	140	125	114	109	111	119	130	22	1	17
141	149	154	153	148	140	130	122	118	120	128	139	151	162	170	170	163	149	132	114	101	93	94	104	23	1	17
118	133	146	154	157	152	141	128	117	113	116	126	140	156	170	178	178	169	152	131	111	97	92	95	24	1	17
108	126	145	160	168	168	159	144	128	115	110	115	129	148	168	184	191	188	174	152	127	104	90	87	25	1	17
96	114	137	160	176	182	176	161	141	122	110	108	117	136	161	185	201	204	195	174	147	119	97	87	26	1	17

Hourly Heights of San Vicente Port																										
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DD	MM	YY
89	104	128	154	176	187	185	172	151	128	108	98	100	116	141	168	191	203	201	185	157	125	96	77	27	1	17
72	82	104	133	162	182	189	182	164	140	115	96	89	98	120	149	177	197	205	198	175	143	110	83	28	1	17
68	69	85	112	143	170	186	189	178	155	127	101	87	88	105	133	165	193	211	213	197	169	134	101	29	1	17
77	69	78	101	132	162	186	196	193	176	150	122	101	92	99	120	150	181	205	216	210	189	158	124	30	1	17
94	77	75	89	116	148	178	197	202	193	170	140	112	93	89	101	125	156	185	206	211	199	174	141	31	1	17
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Hourly Heights of San Vicente Port																										
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Hourly Heights of San Vicente Port																										
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Hourly Heights of San Vicente Port																										
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162	160	156	149	141	136	137	143	152	162	174	182	183	178	170	159	145	131	122	122	127	136	146	158	20	4	17
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137	163	187	203	208	199	178	150	124	103	96	103	126	156	185	208	217	210	191	163	134	110	97	98	24	4	17
115	144	176	202	218	217	201	174	142	112	90	84	98	127	163	197	219	226	215	190	157	125	102	94	25	4	17
104	129	163	197	223	234	225	200	164	127	95	78	80	101	136	175	208	228	229	212	183	148	118	100	26	4	17
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Hourly Heights of San Vicente Port																										
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169	152	140	135	141	155	173	191	206	212	208	194	174	151	129	115	111	118	131	150	169	187	197	196	31	5	17
186	171	157	146	143	147	157	171	185	196	200	199	190	170	151	999	999	999	999	999	999	999	999	999	1	6	17
NOTE: ALL HEIGHTS ARE REFERRED TO ZERO OF TIDE STAFF (0TS) IN CENTIMETERS.																										

Drainage, Bathymetry and Seabed Profiling

The bathymetry of the areas within and around the MPSA area is greatly influenced by the land-based drainage systems that are unloading their load into the depositional basin and by the current that passes through the Babuyan Channel. The drainage system, which has the most significant influence on the project area, is the Cagayan River. The Cagayan River, meandering in a generally north-south direction, originates in the Caraballo Mountain Range and discharges its load into the Babuyan Channel of the Luzon Strait. Being the longest river in the Philippines and having the largest catchment area, its downstream portion has an annual sediment transport capacity of approximately 5 million cubic meters (Oosterberg, 1997).

Based on the bathymetric maps, the proposed project area has a depth ranging from approximately 30 to 360 meters from a distance of 6 to 18 kilometers offshore. The shoreline fronting Cagayan Province is fairly uniform and the beaches are relatively wide. Along the shoreline stretch, the seashore is characterized by gradually dropping bathymetric profile, which allows giant waves from the rough sea to break continuously into the beaches. Waves are most turbulent during storms and northeast monsoon periods. Specifically, the topographic map of the seabed from bathymetric survey reveals that the project area in the coastal waters of Gonzaga has depth that ranges from 35 to 71 meters (**Figure 2.2-5**).

To further confirm the bathymetry result, the company has also conducted a marine geophysical survey consisting of high-resolution seismic profiling and bathymetric measurements. In this activity, the water depth was again conducted. The survey consisting of high-resolution seismic reflection profiling and continuous bathymetric measurements was undertaken primarily to precisely map water depths, characterize submarine topographic features, subsurface stratigraphy of consolidated sediments and to identify, delineate and map areas with potential economic occurrences of magnetite bearing sand bodies in the area.

High-resolution seismic profiling was carried out simultaneous with bathymetric measurements along pre-determined survey track lines. Traverse lines were oriented almost perpendicular to the general trend of the shoreline and spaced at 500 to 1,000 meters interval. **Figure 2.2-6** shows the actual location of traverse lines within the eastern segment of the mineral tenement of JDVC covering/adjoining the municipal waters of Ballesteros, Appari, Buguey and Gonzaga, Cagayan. The traverse lines running NNE-SSW and NNW-SSE were spaced at 1 km interval with the option of using a closer interval (i.e. 500-meter) in areas where on-site preliminary analysis of the data indicates promising sites. The dotted gray lines represent the additional bathymetric measurements.

Bathymetry and Sea Bottom Features

Analysis of the bathymetric contours shown in the NAMRIA 1:250,000 topographic map (**Figure 2.2-5**) indicates contrasting submarine topography of the seabed east and west of the mouth of Cagayan River. A gentler slope of the seabed prevails on the eastern side of offshore Cagayan from the mouth of Cagayan River towards the Municipality of Santa Ana. In contrast, the seabed west of Cagayan River shows a moderate slope of about -1.4% slope from the shoreline of Ballesteros to a distance of 3,600 meters (where the -50-meter contour is encountered) seaward. The slope of the seabed from the Municipality of Buguey to a distance of 24,500 meters (up to -50-meter contour line) has a relatively gentler slope of about -0.2%. Result of the bathymetric survey of the eastern segment of MPSA-338 is shown in **Figures 2.2-6 and 2.2-7**.

The most prominent sea bottom topographic feature of offshore Cagayan is the submarine delta situated east of the mouth of the Cagayan River. As illustrated in **Figures 2.2-6 and 2.2-7**, the sea bottom from the coast of Buguey and vicinity gently slopes toward the north to about 100-meter isobath

but becomes steeper further offshore. The latter defines the flanks of the delta. Huge quantity of riverine sediments transported by Cagayan River to Babuyan Channel is believed to have caused the delta built up. The deflection of part of Kuroshio Current towards the Babuyan Channel coupled by the constriction on its exit as well as the opposing northeasterly current from the West Philippine Sea and South China Sea have caused the clockwise circulation toward the delta area. Subsequently, the resulting strong undercurrent could have also caused the migration of very fine sediments towards the deeper part of Babuyan Channel.

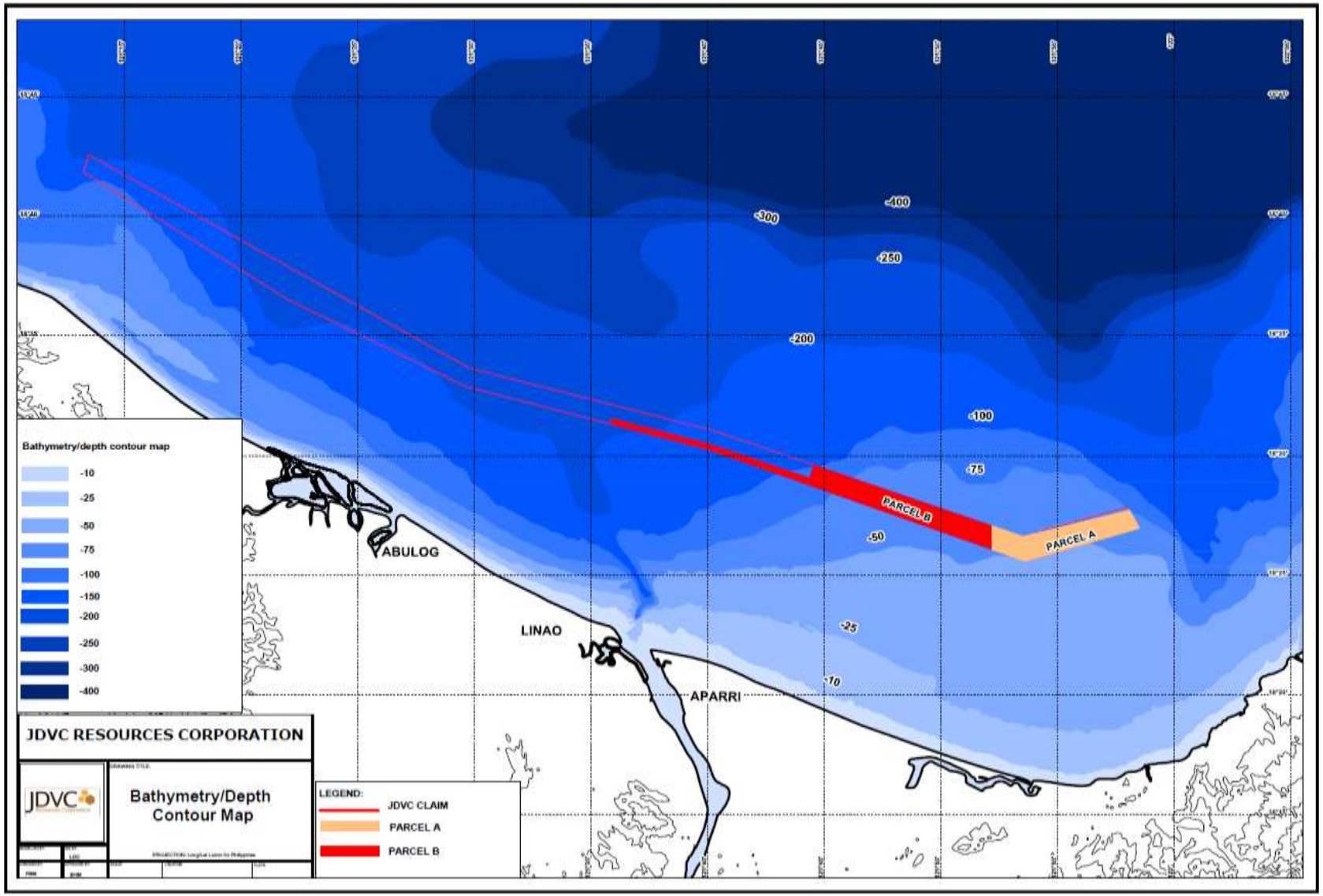


Figure 2.2-5. Bathymetry/Depth Contour Map of the MPSA Area

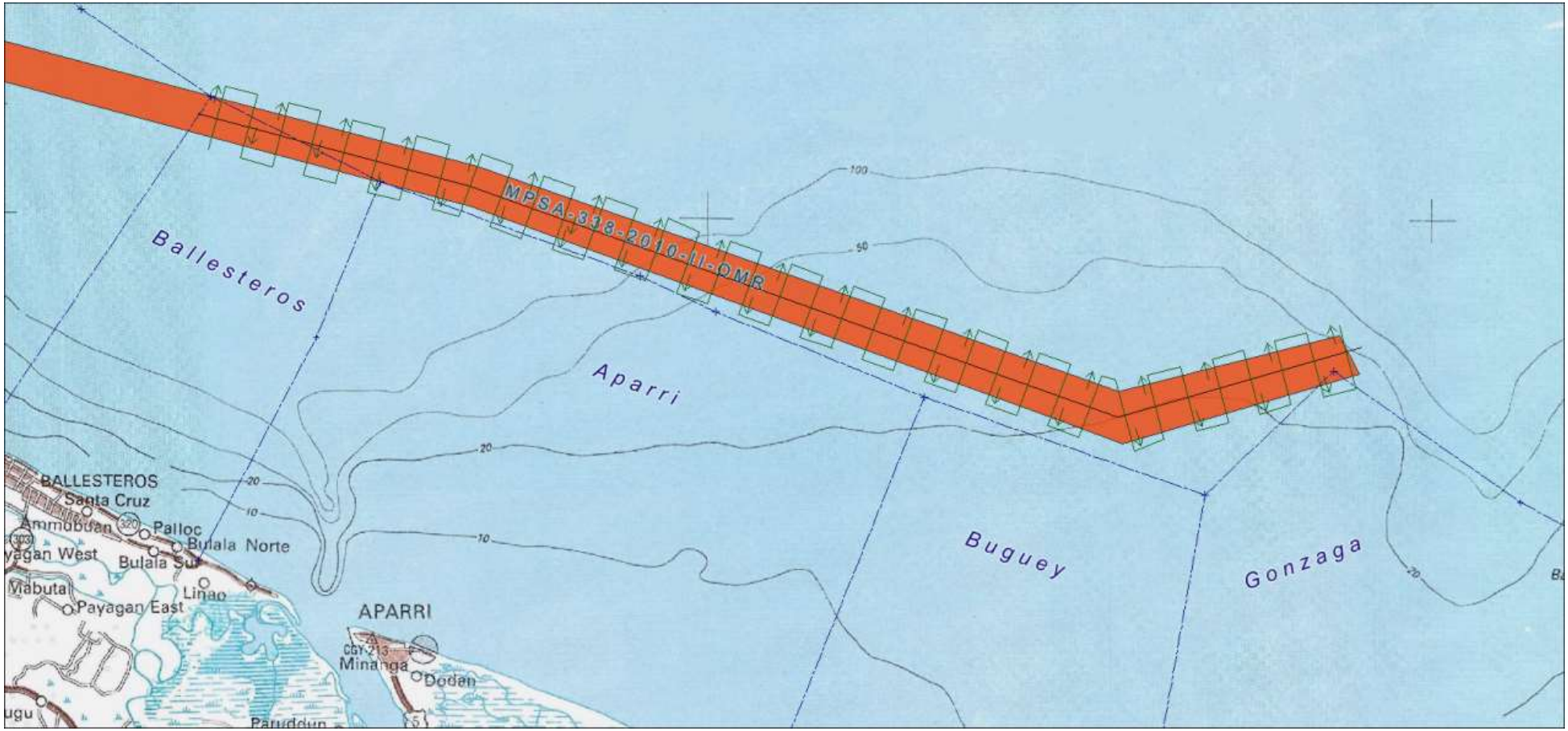


Figure 2.2-6. Location of Actual Track lines Along the Eastern Segment of the JDVC Tenement

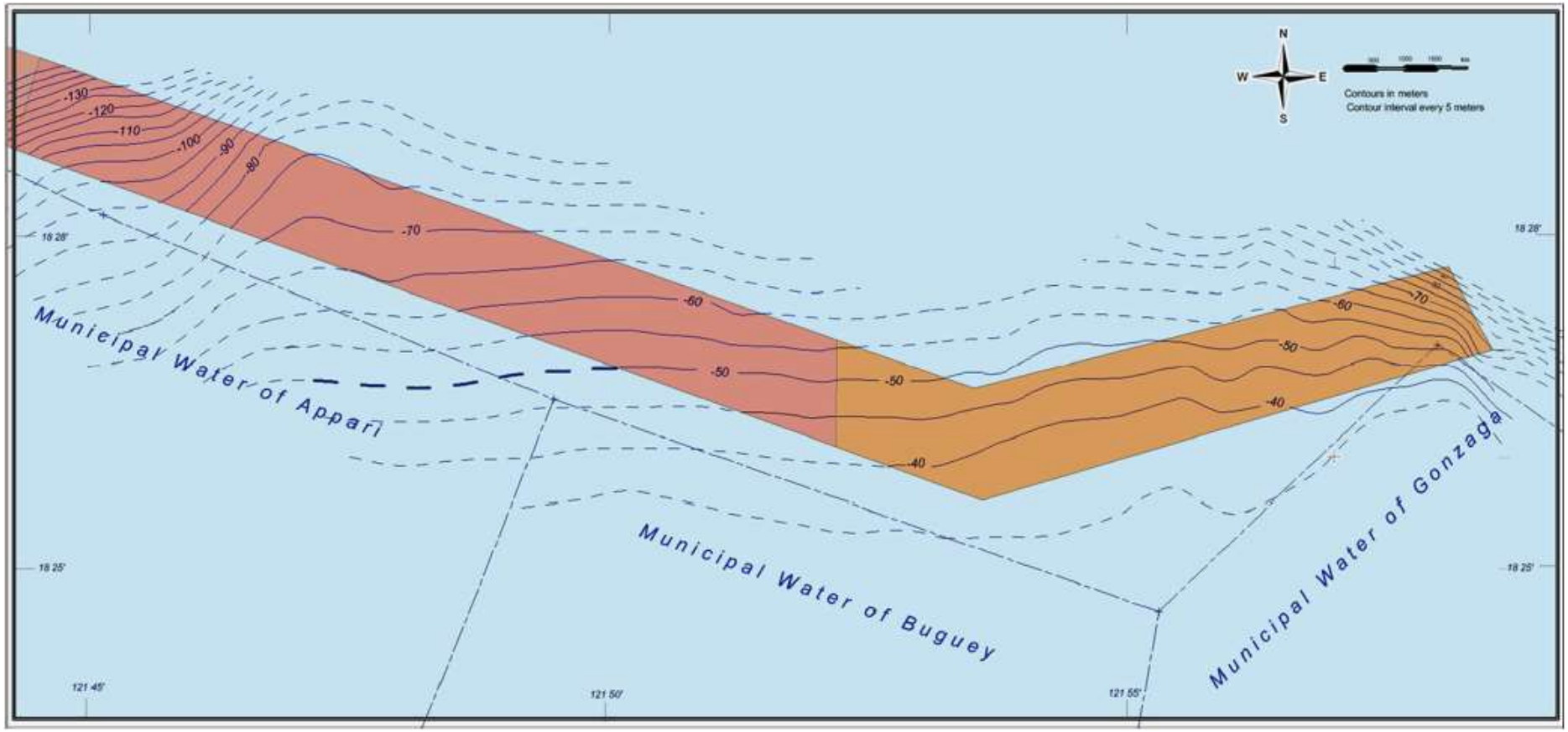


Figure 2.2-7. Bathymetry of the Eastern Segment of MPSA Area

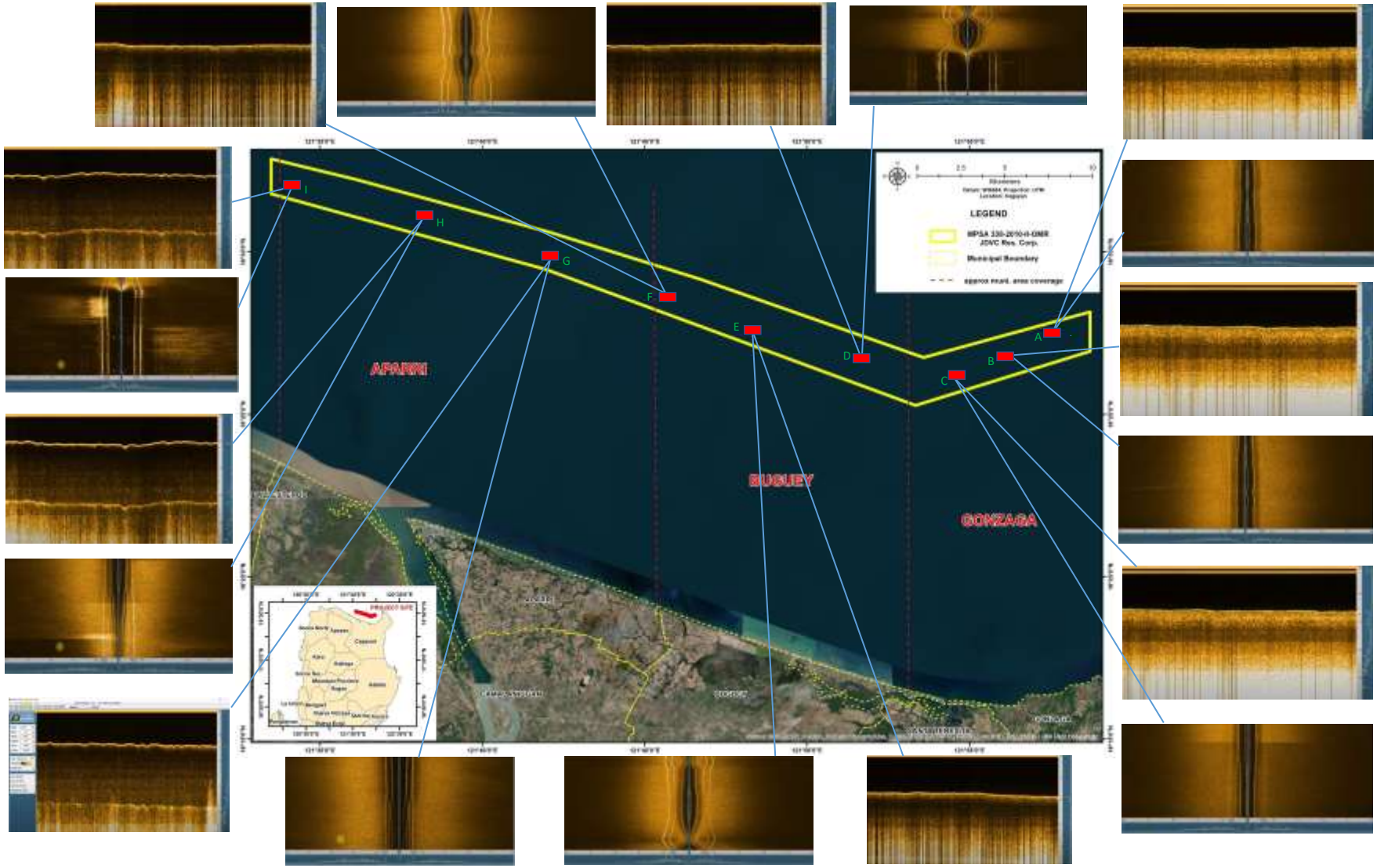


Figure 2.2-8. Side Scan and Sea Bottom Profiling of each Municipality

High-resolution Seismic Reflection Data

Analysis and interpretation of marine geophysical data gathered in the tenement area led to the identification and mapping of seismo-stratigraphic units and subsequently led to the delineation of areas that may potentially contain economic concentrations of magnetite sand, particularly along the eastern segment of the tenement area. These areas predominantly consist of layers or horizons with progradational characteristics of sediments exhibiting sigmoidal to oblique reflection characteristics.

In most instances, these layers are overlain by fluviatile to shallow marine sediment sequences. **Figure 2.2-9** shows the generalized seismo-stratigraphy of nearshore sedimentary sequences, showing the several progradational sediments (Units 2 and 3) representing stages of delta build up along coastal environment. The progradational sequences consisting of mostly of fine to coarse grained sand grade into finer sediments (clay and silt) seaward (Unit 1). The latter unit in offshore Cagayan generally consist of silty fine sand as the fine sediments are washed away by the circulating under current in the channel. In some instances, the most recent prograded sediments lie on top of the previously formed sequence giving rise to thick deposits of sand bearing horizons.

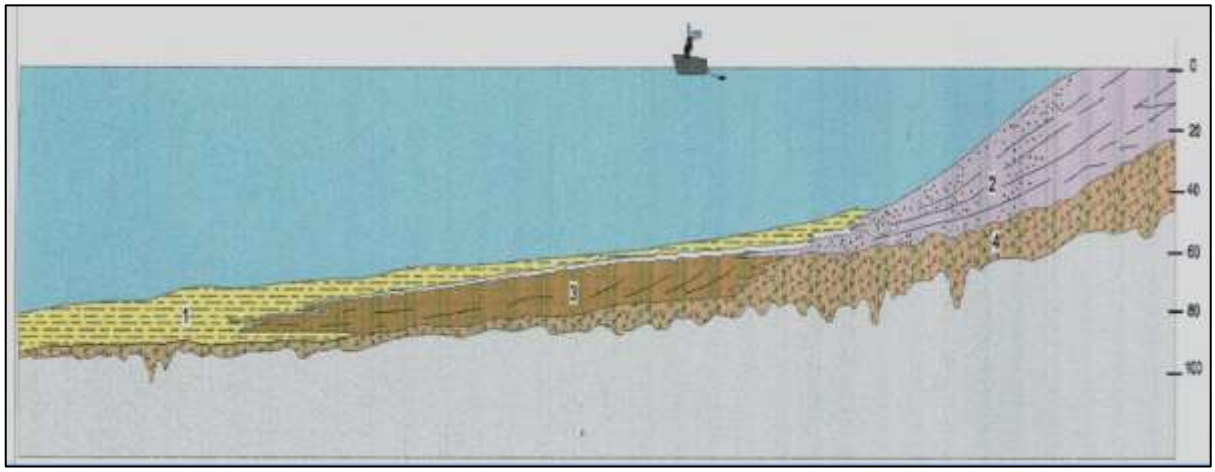


Figure 2.2-9. Generalized Seismo-stratigraphy of Coastal and Nearshore Sediments

The Cagayan River as it flows into the Babuyan Channel considerably loses its velocity causing the deposition of its bedload and suspended load. The delta deposits prograde or advance its edges into the Channel. **Figure 2.2-10** graphically illustrates the delta deposition.

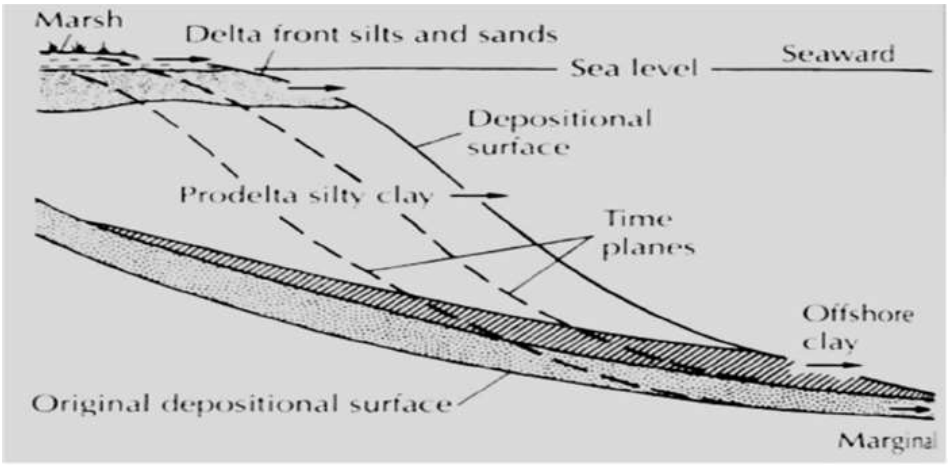


Figure 2.2-10. Schematic Diagram of Sediment Progradation in Deltas

The progradational sequences serve as a good target for magnetite sand deposits. Prospective areas were identified based on seismic reflection patterns and internal reflection characteristics. The following reflection characteristics were considered in the assessment:

- *Parallel to sub-parallel reflection pattern* – Fine-grained horizontally layered marine sediments consisting mostly of silt to silty fine-grained sand. This unit is interpreted to correspond to the Holocence mud sequence. Nevertheless, the finer component of this sequence appears to have been washed away due to the influence of the Kuroshio Current.

- *Oblique to sigmoidal reflection pattern* – Prograded sediments consisting chiefly of sand derived from delta building and wave concentrated deposits.

- *Chaotic reflection characteristics* – Channel filled sediments deposited in fluvial environment.

Results of data interpretation reveal that the unconsolidated sediment section underlying the contract area was deduced to be divided into four (4) distinct units characterized by their different internal seismic reflection patterns and separated by distinct reflection horizons. For purposes of identification, these units are hereby designated as **Unit 1, Unit 2, Unit 3** and **Unit 4** (from top to bottom).

- *Unit 1*

  Unit 1 generally consists of recent sediments of beach deposits along the shore grading into finer sediments offshore. It is characterized by parallel to divergent reflection patterns. Due to the influence of the Kuroshio Current flowing from the East Philippine Sea and deflected towards the Babuyan Channel, the finer sediments particularly on the eastern part of the area are transported towards the west. This unit generally consists of silt to fine grained sand with variable amounts of magnetite sand.

- *Unit 2*

  This unit is inferred to generally comprise of fine to medium sand of fluviatile to shallow marine origin. The internal reflection pattern consists of sigmoidal to chaotic patterns. There appears to be a gradational change to Unit 1 sediments which are characterized by a weak parallel reflection pattern with some oblique reflections nearer “shore”. This unit is inferred to consist of shallow marine sediments deposited nearshore or at the shoreline.

- *Unit 3*

  Characterized by parallel to seaward dipping/sigmoidal reflections and consists of the prograded shoreline deposits characterizing the eastern part of the contract area. It is deduced to consist essentially of fine to medium – grained sand materials.

  This Unit together with Unit 2 is believed to host valuable detrital mineral deposits particularly magnetite sand accumulations. Representative seismic profiles in the eastern and western parts of the area are shown in Figures.

- *Unit 4*

  The oldest unconsolidated sediment sequence in the area is Unit 4 that generally shows parallel to divergent and in some place’s hummocky reflection patterns. It is inferred to consist predominantly of older mud to silty sediment sequences. Underlying this unit is the acoustic

basement which in, some instances coincide with the bedrock. In seismology, the term acoustic basement is generally referred to as the surface, below which strata cannot be penetrated by seismic signals or cannot be imaged by seismic data. The acoustic basement surface covered by the survey, so far, is interpreted to be a relatively strong and irregular reflector.

Based on the analysis and interpretation of seismic reflection data gathered in the area, the seismo-stratigraphic units that can be considered as the most promising targets for magnetite sand exploration are units 2 and 3.

The exploration targets considered for the boring operation are the submerged prograded sediment sequence. The prograded sediments are characterized by inclined beddings that result from the deposition and accumulation of relatively coarse and heavy materials along the shore in a high-energy environment such as those in deltaic environment. The winnowing action of waves and tides bring forth concentration of comparatively heavy sediment grains along the shore and wash away the lighter and often fine-grained factions of sediments. They are also affected by longshore currents which cause deposition of magnetite sand parallel to the shoreline. It is characterized by oblique to sigmoidal reflection character and often has a high amplitude signal indicating sharp impedance contrast owing to the high density and sound velocity variations between the sediment types. The fluviatile and shallow marine sediment sequence was also included in the exploration target based on the internal reflection characteristics.

Representative seismic profiles in the area covered by the survey are shown in **Figures 2.2-12 to 2.2-20** and their locations are shown in the map in **Figure 2.2-11**.

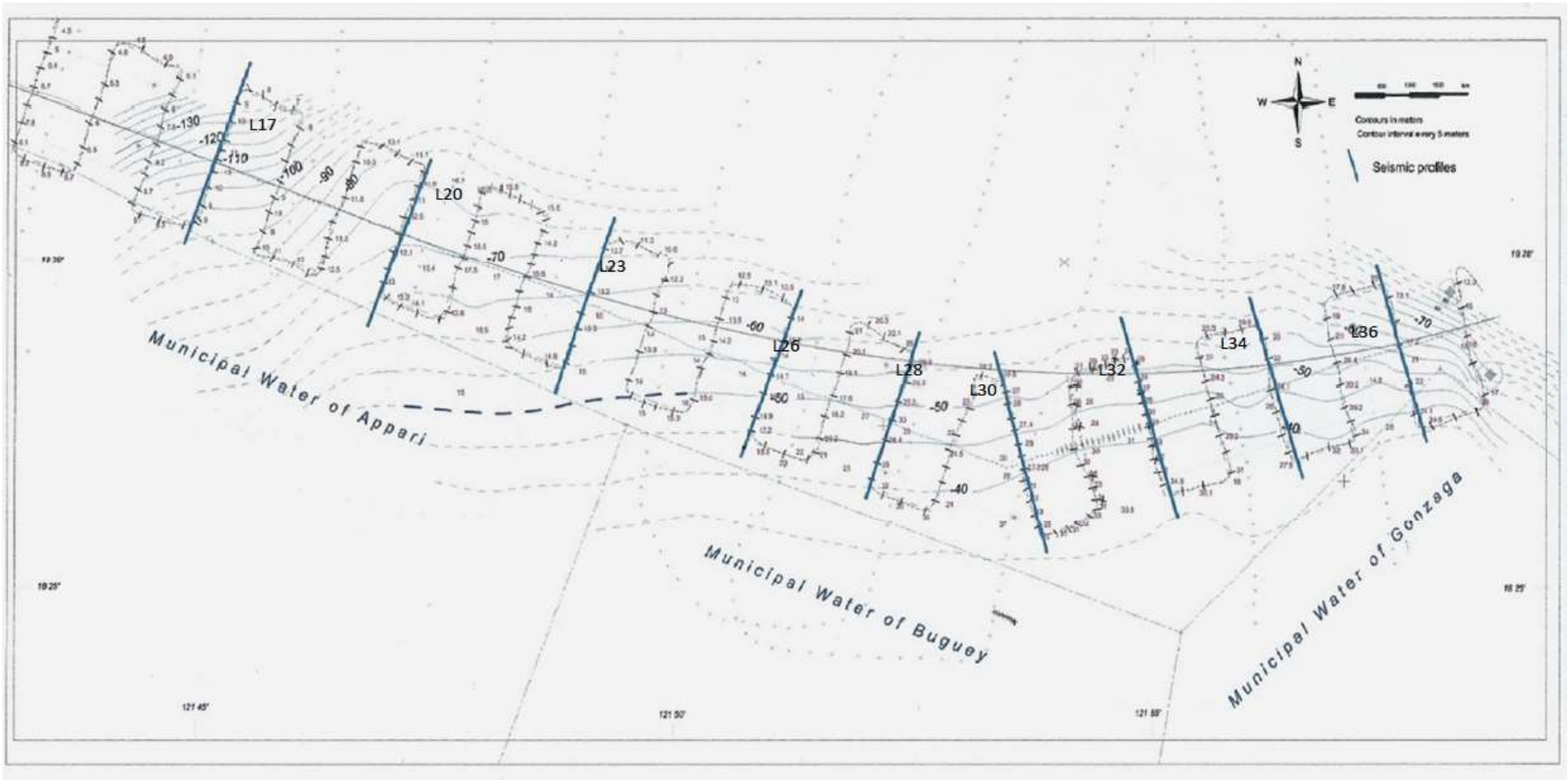


Figure 2.2-11. Location of Seismic Profiles (represented by the blue solid line)

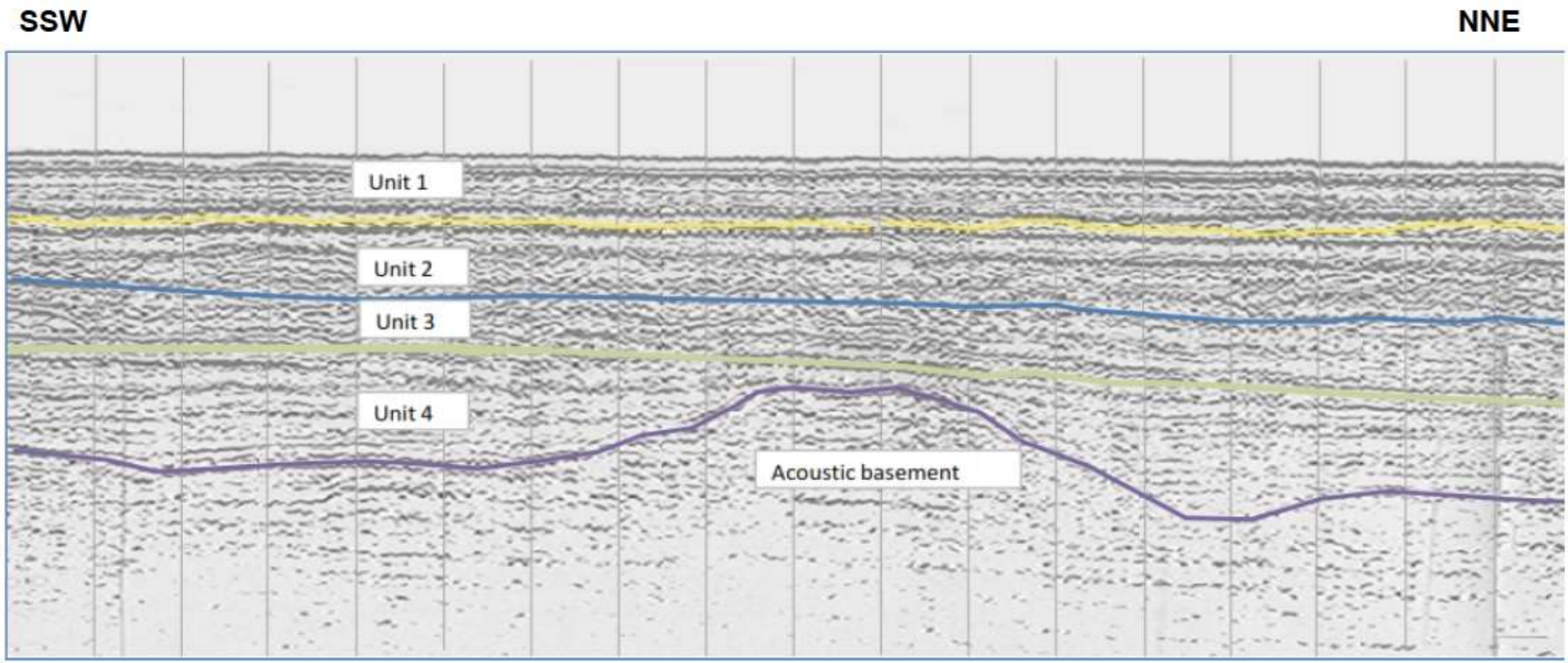


Figure 2.2-12. Seismic profile extracted from Line 17 situated off the coast of Appari, Cagayan. Unit 1 represents the offshore continuation of prograded sequence of sediments. The internal reflection character indicates several bands of silty fine-grained sand. In other areas of the Archipelago, this unit is generally characterized by almost transparent internal character suggesting very fine-grained sediments (Holocene mud).

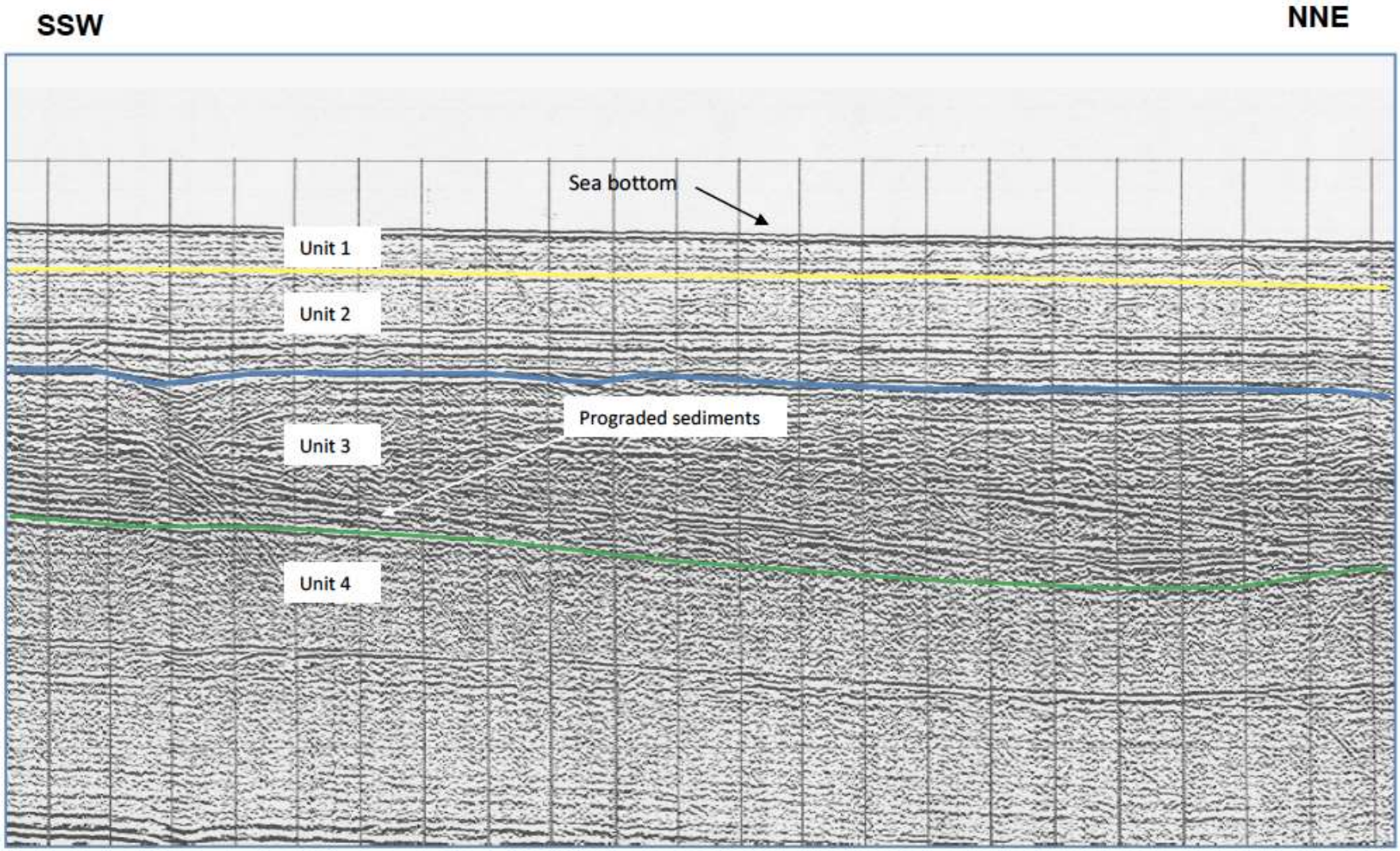


Figure 2.2-13. Seismic profile extract from Line 20 gathered off the coast of Appari, Cagayan. Sigmoidal reflection pattern is recognized within unit 3 indicating progradational sequence of sediments that are interpreted to consist of fine to medium grained sand deposit.

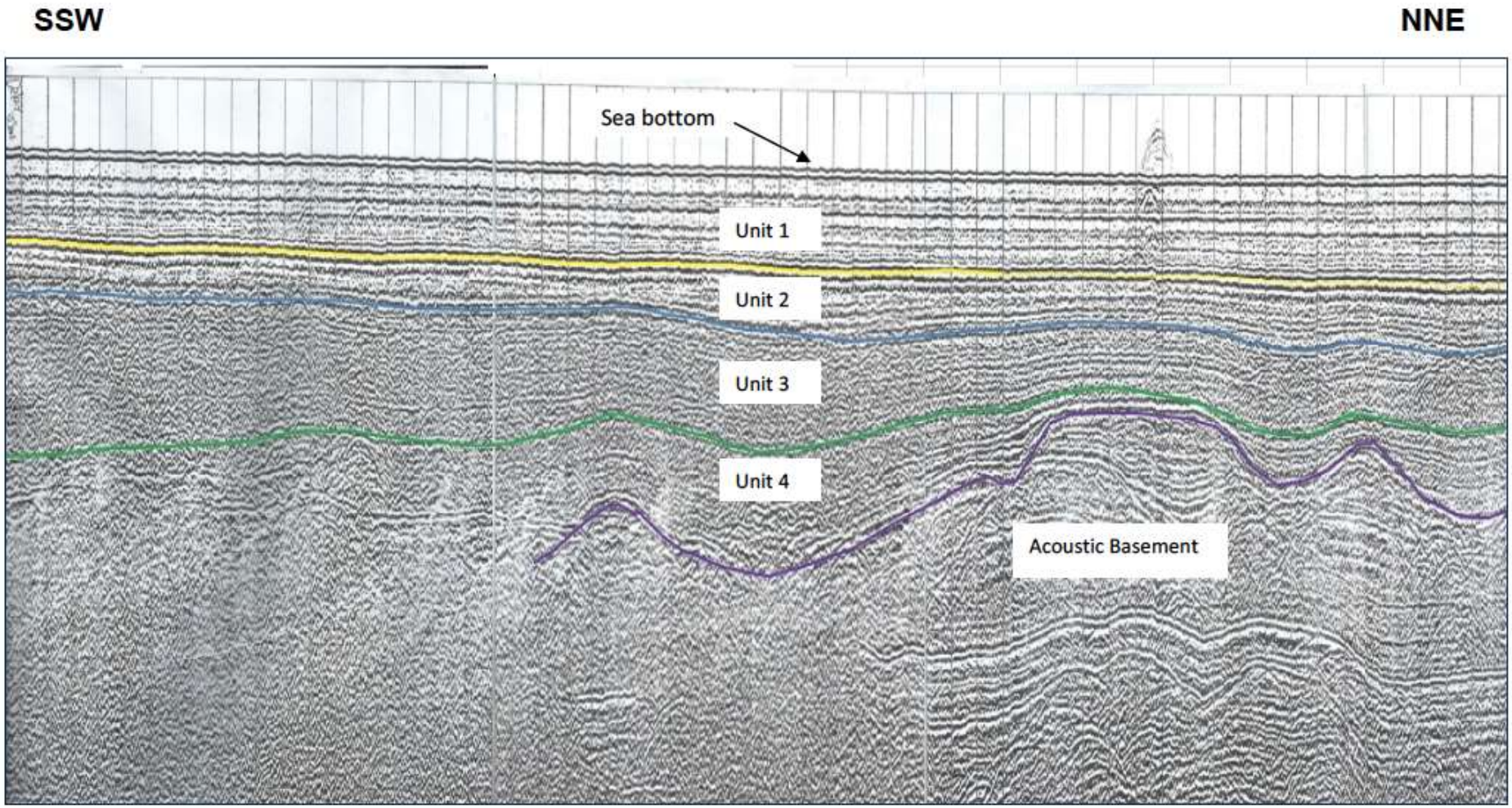


Figure 2.2-14. Seismic profile along Line 23 situated off the coast of Appari, Cagayan Province.

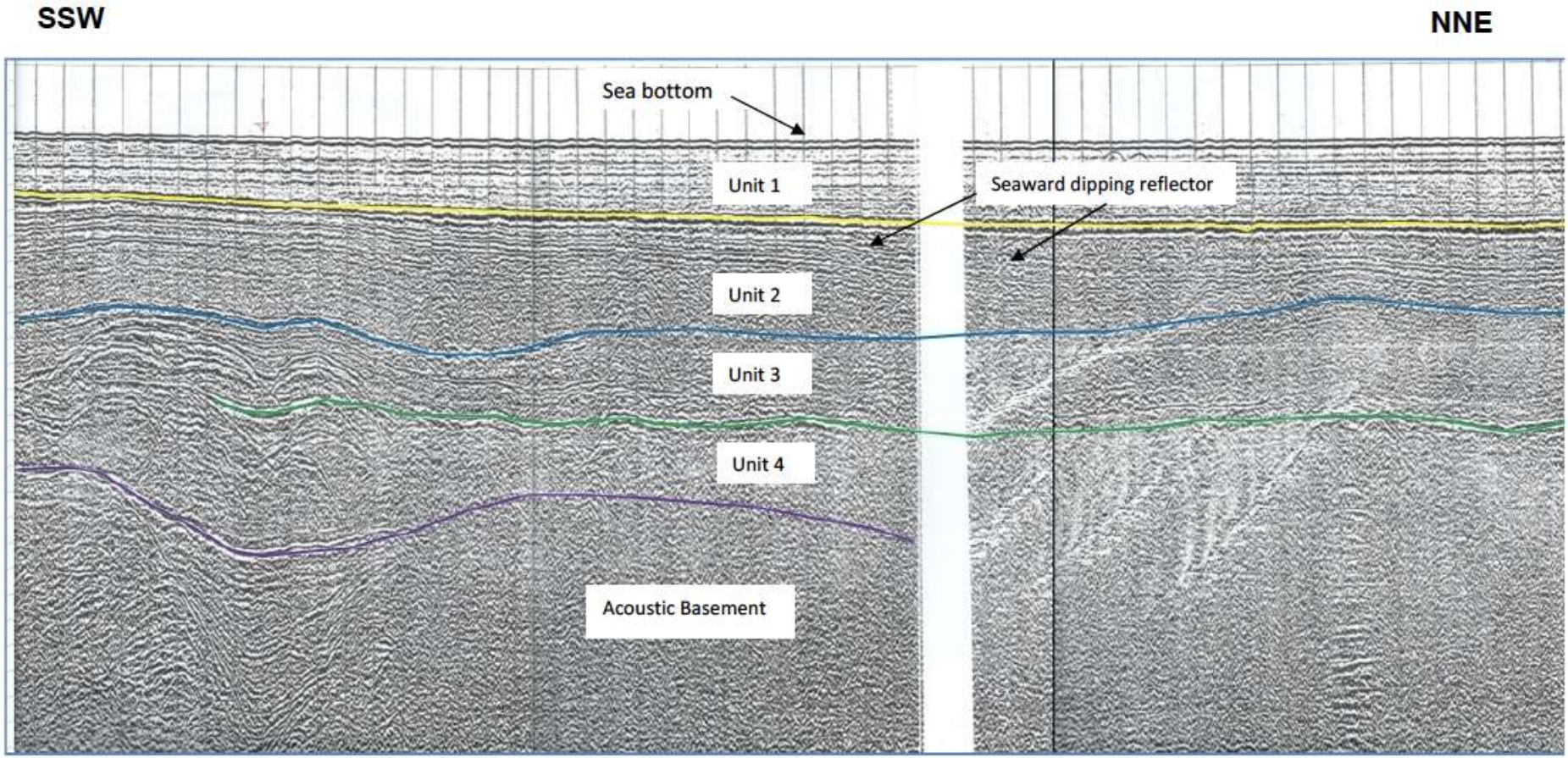


Figure 2.2-15. Seismic profile extract from Line 26 off the coast of Buguey, Cagayan. Seaward dipping reflectors showing sigmoidal reflection pattern are identified within the upper portion of Unit 2.

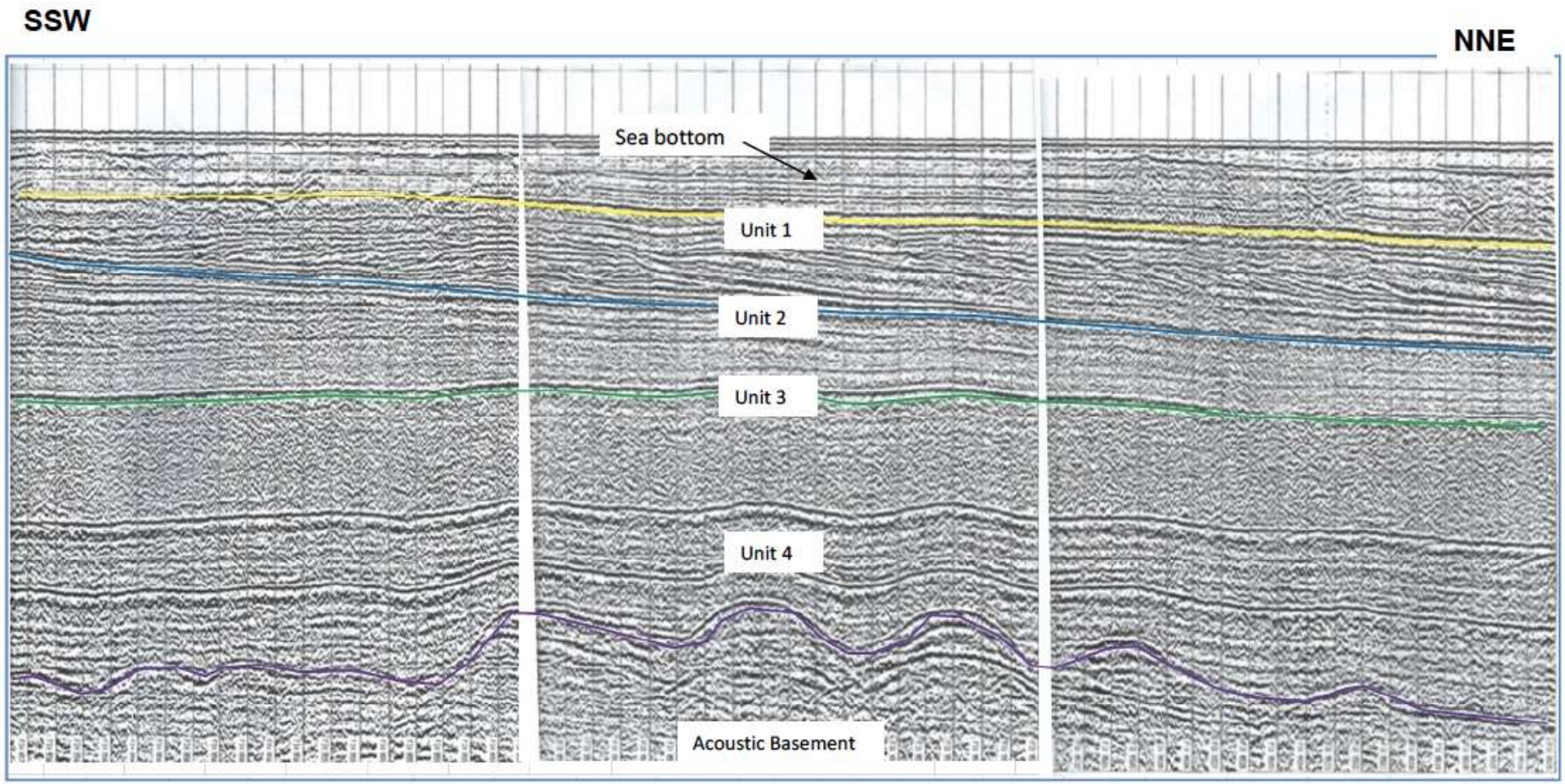


Figure 2.2-16. Seismic reflection profile extract from Line 28 off the coast of Buguey, Cagayan. Prograded sediments are clearly manifested in Unit 2 suggesting sand-prone horizons that may contain economic concentration of magnetite sand.

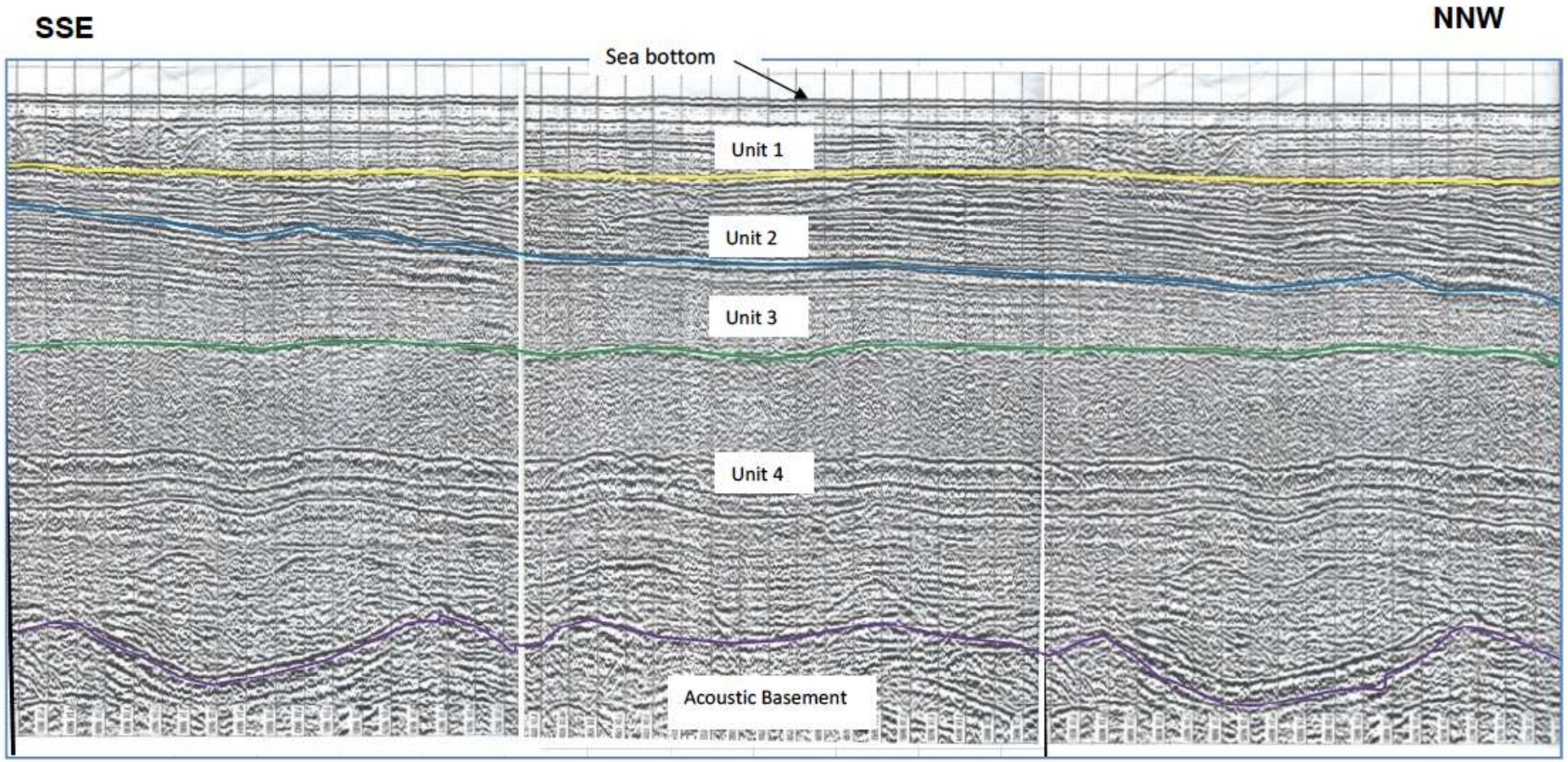


Figure 2.2-17. Seismic profile along Line 30 off the coast of Buguey, Cagayan.

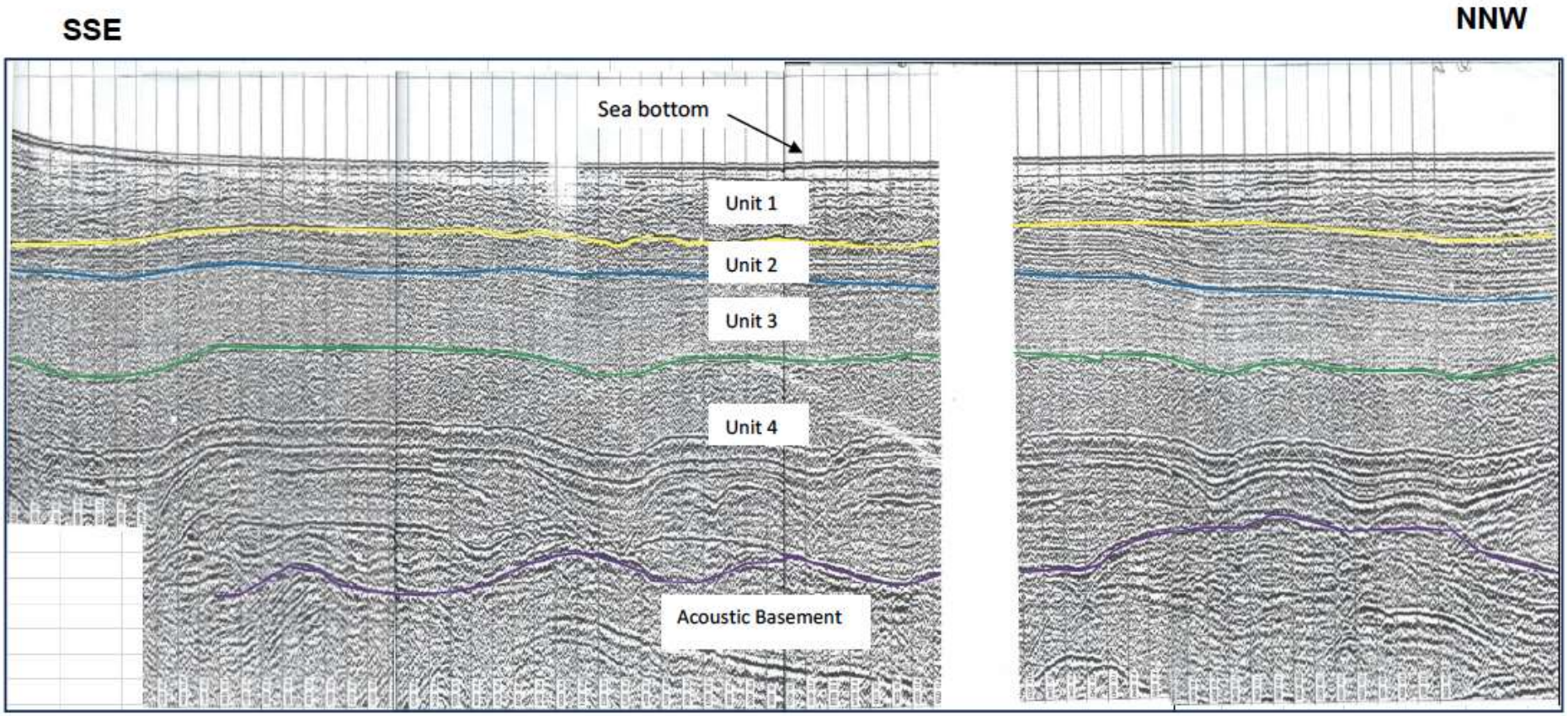


Figure 2.2-18. Seismic profile along Line 32 off the coast of Gonzaga, Cagayan.

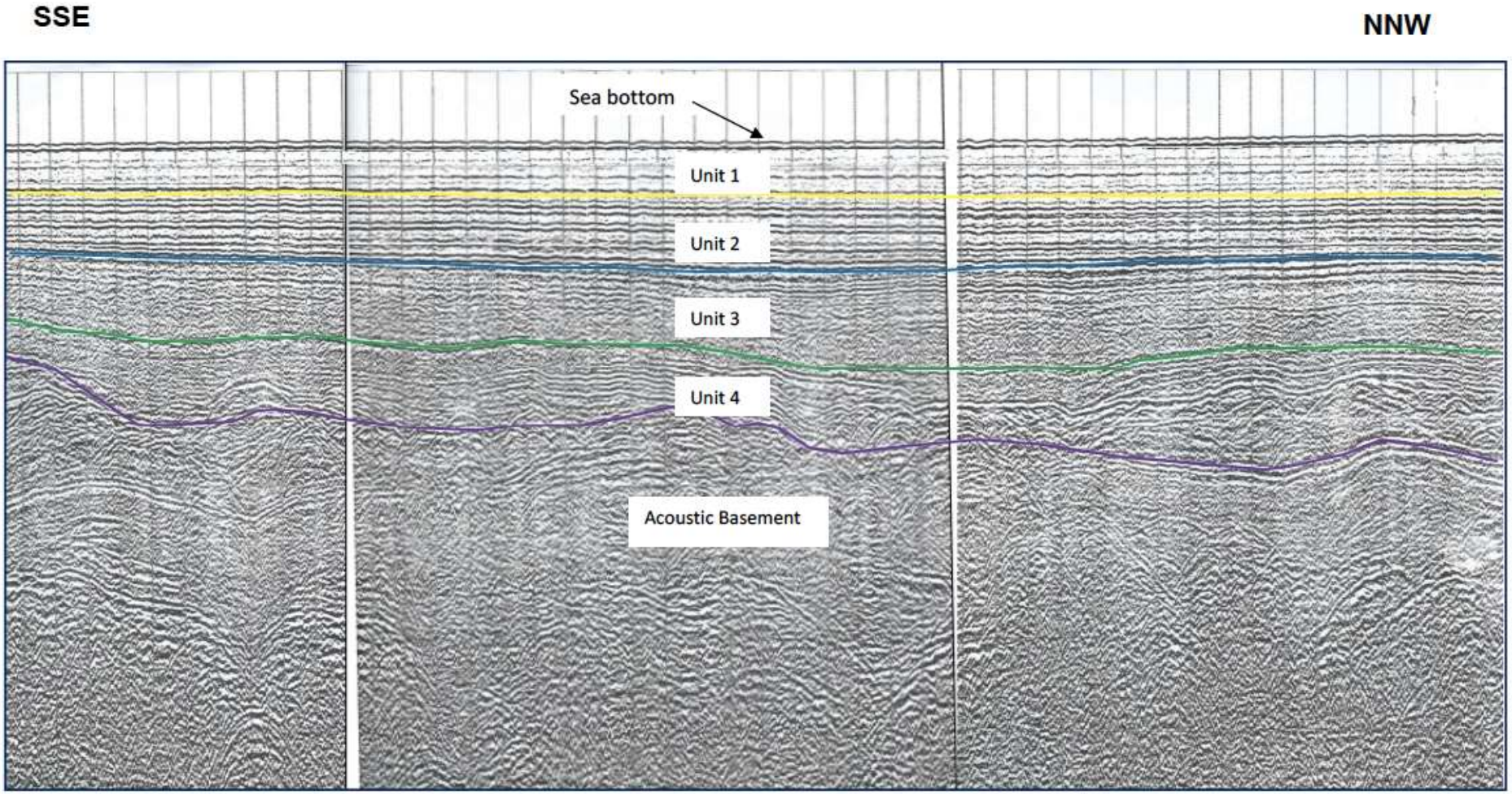


Figure 2.2-19. Seismic profile along Line 34 off the coast of Gonzaga, Cagayan

Sea Level Rise

There is a natural fluctuation in sea level in different areas around the world and within the geologic history of the earth. In the current epoch however, there is an observed global sea level rise on the average. Sea level rise is attributed to the thermal expansion of the upper ocean layers and the melting of glaciers and ice sheets. These are all related to the increase in global air temperature. A study conducted by NOAA Laboratory for Satellite Altimetry, NASA and other space agencies utilizing satellite altimetry revealed that there is 2.6±0.04 mm/yr rate of sea level rise in the Pacific Ocean **(Figure 2.2-20)**. The area with the greatest change is in the western Pacific side where the Philippines is situated **(Figure 2.2-21).** The rate in the Philippines is 5.8±0.6 mm/yr based on 1992 to 2011 data (Clavano, 2012). This is due to regional ocean – atmosphere dynamics, known as North Pacific Sub-tropical Gyre, wherein water is pushed clockwise in the northern hemisphere due to earth's rotation. The ocean current is further intensified by trade winds blowing westward. In the local scale sea level also varies due to other factors such as physiography, tectonic activity, tides, climate patterns and weather effects.

The average sea level rise in the western pacific region based on the Climate Change Synthesis Report prepared by IPCC in 2014 shows an increase of 60 to 70 cm for 2081 to 2100 as compared to the 1986 to 2005 data **(Figure 2.2-23).** A coastal vulnerability study conducted by Clavano (2012) showed an increase of about 20 cm in sea level in the Philippines in the next 40 years if the 1992-2011 values do not significantly vary. **Figure 2.2-24 (left)** shows the absolute rise of sea level in the Philippines by 2050. The highest increase is along the Pacific seaboard. Clavano (2012) developed a vulnerability index incorporating the effects of other factors such as erodibility of coastal landforms, rate of erosion and deposition, coastal slope, wave heights and tidal range **(Figure 2.2-24, right).** The result shows that the sea-level in the coastline of Cagayan is projected to rise by 25 to 30 cm in the year 2050. The coastal vulnerability index of the municipalities in Cagayan, is classified as high. This could have an impact in low-lying areas with very flat topography, which could be severely affected by coastal flooding. These areas include the coastal barangays identified as part of primary and secondary impact areas. These are the same barangays that are susceptible to flood and storm surge. Aside from flood, sea-level rise could also push the freshwater-saltwater interface farther inland. The effect of this is that wells near the coasts would pump-out saltier groundwater.

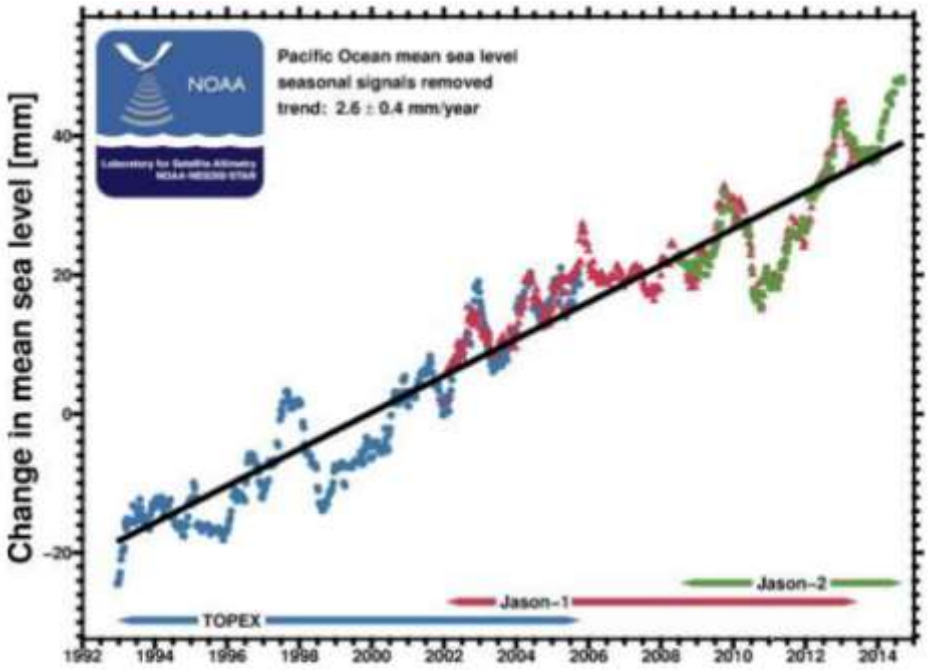


Figure 2.2-20. Sea level fluctuations in the Pacific Ocean from 1993 to 2014 (NOAA-STAR)

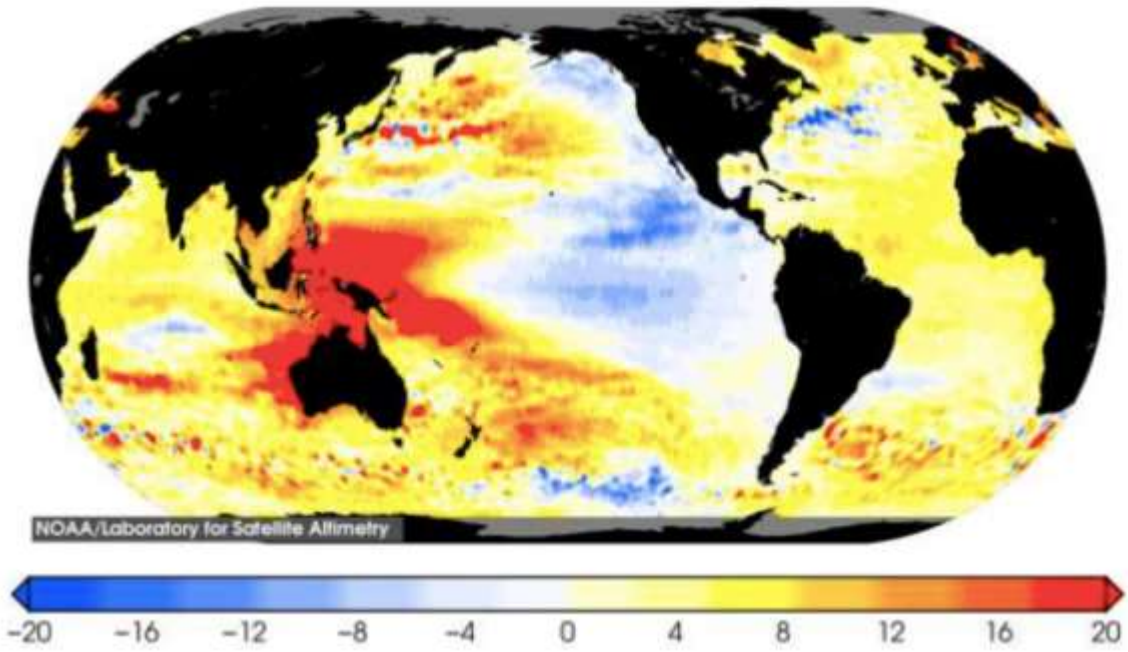


Figure 2.2-21. Sea Level Change (cm) (NOAA-STAR)

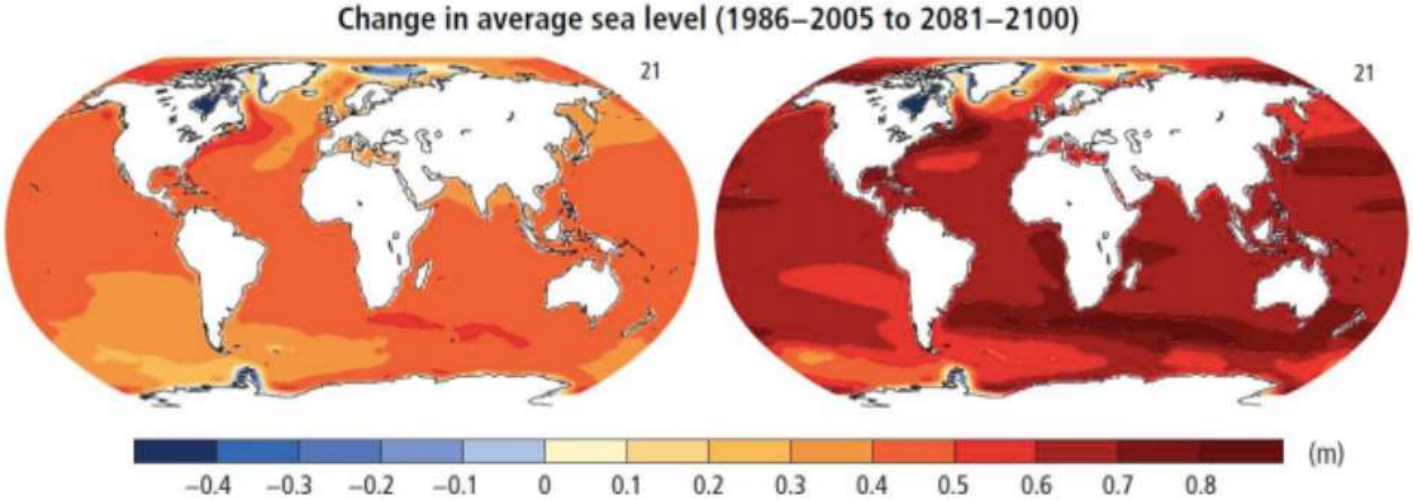


Figure 2.2-22. Projected Change in Average Sea Level for 2081-2100 based on the Climate Change Synthesis Report (IPCC, 2014)

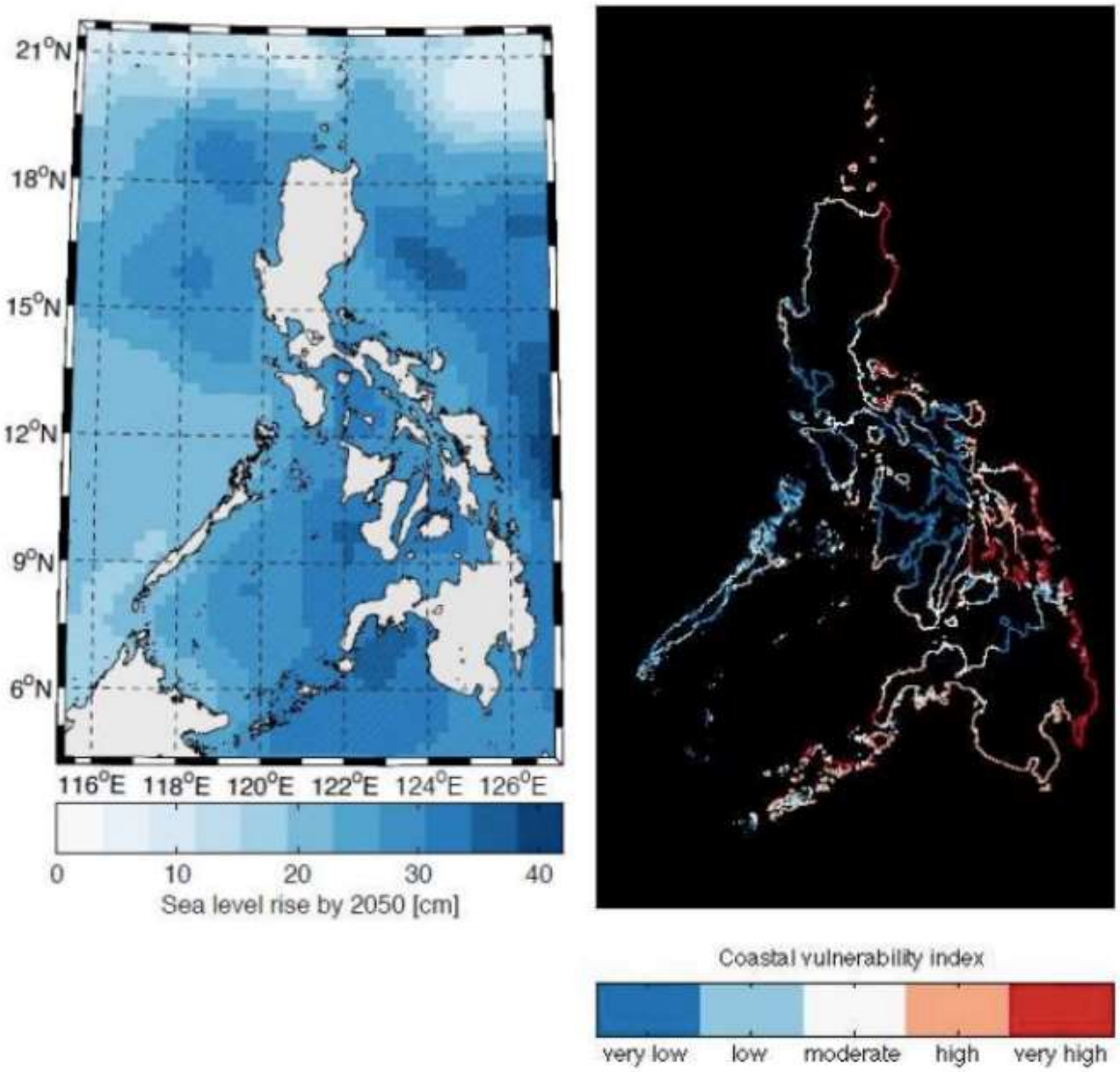


Figure 2.2-23. Left figure shows the projected sea level rise in the Philippines by 2050; Right figure shows the vulnerability index of the Philippine Coastline (Clavano, 2012)

Structure of Seabed Strata

During the preliminary investigation, large deposit of magnetite was confirmed through visual inspection. Visibility is limited during the investigation as a result of the rapid change between the ebb tide and flood tide. No mud was observed in the surface layer, and a 3-5 cm thick floating layer was formed. Seashells were found in some areas while majority of the surveyed site has sand layer but without any gravel, rock, or coral reef. The surface layer consists of all black sands and has a gentle slope from the coastline up to about 1.5 km offshore.

The direction of maximum fetch is northeast. This is a long narrow corridor bounded by Fuga Island and Camiguin Island and may run up to more than 200 kilometers. From the east, the fetch is only about 100 kilometers. Based on the above-mentioned fetch lengths that may control wave heights within the study area, the significant wave heights were calculated using nomograms of deep-water significant wave prediction curves as functions of wind speed, fetch length and wind duration.

The tide within the channel flows in a constant direction without turbulence and the velocity of the current is relatively high in the 2 to 2.5-knot range which would not affect the mining activities. The water depth,

on the other hand, was measured to be below 35 to 45 meters from a maximum of 23 kilometers to a minimum of 11 kilometers offshore, followed by a sudden slope of more than 90 meters thereafter.

Dominant current patterns

Based on previous studies, the surface circulation south and east of the Luzon Strait is dominated by strong and persistent subtropical current systems. At the surface, the yearly mean Pacific North Equatorial Current bifurcates at 13°N near the east coast of Luzon to form the northward-flowing Kuroshio and the southward-flowing Mindanao Current. The near-surface bifurcation latitude moves between 11°N in May and 14.5°N in November, and at depth it is even farther north of its surface expression. At 18°N the Kuroshio is a well-formed, northward-flowing western boundary current concentrated entirely west of 124°E; its high-speed core is positioned at 123°E, and its baroclinic structure is evident in the upper 600 m. Before reaching Taiwan, the Kuroshio encounters the Luzon Strait, which is the deepest passage from the Pacific Ocean to the South China Sea. At the southern portion of the strait, the Kuroshio takes a westward set and makes a detour into the South China Sea through the deepest channels of the Luzon Strait: The Balintany Channel and south of Babuyan Island. West and north of Batan Island, the Kuroshio flows within the Bashi Channel until it reaches the southeast coast of Taiwan (*Centurioni, 2004*).

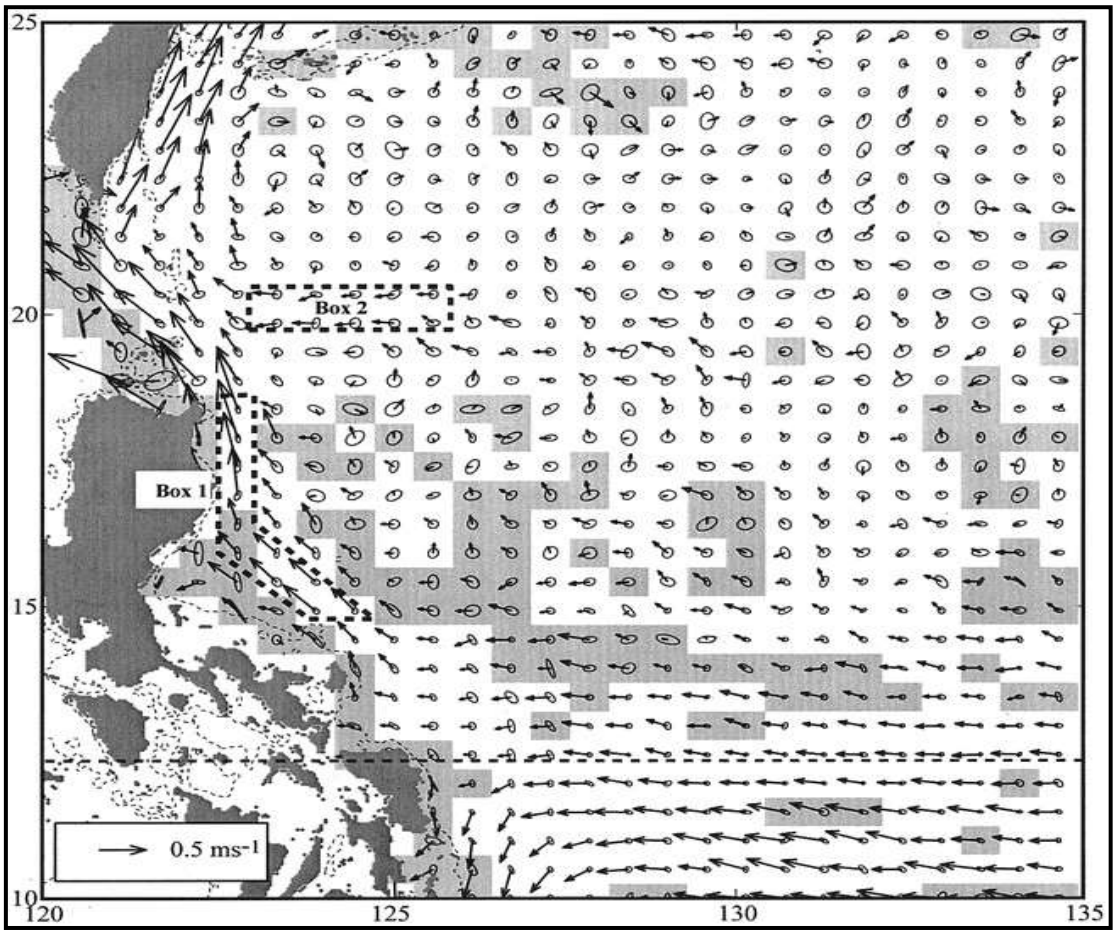


Figure 2.2-24. Mean velocity and standard-error ellipses plotted on the same scale: Nov 1986–May 2002. The 500-m contours of bottom depth are shown with a thin dashed black line. (*Source: Centurioni, 2004)*

The largest westward component of the Kuroshio intrusion is through the deepest channels of the Luzon Strait (the Balintany Channel, and south of Babuyan Island) and the largest eastward component (outflow back toward the Philippine Sea) is through the Bashi Channel between southern Taiwan and Batan Island. However, the westward component of the intrusion through the Balintany Channel in

August was much smaller than in December. This seasonal variability is consistent with the previous findings that the Kuroshio intrusion into the interior of the SCS is mainly between October and January (*Wu, 2007*).

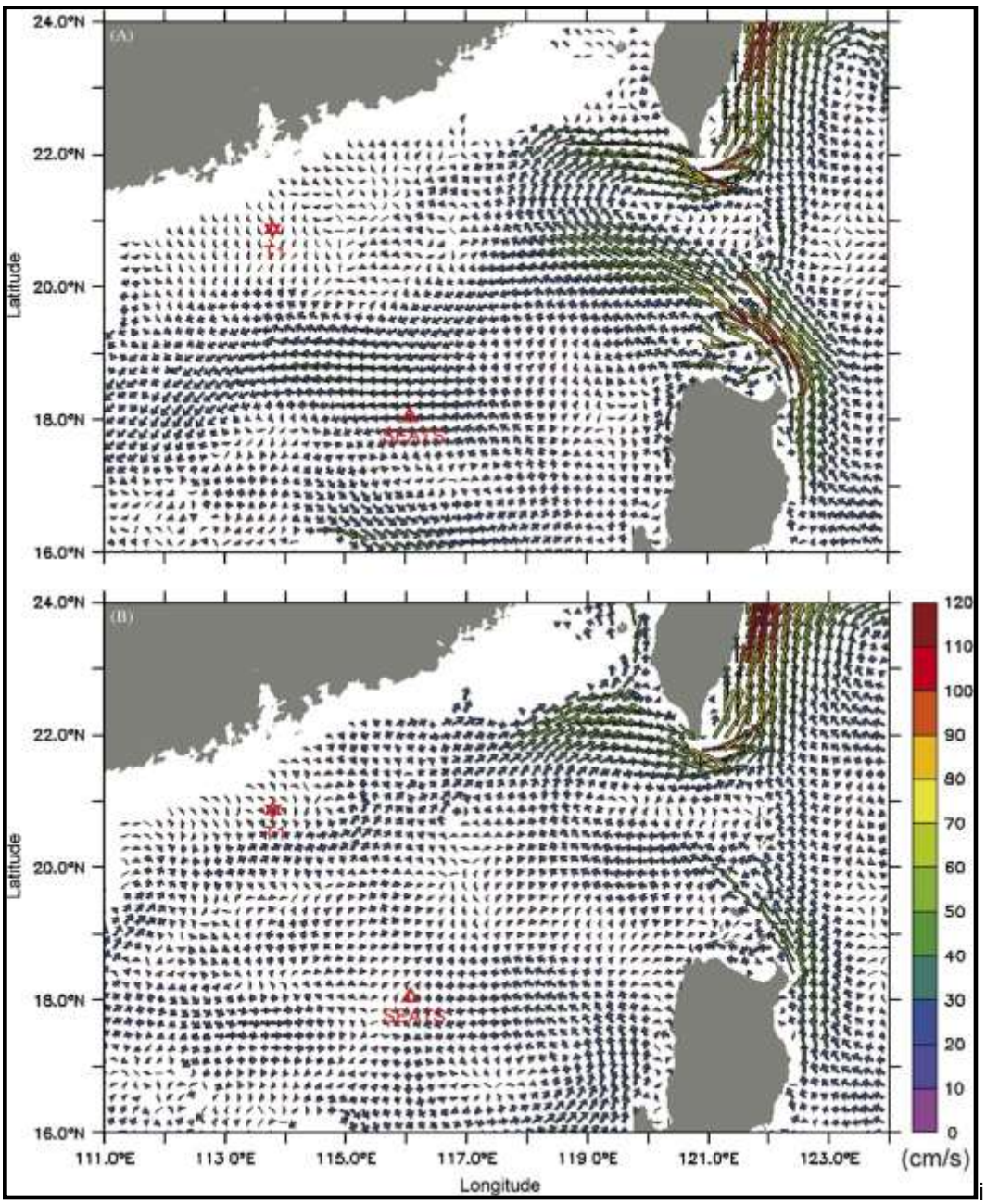


Figure 2.2-25. The five-year average of the model-derived velocity at 50 meters depth in (A) December and (B) August, respectively. *(Source: Wu, 2007)*

The study area is dominated by a generally westward moving current which is a result of the deflection of the Kuroshio current moving westward through the Babuyan Channel**.** **Figure 2.2-27** shows the primary and secondary impact areas (delineated by the black box) in relation to the currents.

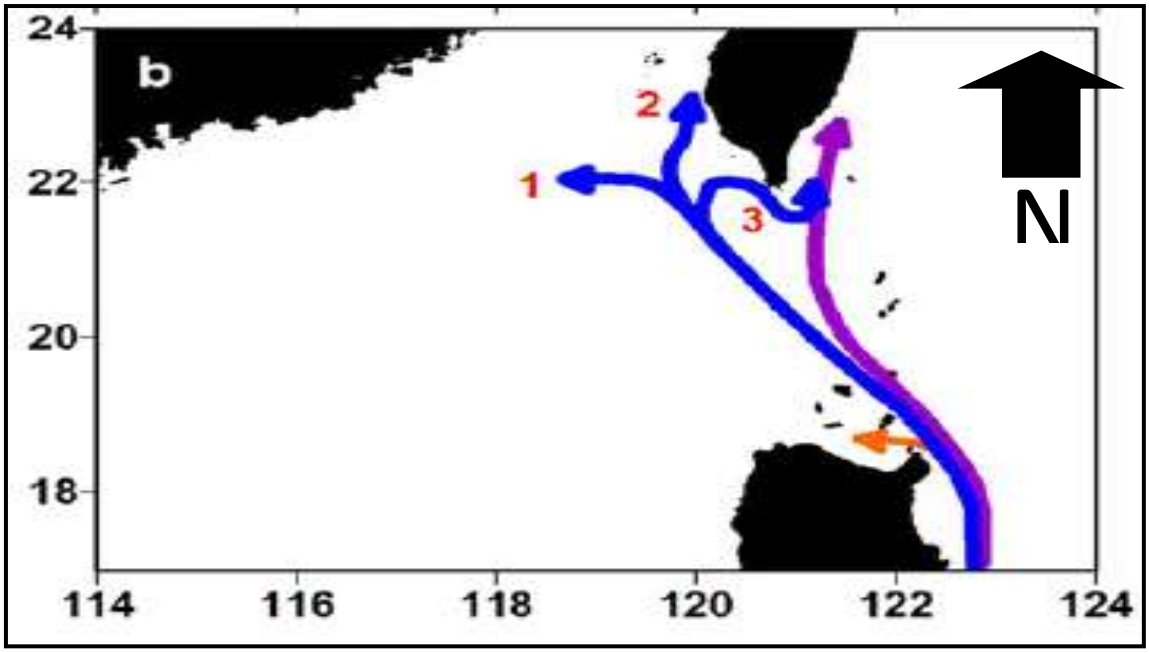


Figure 2.2-26. Different paths of Kuroshio Current across the strait. The westward orange arrow shows the Kuroshio penetrating the Babuyan Channel *(Source: Peñaflor, 2007)*

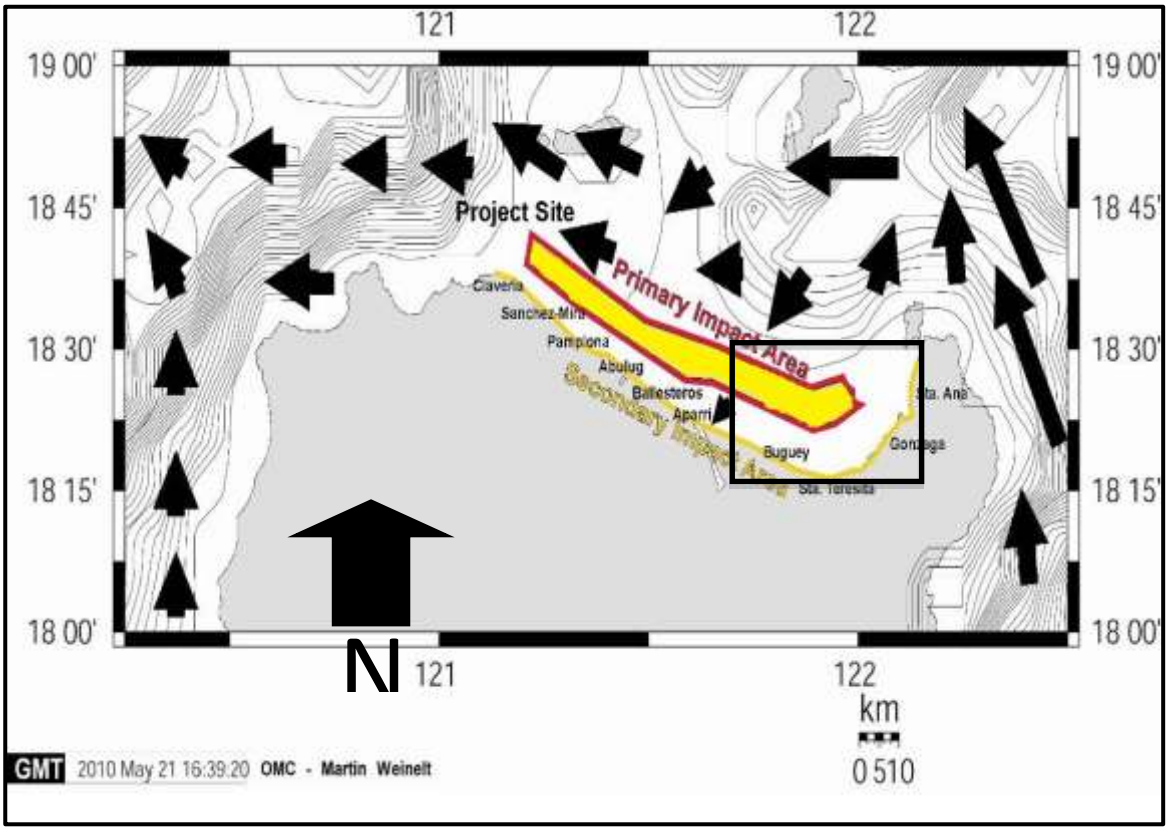


Figure 2.2-27. Current patterns affecting the primary and secondary impact areas

Photo 2.2-1. Visibility is minimal due to high amounts of suspended particles in the water column

Sea Bottom Topography

The Luzon Strait is approximately 250-kilometer-wide span of body of water that connects the East Philippine Sea and the Pacific Ocean with the West Philippine Sea and the South China Sea (**Figure 2.2-30*, JDVCRC***). The Strait is subdivided into three smaller channels (***JDVCRC***). The Babuyan Channel separates mainland Luzon with Babuyan Islands, which is separated from the Batanes Islands by the Balintang Channel. The Bashi Channel separates Batanes Islands with Taiwan. Based on the NAMRIA nautical chart and from satellite images, the bathymetry of the Babuyan Channel ranges from a few meters to more than 1,000-meter depth (***JDVCRC***).

The prominent sea bottom topographic features of the Babuyan Channel are the westward trending trough that passes through the northernmost tip of northern Luzon in Sta. Ana Cagayan and the Camiguin and Fuga Islands of Babuyan Group of Islands. The peculiar delta built up is present northeast of the mouth of Cagayan River in Aparri, Cagayan (**Figure 2.2-30**, ***JDVCRC***).

The sediment built-up is influenced by the supply of sediments coming from the Cagayan River and the Kuroshio Current **(Figure 2.2-29).** The Kuroshio Current is a northward flowing ocean current induced by West Pacific Current in the North Pacific Ocean and intrudes into the West Philippine Sea and South China Sea through the Luzon Strait. The Kuroshio Current flows from the east coast of Luzon through Taiwan and thence to Japa. The effects of the northeast monsoon cause the deflection of the Kuroshio Current towards the deeper portion of the Babuyan Channel. The Kuroshio Current contributes significantly to the dispersal pattern and accumulation of sediments in the Babuyan Channel including the delta built-up in northeast of Appari

There are indications that Cagayan River had meandered through time as suggested by the relict lakes and marsh lands in the Buguey, Cagayan **(Figure 2.2-27, JDVCRC).** The blue colored arrow in **Figure 26** is presumed to be the former river path and the submerged channel. The blue dotted line is inferred to be the relict river path of Cagayan River; the white dash arrow represents the trajectory of the Kuroshio Current deflected from its northward direction. As will be shown later, the submarine channel has been identified and traced during the bathymetric survey in the project area.

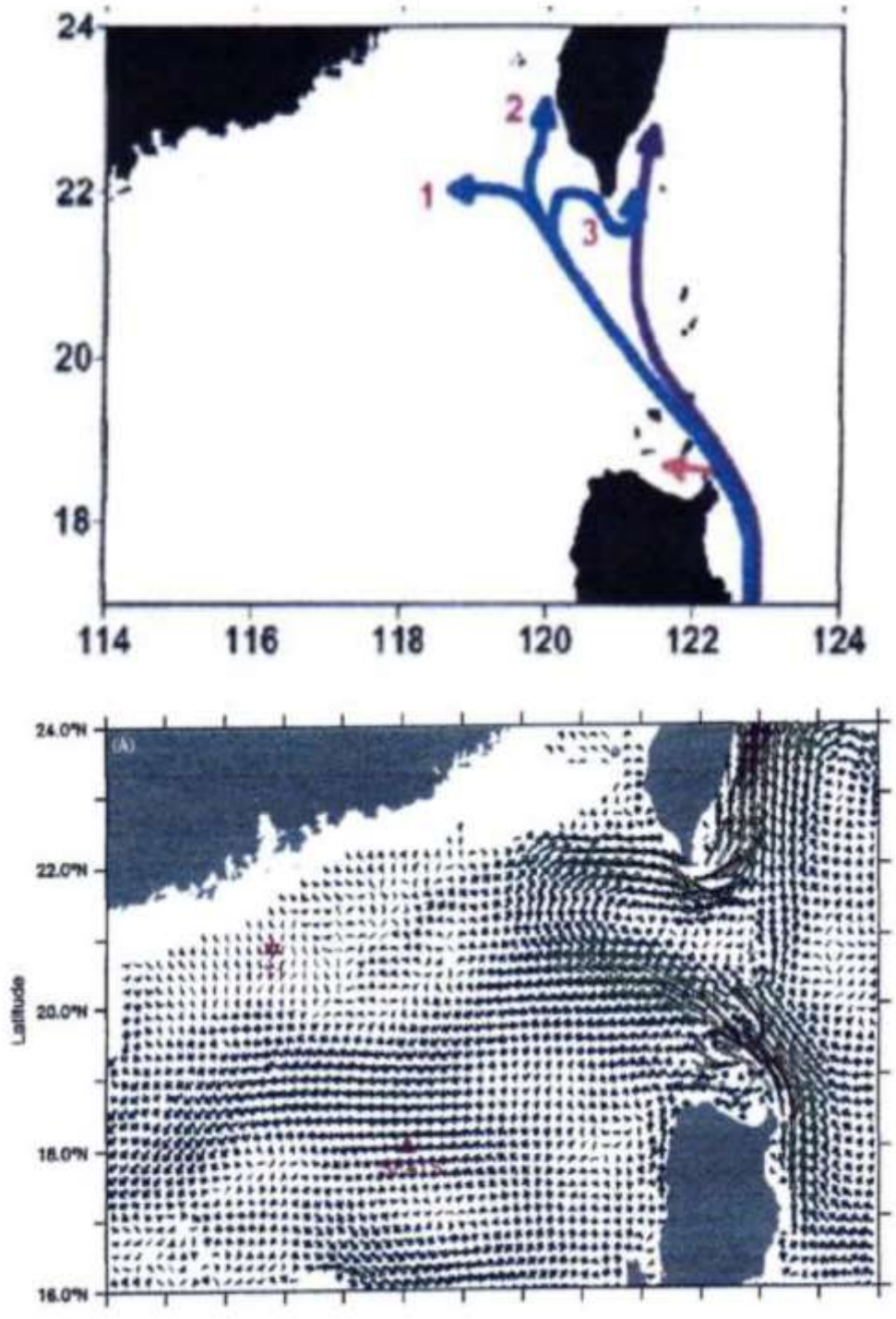


Figure 2.2-29. Paths of Kuroshio Current in Luzon Strait through Babuyan, Balintang and Bashi Channels

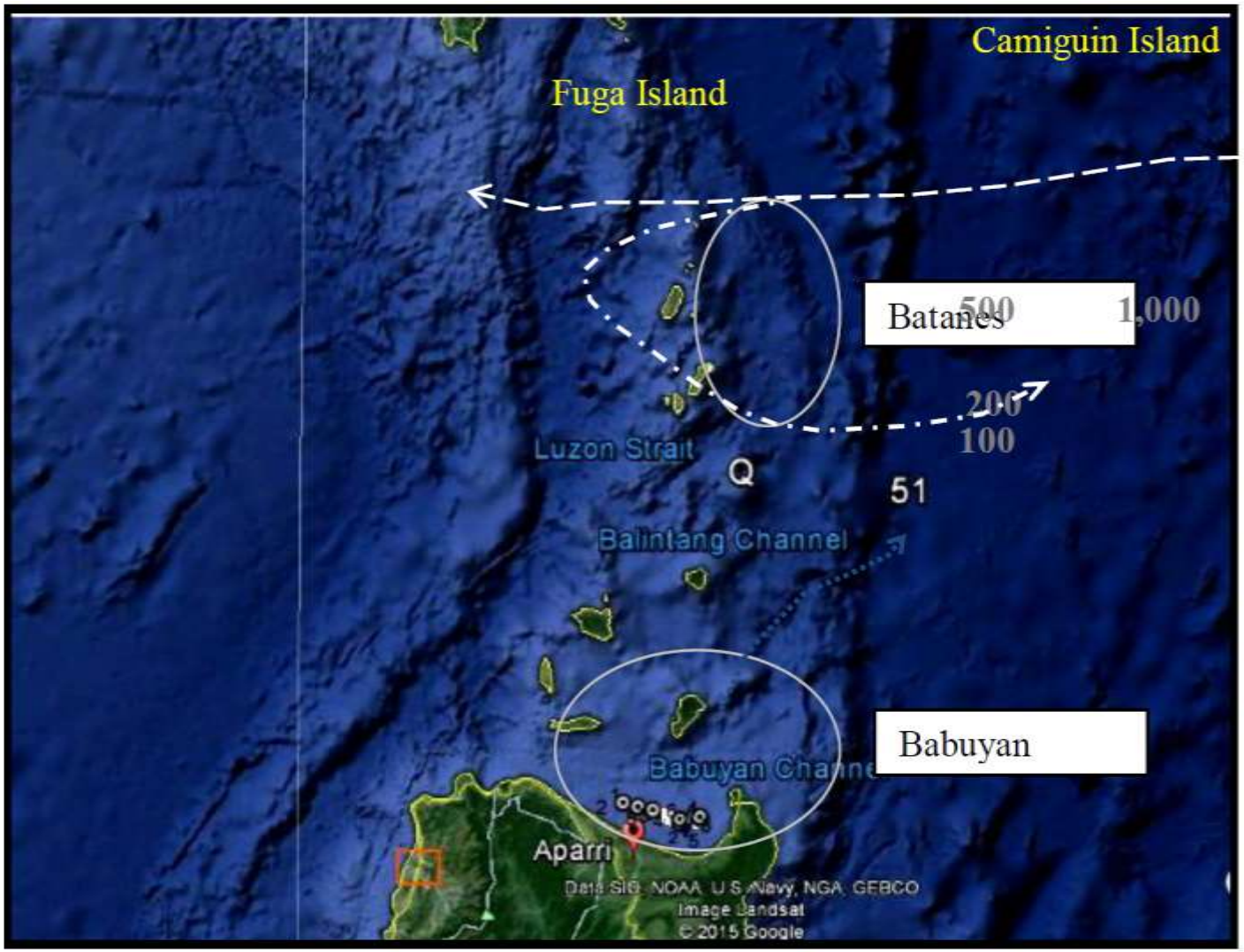


Figure 2.2-30. Location of Luzon Strait, Balintang and Babuyan Channel *Source: JDVC FER*

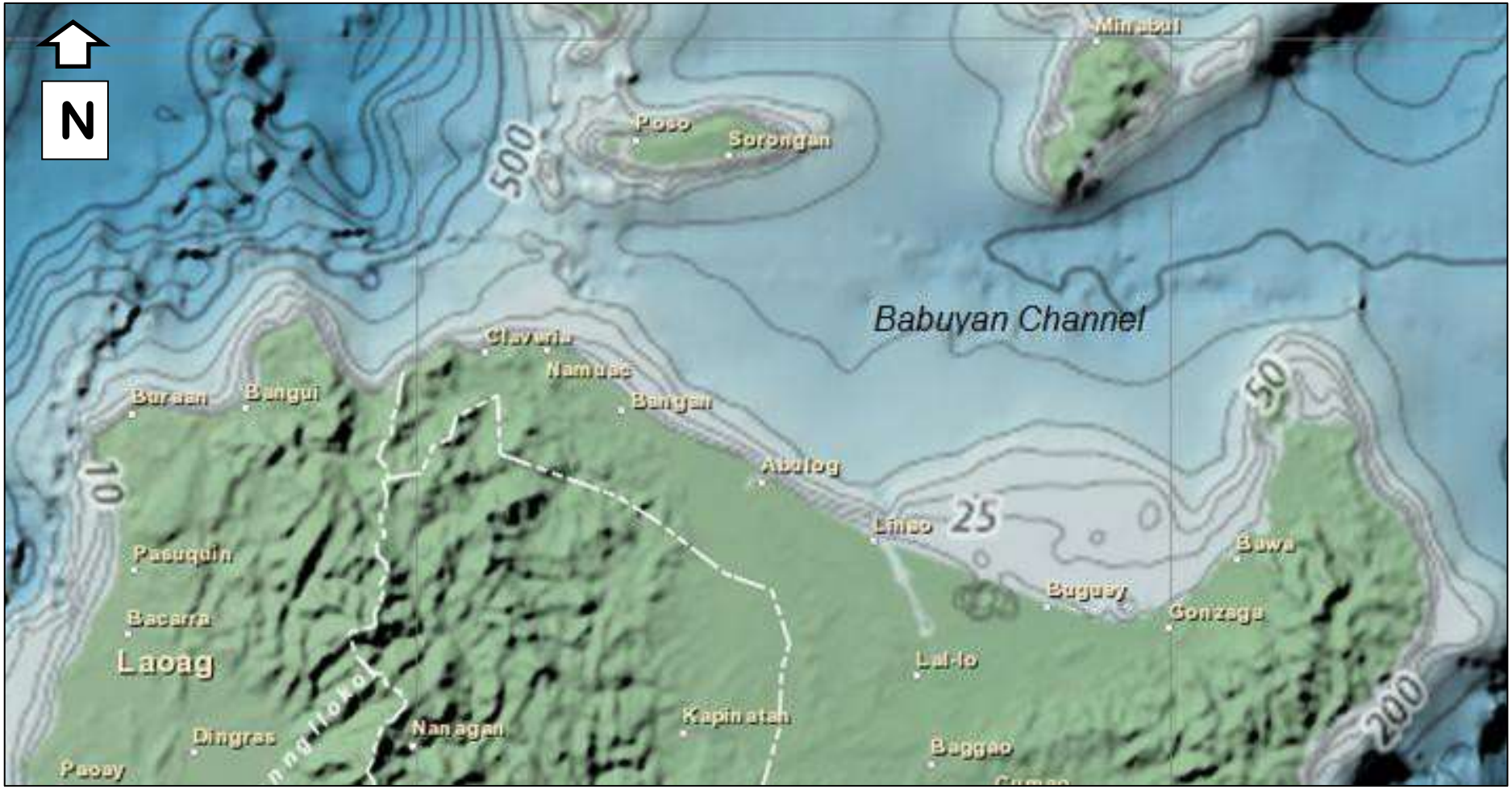


Figure 2.2-31. Sea Bottom Topography and Submarine Features of Babuyan Channel *Source: JDVC FER*

2.2.2.2 Change in Bathymetry

To quantify the physical processes and provide insights as to the coastal circulation, water movement, tidal fluctuations offshore of the proposed expansion of extraction volume of the Cagayan Offshore Magnetite Mining Project, numerical modelling is employed to fully describe the natural coastal processes within the project area. Using available secondary data, numerical model is used to assess the coastal currents and water movement for different wind speed and directions, as well as different tidal conditions (spring and neap tides).

2.2.2.2.1 Bathymetry – Baseline and Impact Assessment

To determine the topographic configurations of the seabed (known as bathymetry), available topographic map covering the offshore areas of Cagayan from NAMRIA were digitized and merged with the depth surveys conducted in the project area, as well as digital bathymetry from the General Bathymetric Chart of the Oceans (GEBCO) for the other areas without available data.

Post-processing of the interpolated bathymetry of the areas covering this area were conducted using GIS. From this analysis, under the present condition, the total 'wet' surface area of Babuyan Channel covers 18,159.7 square kilometers (using the areal extent shown in the bathymetry map below), and the total water volume of some 21,432.5 billion cubic meters with an average depth of about 1,180.22 meters.

During operational phase, there are minimal changes in the bathymetric configurations in the project area, as during the process of offshore mining of magnetite sand, about 90 percent of extracted sand will be returned to the previously mined area through a pipe to minimize the suspension of the finer sediments. With no changes in topography of the coastline and minimal losses of the seabed materials after extraction which will be replenished by the influx of sediment materials from the watershed of Cagayan River, the change in bathymetry due to the Project is not expected and will not significantly alter the existing bathymetry of the Channel.

The bathymetry map of the area using the coupled bathymetry from NAMRIA and GEBCO, and depth surveys is shown in the next figure. This data was also used in the hydrodynamic and sediment plume modelling conducted as part of impact assessment which is discussed in the following sections.

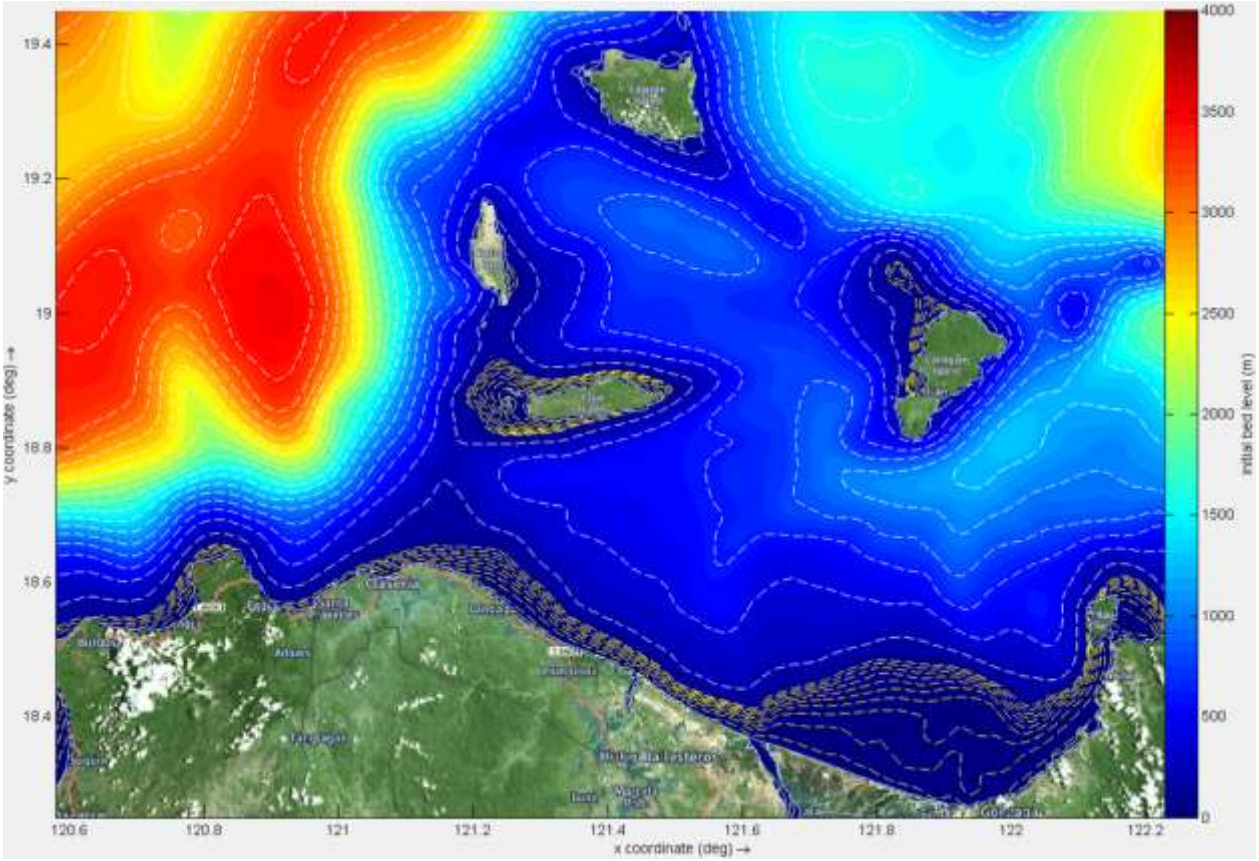


Figure 2.2-32. Generated bathymetry map of Babuyan Channel offshore of Cagayan. White contour interval shown is every 200 meters, while broken yellow contour lines near shore is at 10-meter intervals.

2.2.2.2.2 Water Circulation - Baseline and Impact Assessment

Water movement is dependent on the combined influence of prevailing wind conditions, tidal fluctuations, waves, coastal configurations, depths, etc. As part of the baseline and impact analysis of the water circulation and movement in the project area, numerical modelling tools were set-up and utilized for the assessment using secondary information as inputs, the results of which are summarized below:

- ***Analysis of Available Proximate Tides Data***

Predicted tide signals (using Delft Dashboard) for the nearest gauging station (Port San Vicente IHO) is shown in the figure below. As there is no adequate long-term water level observations that can be used for subsequent comparative analysis, and with tidal levels based on tide prediction tool are available, the major tidal constituents of this station can be used as representative values for the project area.

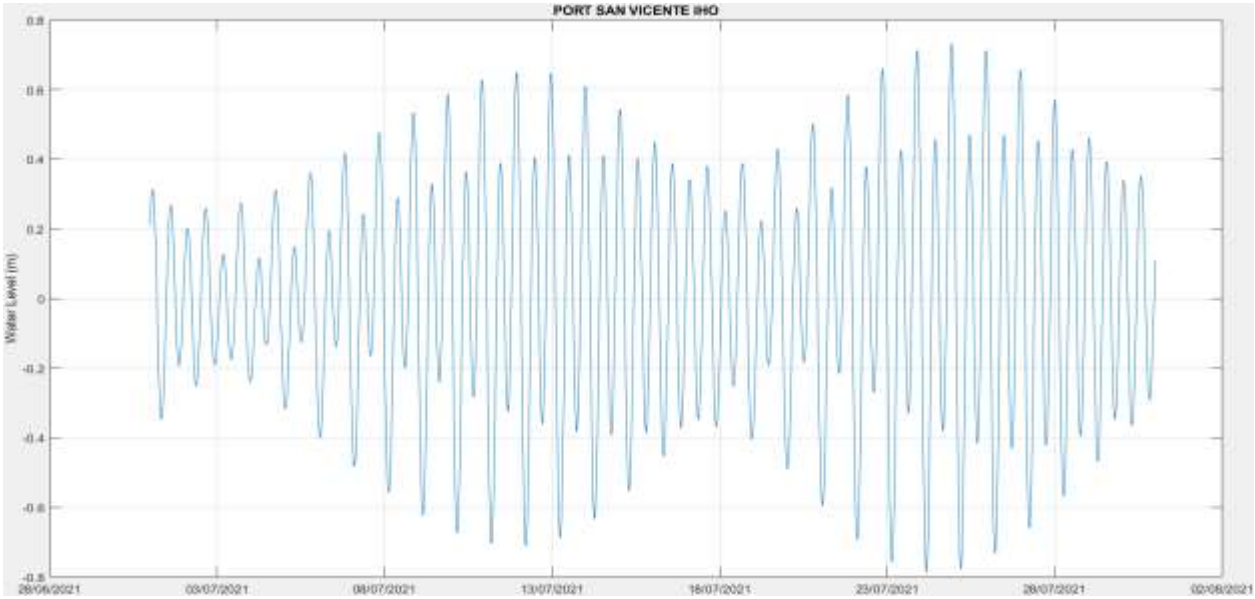


Figure 2.2-33. Tide level prediction for the month of July 2021 in Port San Vicente IHO Tide Station.

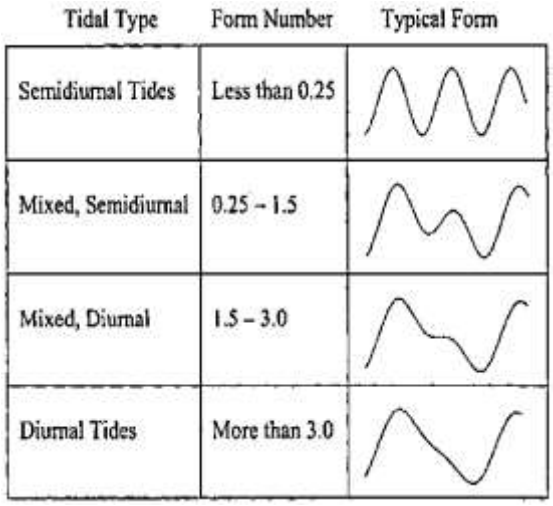
To determine the type of tide in the area, the time series of the predicted tidal water levels of Port San Vicente and Claveria Bay IHO Stations, whose patterns were subjected to harmonic analysis to quantify the equivalent representative tidal constituents. Table below summarizes the amplitudes and phases of the major tidal constituents for the said nearest tidal stations.

The Form Number (F) or the amplitude ratio, is a convenient way to determine the type of tide (diurnal, semi-diurnal, or some combination of the two). It is computed as the sum of the main two diurnal amplitudes (K1+O1) divided by the sum of the main two semidiurnal amplitudes (M2+S2). Based on the values of tidal harmonics derived from predicted tidal levels, the computed Form Number is 0.351 at Port San Vicente IHO and 0.984 at Claveria Bay IHO tide station. This value can be interpreted as an indication that the area is experiencing mixed semidiurnal tide cycle, since the computed Form Number falls between 0.25 to 1.50 (i.e., two high and two low tides with different heights in a given day), see Table inset below for reference (**Table 2.2-2)**.

Table 2.2-2. Summary of Tidal Constituents for Port San Vicente and Claveria Bay, and typical tidal types defined by Form Number (inset)

Tidal Constituent	PORT SAN VICENTE IHO		CLAVERIA BAY IHO	
	Amplitude	Phase (deg)	Amplitude	Phase (deg)
Semi-diurnal species				
M2 (principal lunar)	0.395	279.7	0.19	323.8
S2 (principal solar)	0.201	309.7	0.068	336.8
N2 (elliptical lunar)	0.08	273.8	0.038	312.8
K2 (declination lunar-solar)	0.055	309.7	0.019	336.8
Diurnal species				
K1 (declination lunar-solar)	0.108	89.9	0.122	170.9
O1 (principal lunar)	0.101	78.9	0.132	136.9
P1 (principal solar)	0.036	89.8	0.041	170.9
Q1 (elliptical solar)	0.02	72.9	0.023	118.9

Tidal types defined by Form Number



- ***Numerical Simulations of Water Circulations and Movement***

To help quantify the baseline coastal circulation and sediment plume dispersion on the offshore study area, the hydrodynamic model was used to simulate the effect of the representative tidal events occurred from July 01 to August 5, 2021, representing the transition month from summer to wet season, with corresponding changes in prevailing winds from Amihan to Habagat wind fields. The first 5 days of these simulations were used to ensure that the model reaches its steady state thus preventing the effect of numerical oscillations because of the initial conditions of the model run. The numerical simulation started from the 5th of July until the 5th of August 2021, using the first 5-days of hydrodynamic simulation as the initial condition in the computations. Due to computer memory limitations, the duration of modelling performed is limited to one-month, while also acknowledging that long-term, comprehensive data set to fully model in detail the complex coastal circulation was not available at the time of preparing this report.

a) Predicted Water Circulation under the Baseline Condition

The Delft3D-Flow simulations were used to analyze the spatial distribution of current and water movement of the offshore areas of the project. The next sets of figures below show the predicted depth-average current for Amihan wind conditions (gentle wind breeze with speed of 4 m/s from the northeast) during tidal flooding and ebbing, for the month of July 2021. The right panels show the predicted current speeds as a function of time. The direction axis indicates the direction the current is heading towards.

Generally, the model runs revealed that the general trend of water movement off Babuyan Channel is towards the west during high tidal events and reverses its direction towards the east during tidal ebbing. Near the offshore project area, the flow patterns follows the general direction of tidal currents, with numerous circular eddies formed especially during transition of the tides. Because of the natural constrictions due to Calayan Group of Islands, jet-like currents passing thru the narrow spaces of these islands are formed especially during tidal flooding and ebbing with the same trend of tidal flow rushing outwards the open area of Philippine Sea as it moves past Babuyan

Channel. For wind driven flow, using a gentle wind breeze blowing from the northeast (the so-called Amihan wind), the velocity field near the proposed Offshore Mining Project is in the range of 10- 40 cm per second which is somewhat lower than what is predicted in the areas of Calayan Group of Island further north.

Near the shore, the direction of alongshore currents follows more or less the direction the tidal currents and is flowing parallel to the configuration of the coast with moderately influenced by prevailing wind fields creating small circular gyres in the area.

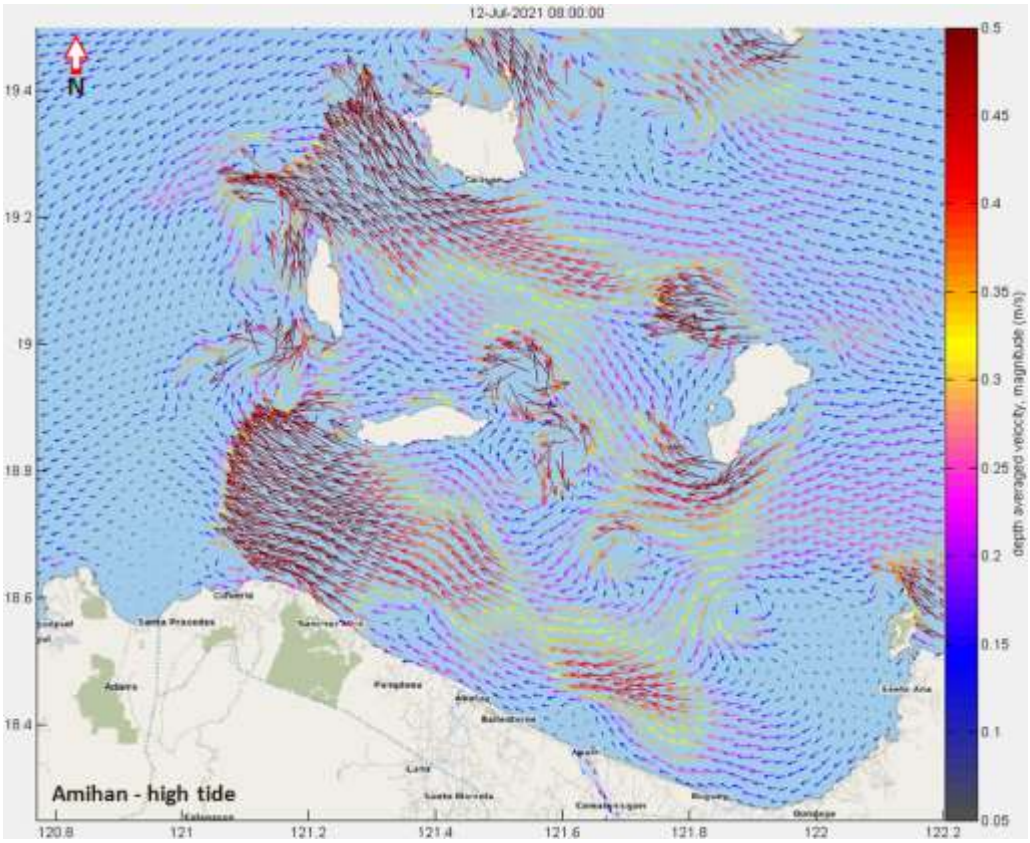


Figure 2.2-34. Predicted currents in the project area during tidal flooding (Amihan wind condition).

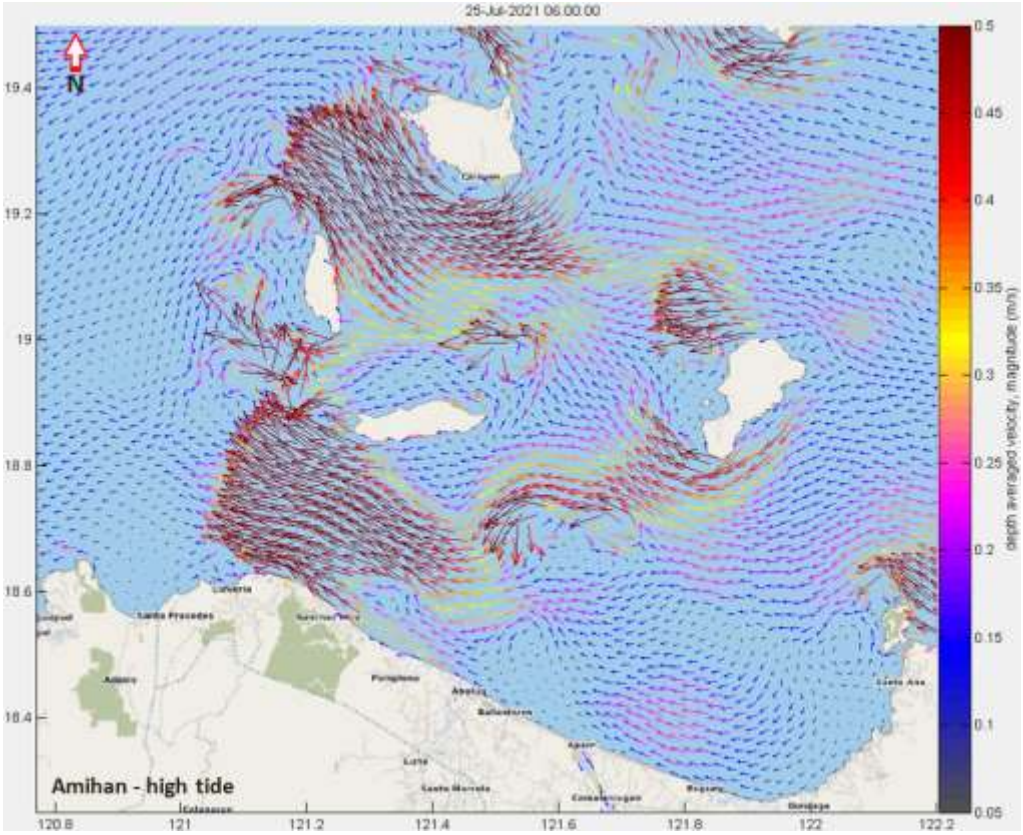


Figure 2.2-35. Predicted currents in the project area during tidal flooding (Amihan wind condition)

During neap tides (i.e., smaller tides that are formed when the earth, sun and moon form a right angle) and during flow transition from high tide to low tide, the flow velocity field is somewhat lower in magnitudes with numerous circular gyres formed inside Babuyan Channel. During these episodes, the predicted flow magnitudes is about 10 to 30 cm/s near the Offshore Mining Project area and in the middle of the Channel.

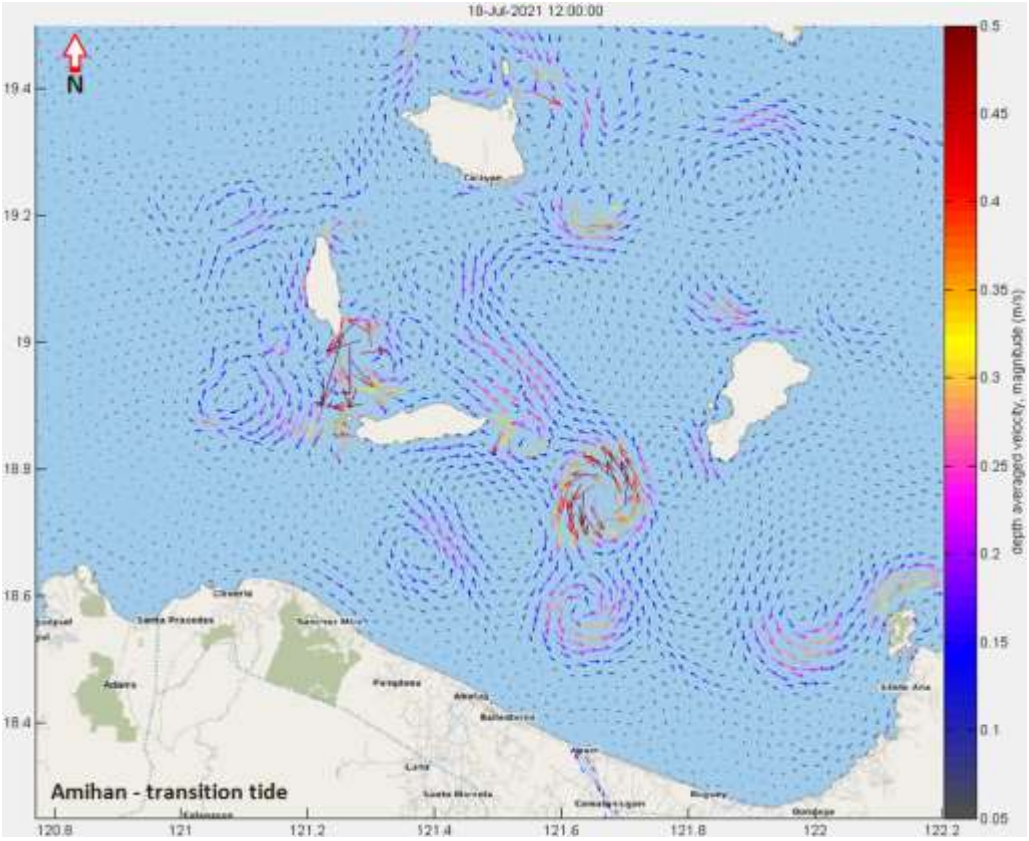


Figure 2.2-36. Predicted currents in the project area during transition from high tide to low tide for Amihan wind condition.

During low tidal events, where the water is at its lowest levels, the flow magnitude is moderately stronger than what is predicted during high tides especially near the coast and constricted areas in between the various islands. The general direction is to the east, with weak circular gyres in between the project area and the coast predicted to formed due to the flow separations of outflowing tidal and wind-driven currents nearshore.

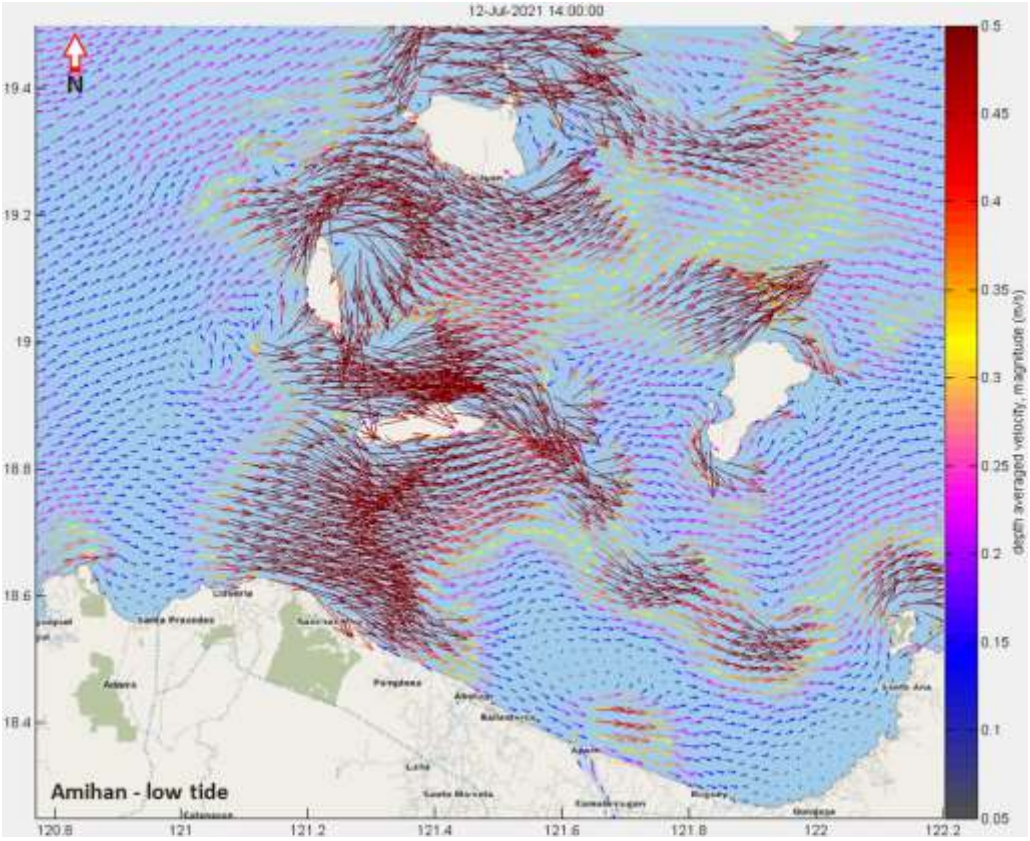


Figure 2.2-37. Predicted currents in the Channel during low tidal event (Amihan wind condition).

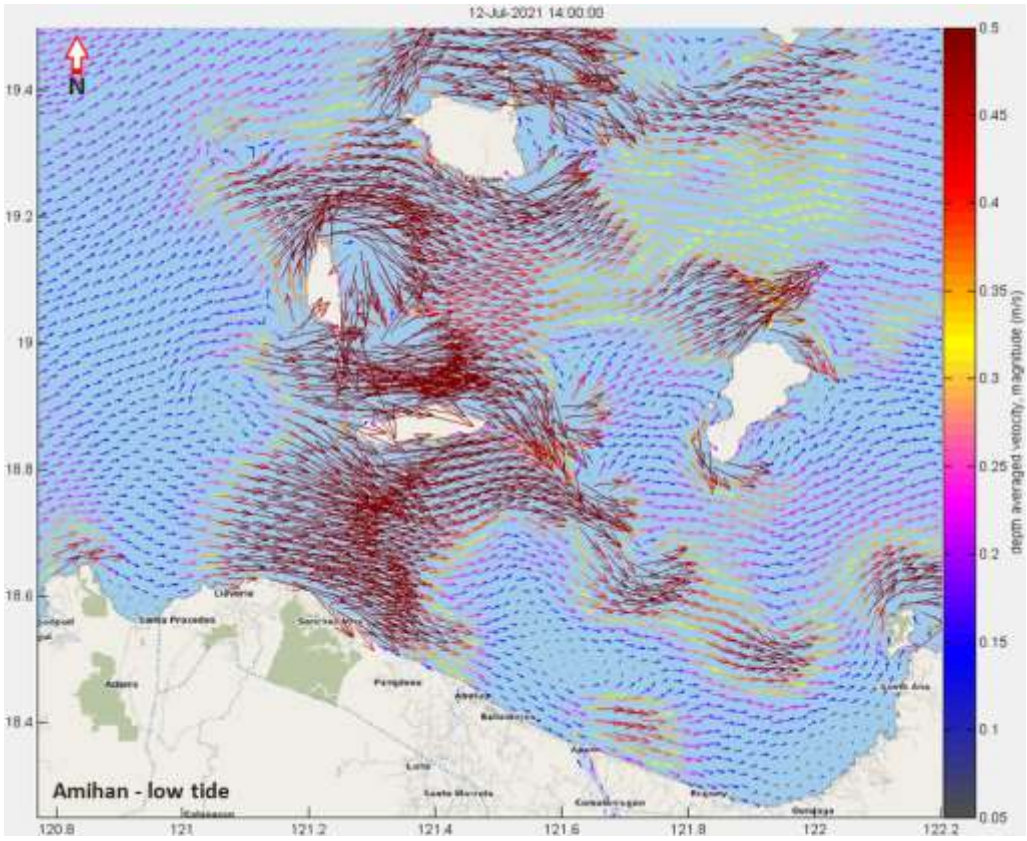


Figure 2.2-38. Predicted currents in the Channel during low tidal event (Amihan wind condition).

Under Habagat wind conditions scenario for moderate wind velocity input of 4 m/s and blowing from the southwestern direction, the model results revealed that the general direction of the flow remains to be somewhat similar to Amihan wind scenario, and wind-driver flows are mainly in the areas near the shore. This means that the flow inside Babuyan Channel is tidal dominated. At the middle of Babuyan Channel, flow velocity fields are in the range of 10 to 40 cm/s, except in the constricted areas in between islands where the flow magnitudes exceeding 50 cm/s especially during tidal flooding and ebbing. Near the project are, the depth-averaged flow is somewhat sustained to less than 30 cm/s. The wind-induced flow is predicted to manifest along the coast, while weak circular gyre is formed at the concave municipal waters of Gonzaga, Cagayan.

The offshore area of the project is at the leeward side of Cagayan mainland during Habagat wind condition, such that the flow predicted near the project area is moderately less in magnitude compared to what is predicted during Amihan wind fields, with weak circular gyres formed due to the merging of high tidal flow velocities and counteracted by wind-induced flow nearshore producing a rather low flow velocities around this area.

The flow velocities in the open area of Babuyan Channel farther offshore during high tides for Habagat wind are predicted to be almost of same magnitudes compared with the same tidal event for Amihan wind scenario, with winds blowing at the surface hardly influence flow directions.

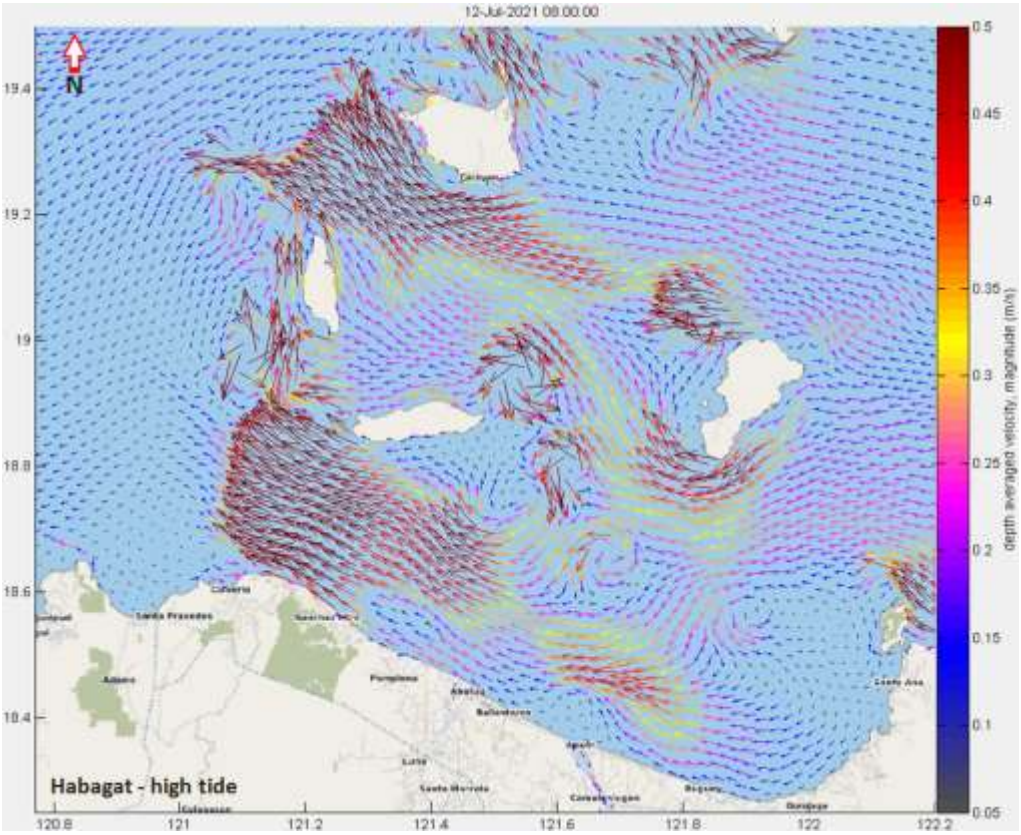


Figure 2.2-39. Predicted currents in the Channel during high tidal event for Habagat wind condition (wind speed of 4 m/s blowing from the southwest).

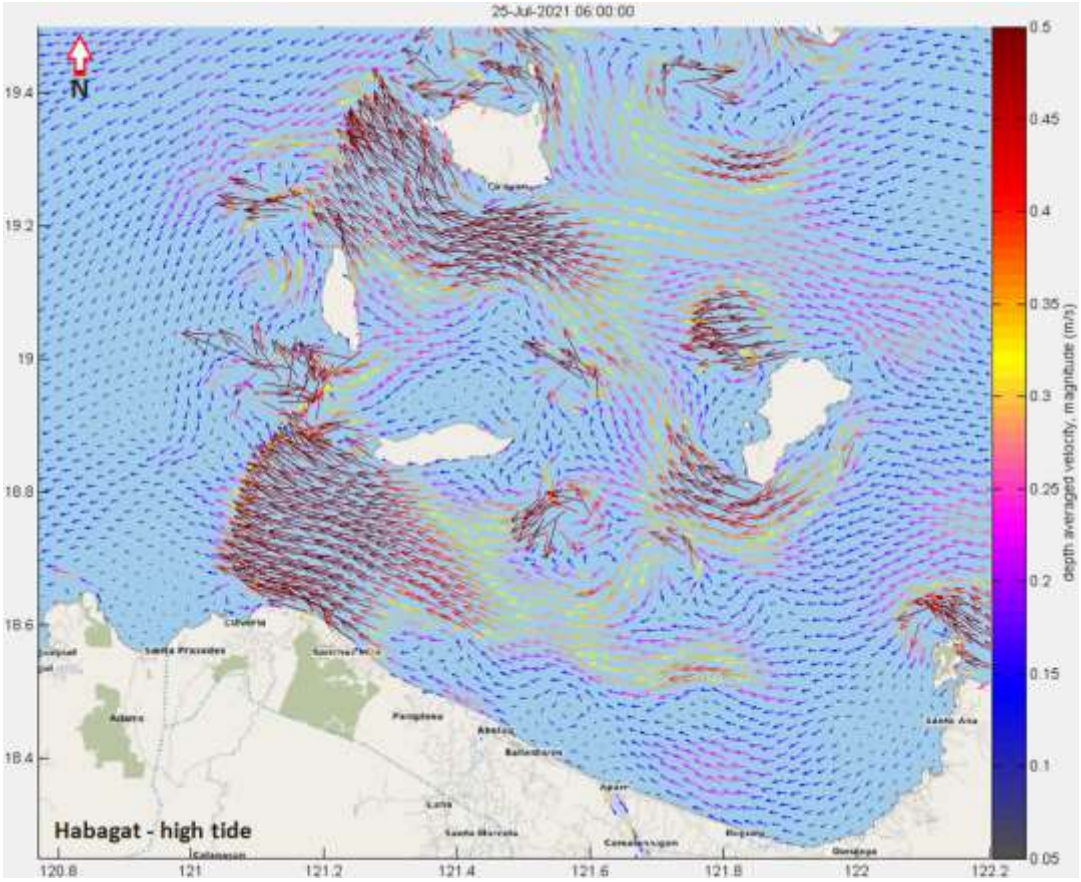


Figure 2.2-40. Predicted currents in the Channel during high tidal event for Habagat wind condition (wind speed of 4 m/s blowing from the southwest)

During tidal ebbing, the model predicts that the range of flow magnitudes is higher than what was predicted during high tides. The general direction reverses and is now directed towards the east, with formation of weak circular gyres formed nearshore. In the 'sheltered' concave portion in the municipal waters of Gonzaga, Cagayan, resulting magnitudes is quite low compared to other offshore areas and is in the range of 5 to less than 35 cm/s. Similar jet-like currents occur in the areas in between Calayan Group of Islands where flow magnitudes are rather strong compared to other areas, with magnitudes in the range of 40 to more than 50 cm/s.

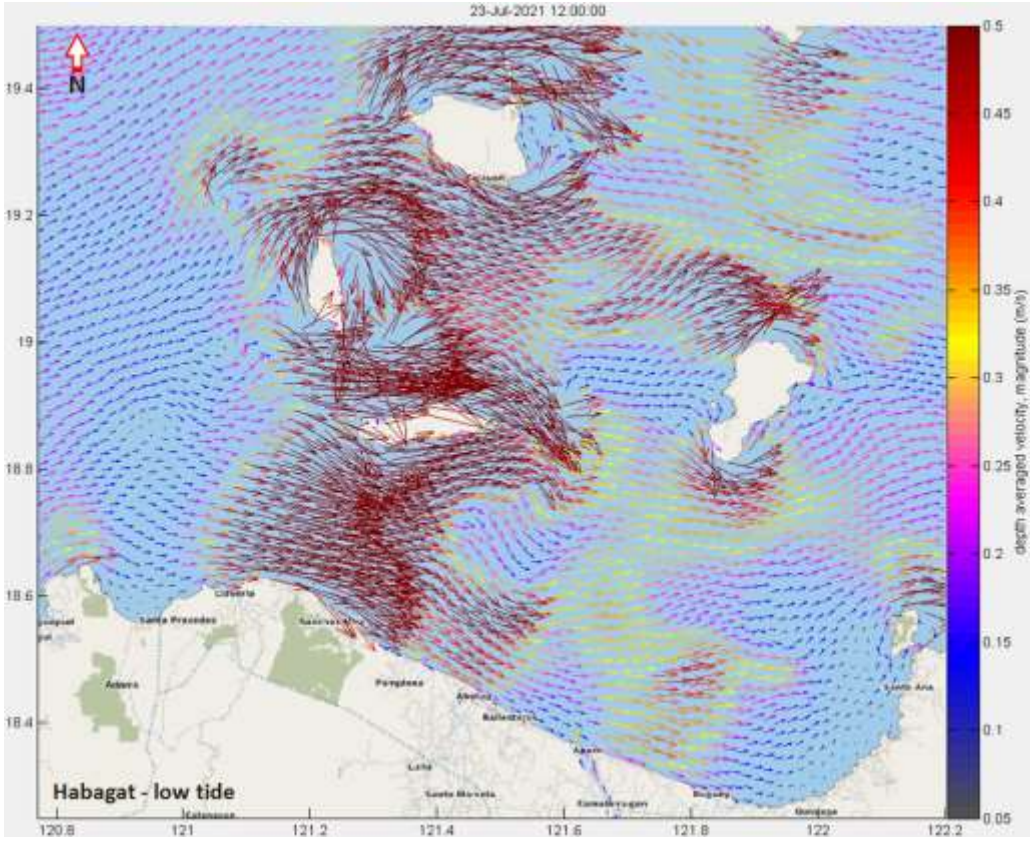


Figure 2.2-41. Predicted currents in the Channel during low tidal event for Habagat wind condition.

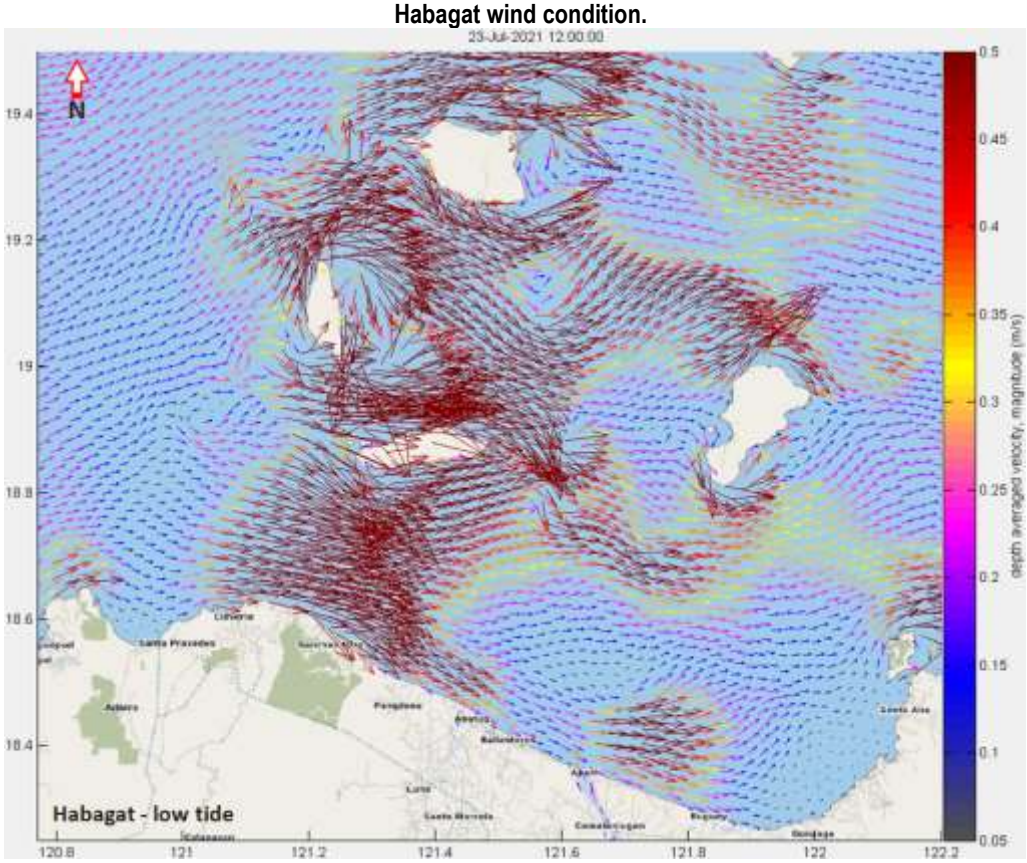


Figure 2.2-42. Predicted currents in the Channel during low tidal event for Habagat wind condition.

The various flow velocities presented above considers the depth-averaged flow velocities to conserve report space. As the project area is rather deep, flow velocities may not be the same in different depths. It is expected that highest velocity occurs just below water surface, middle depth has lower velocity and the lowest velocity usually occurs in near the bottom. Shown below are the comparative flow velocities predicted near the surface and near the bottom, left and right figures respectively, for the same time frame. The most visible difference in the graphs is the area near the shore, wherein the flow magnitudes near the surface is greater than 0.30 m/s (see yellow colored area), whereas near the bottom of the same location, the flow magnitudes are less than 0.25 m/s. The general direction of the flow is, more or less, the same regardless of depth section.

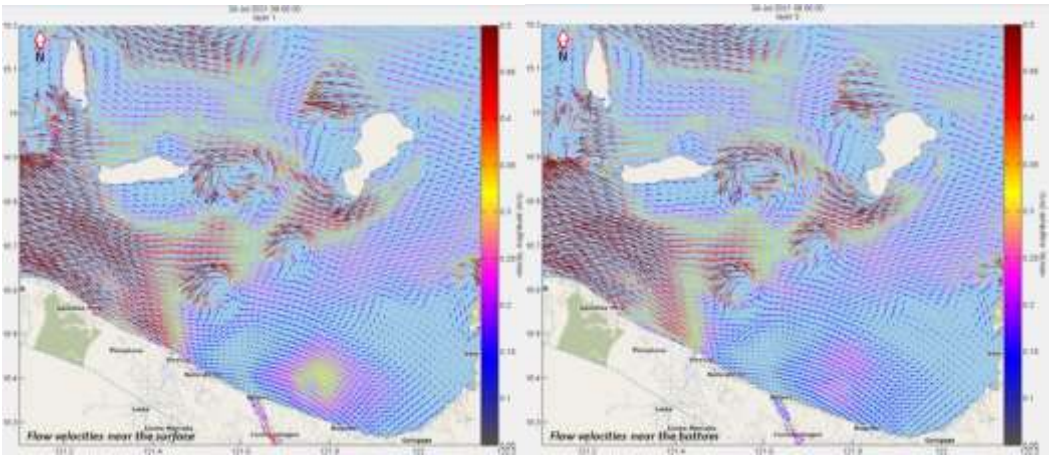


Figure 2.2-43. Predicted currents near the surface (left) and near the bottom (right) of the Channel.

From examination of the predicted currents in the study area during the two wind conditions Amihan and Habagat, coupled with representative tidal fluctuations in the area, it follows that tidal conditions dictate the direction of current inside Babuyan Channel where the offshore project is located.

At narrow areas in between the islands, regardless of tidal water levels, the flow therein is generally higher compared to the other areas of the Channel and the general direction of flow is westwards during tidal flooding while during tidal ebbing, the flow is rushed eastwards towards the open areas of the vast Philippine Sea past Babuyan Channel.

In the offshore mining areas of the project, the predicted currents are generally about 10 to 30 cm/s for both Amihan and Habagat wind conditions for a wind speed of 4 m/s. For higher wind magnitudes, it is expected that high flow velocities would occur, but for a more conservative sediment plume dispersal prediction, for which this tide and wind-generated flows are needed, low magnitude winds are used.

b) Predicted Change in Water Circulation due to the Project

With the proposed project, the extraction of sediment bed material using the siphon vessel for magnetite sand is deemed not to produce significant changes in the prevailing water movement in the area. Also, there is no major physical development that will be introduced as part of the Project that will otherwise alter the prevailing water circulation and movement in Babuyan Channel and in the coastal area of Cagayan. While there will be deployment of ships offshore as part of the operation, these activities are deemed to be too insignificant and will not alter the natural water movement and transport patterns in the Channel.

- ***Pollution Dispersal and Transport thru Sediment Plume Modelling***

This section assesses the transport and fate of water quality pollutants, in this case represented by the non-commercial sand slurry, which is to be released at the location of previously mined area of sediment bed materials. In particular, dispersal, dilution and accumulation patterns of sediment plume as it is transported by the ambient current circulations were investigated. Because of the limited information to model morphological changes in the bed, suspended sediment transport thru sediment plume modelling was conducted. The approach is similar to the release of a coloured dye in the water to determine the extent of transport and mixing of the dye as it moves with the flow.

The model considers the release of sediment in the vicinity of the proposed loading/unloading area, which represents the continuous discharge of say, polluted waters or accidental spillages, to visualize and quantify the dispersion patterns in the area. Aside from tidal fluctuations, scenarios incorporating the effect of north-easterly (Amihan) and south-westerly (Habagat) wind, to investigate the propagation and dispersal of the suspended sediment plume as current is forced by wind, particularly near the surface. The dispersal patterns of the non-commercial sand released back to the previous blocks of mining area, which can stir and suspend bottom sediment deposits, were assessed with the end in view of determining how the project will potentially impact the existing coastal water quality process.

The sand extraction process will be conducted using the Siphon Vessel through a suction hose connected to the vacuum pump, with a projected feed to the siphoning vessel of 159.46 million tons of raw sand annually. The extracted sand will be transferred from the suction vessel to the piling barge and are then processed through a two-stage magnetic separation process. The magnetic separator would only qualify about 10% average for quality grading required hence, about 90% of the lesser grade extracted sand will then be returned to the same seabed area (or about 143.514 million tons) using a separate pipe and pump. The discarded sand shall be brought as close as possible to the sea bottom, in order to minimize the suspension of the fine sediments during operations.

For sediment plume tracer modeling, out of the 143.514 million tons that is projected to be released back to the seabed, it is assumed that suspended sediments due to stirring at the bottom and accidental spillages amounts to 10% of this load. Point source of this sediment were assumed to be continuously released inside Parcel A of JDVC's DMPF Area with a discharge rate of 455 kg/s (or 1.0 m3/s discharge with concentration of 455,000 mg/L) for a one-month period.

To consider the effect of accordion-type pollution prevention curtain or screen that is proposed to be installed to surround the suction and discharge lines, a model parameter 'local weir' is used for the simulations. It is assumed that the friction coefficient is the same for all the computational layers and is modelled as a sub-grid phenomenon, i.e., its dimensions are (assumed to be) much smaller than the grid size and only its overall influence on the flow is considered. This overall influence is modelled by the energy losses due to the weir. These energy losses are described as an additional quadratic friction term in the momentum equations. In this study, the total water depth at local weir points surrounding portions of Parcel A is based on the crest height of zero meter from the datum, meaning the total height of the local weirs is set up to mean sea level and spillages is considered if the velocity point is wet during the drying and flooding algorithm of the model.

The hydrodynamic data necessary for the analysis of the dispersion of sediment plume were generated with the detailed hydrodynamic model set-up as discussed in the preceding sections. The transport and dilution of continuous release of sediment inside Parcel A of the Project were simulated for 30 days in the model, to allow build-up of the far field sediment plume concentrations over many tidal cycles. Results were examined over a spring and neap cycle using tidal data from July 05 to August 05, 2021 (and using Amihan and Habagat wind scenarios).

The results of the model runs are shown in the next succeeding figures. Some of the results of the 30-day simulation of sediment plume incorporating the effects of surface winds, and the rise and fall of tides are presented. Therefore, the snapshots cover most of the interesting patterns that may be expected during flooding and ebbing and also during slack water.

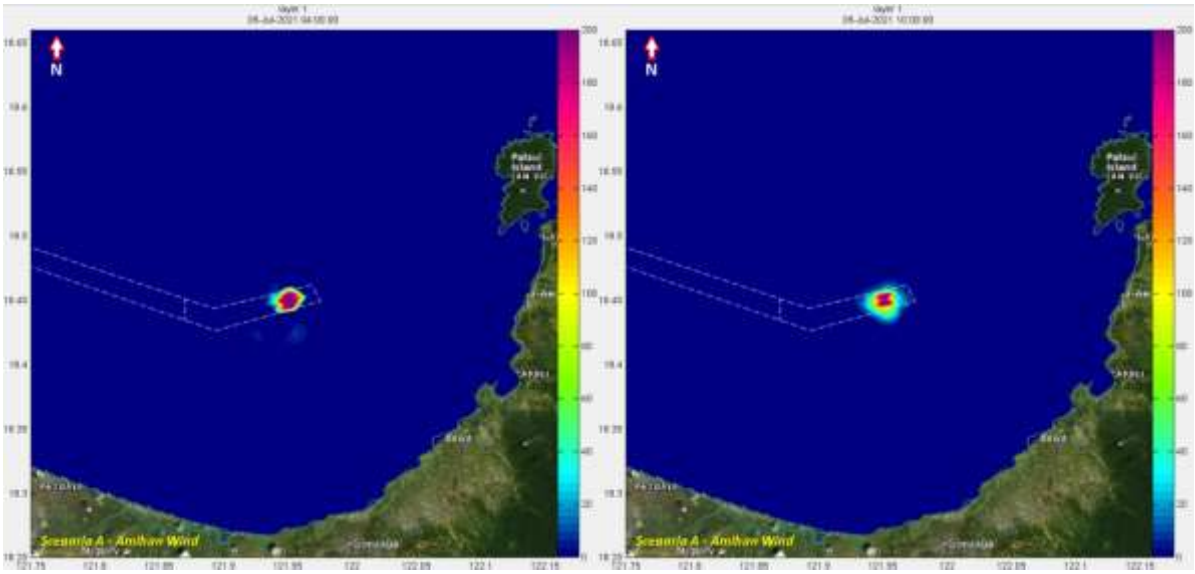
a) Scenario A – North-easterly (Amihan) Wind Condition

This scenario incorporated the influence of wind on coastal current circulation and transport and movement of sediment plume in the study area. This was accomplished with the use of a north-easterly wind, with a moderate speed of 4 m/s, representative of the summer monsoon conditions.

From the results of the model runs, it appears that for the first few hours of release of sediment plume, the patch is confined at the release point and the mixing is caused by small-scale turbulence effects only. However, after some time, the sediment plume will have spread sufficiently such that larger-scale eddies and water circulations will contribute to the mixing effect.

For Amihan wind conditions, the model predicts that at the start of sediment release, the sediment plume is propagating in a semi-elliptical pattern with its major axis directing towards the north and south of the release point. After one day, the spreading of the plume follows more or less the flow of current. The extent of the maximum change in sediment concentration (see differences in colors, with units of mg/L in the figures), after a few hours of continuous sediment releases are already noticeable. Higher than 200 mg/L at the release point is clearly visible (shown as dark red area), of which its coverage area moderately shrinks or spreads consistent with the rise and fall of the tide. As the flow within the project area is tidal dominated, coupled with the influence of Amihan wind fields, the sediment plume moved towards different directions during the rush of water in and out of Babuyan Channel due to tidal flooding and ebbing. Although the concentration of the sediment is 455,000 mg/L at the release point, the coastal area east and south of the project is predicted to be not affected by the sediment, with sediment concentrations in the range of less than 10 mg/L. With the surrounding waters relatively deep, reduced sediment concentrations of the plume shows effective natural mixing and transport in the area.

The next series of figures illustrate the propagation of the sediment plume for 31 days of continuous warm water releases for the various time steps to illustrate how the sediment plume responds to dynamic temporal changes in the water movement as influenced by tidal fluctuations and moderate Amihan wind breeze.



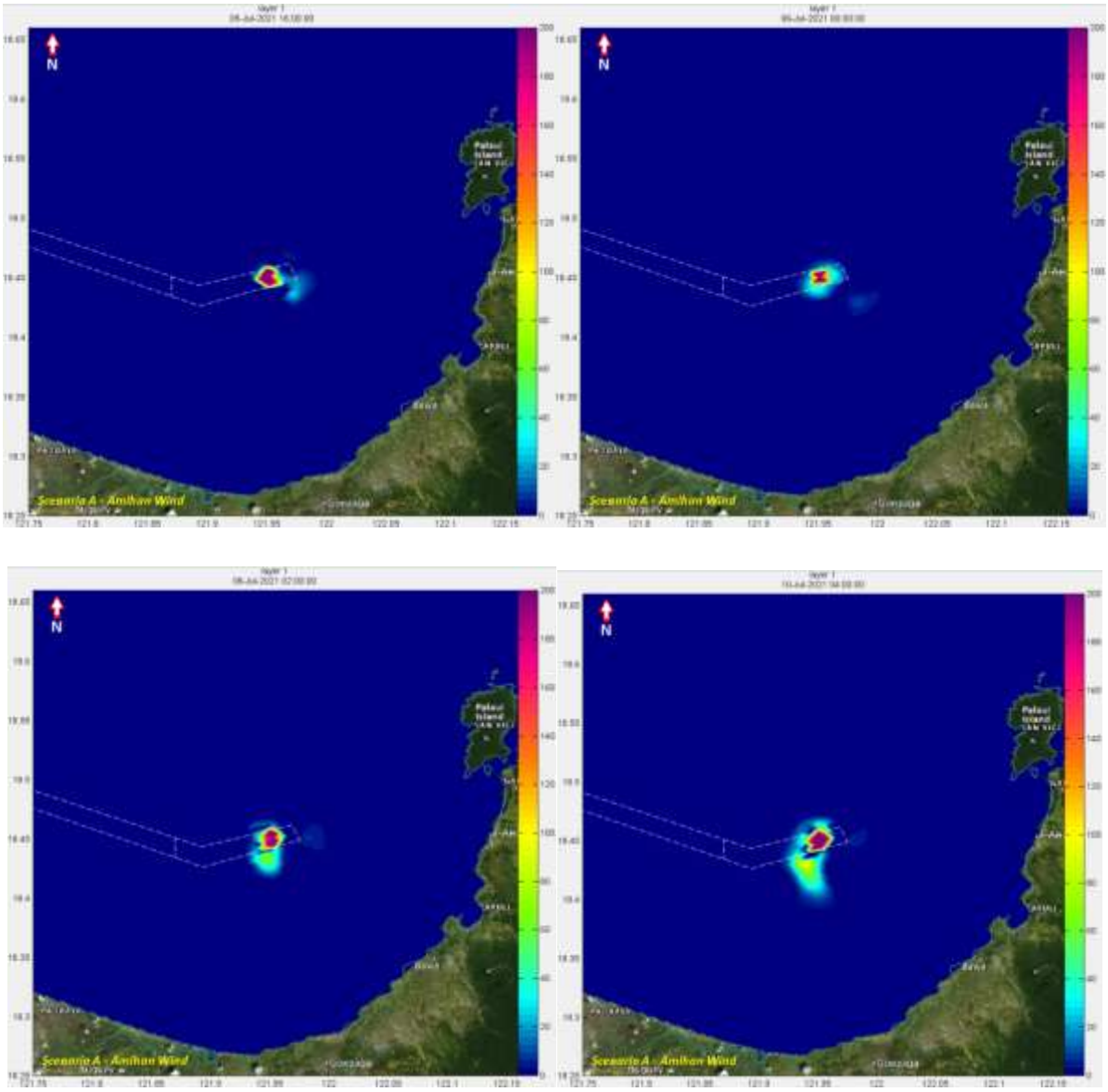


Figure 2.2-44. Predicted trajectory of sediment plume after 4 hours (upper left), 10 hours (upper right), 16 hours (middle left), 24 hours (middle right), 3.083 days (lower left) and 5.167 days (lower right) of continuous releases inside Parcel A under Amihan wind condition.

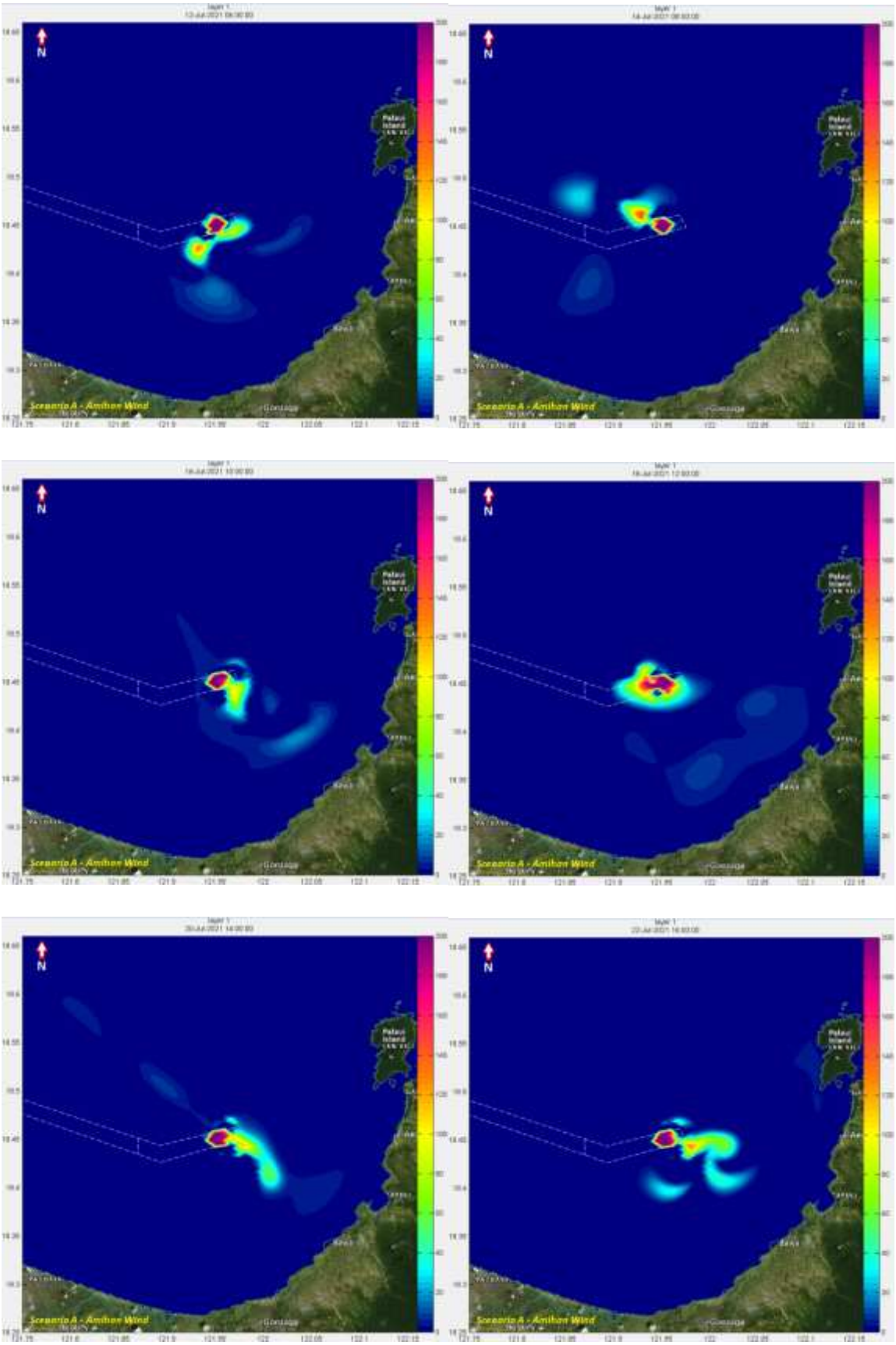


Figure 2.2-45. Predicted trajectory of sediment plume after 7.25 days (upper left), 9.333 days (upper right), 11.417 days (middle left), 13.50 days (middle right), 15.583 days (lower left) and 17.667 days (lower right) of continuous releases inside Parcel A under Amihan wind condition.

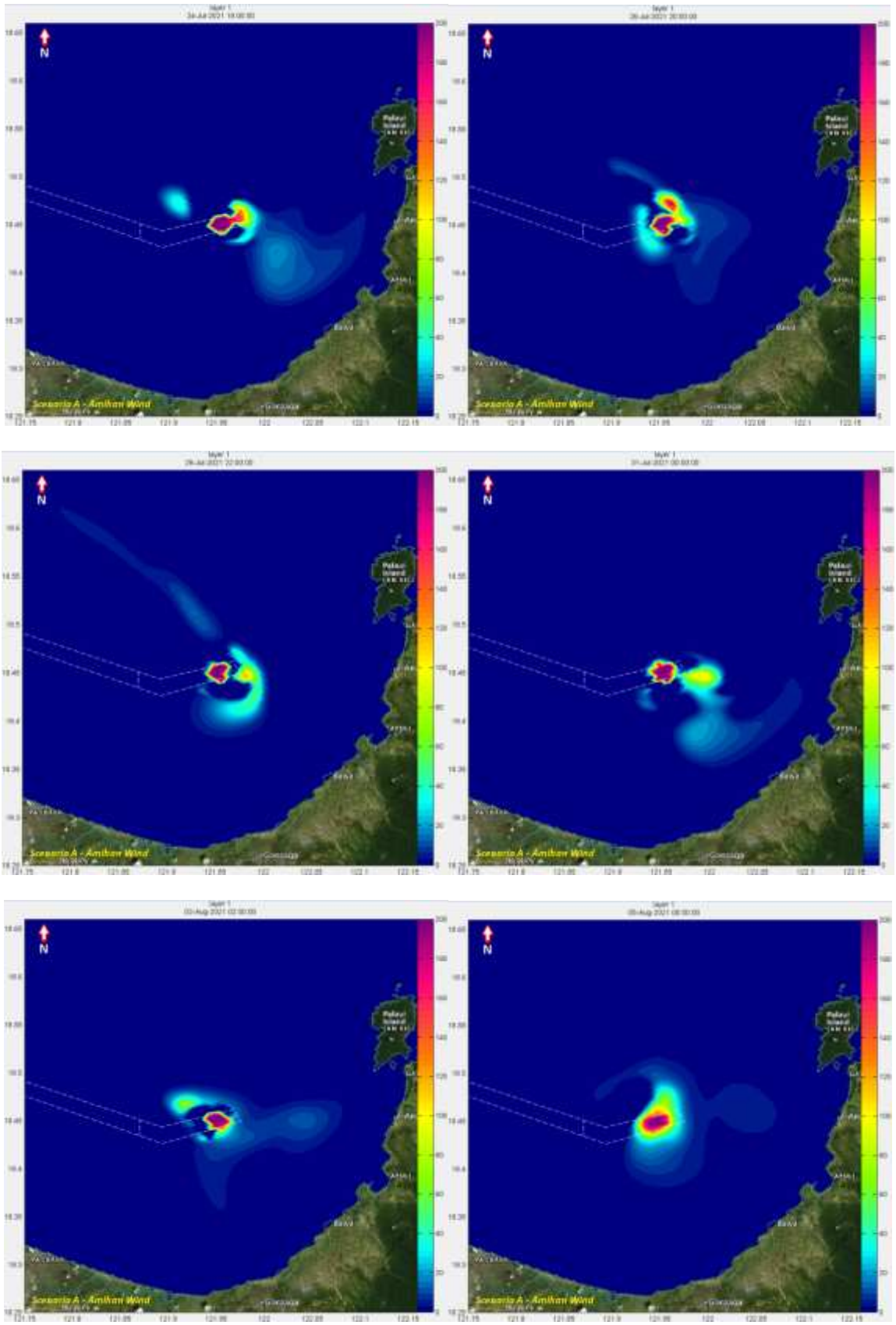


Figure 2.2-46. Predicted trajectory of sediment plume after 19.75 days (upper left), 21.833 days (upper right), 23.917 days (middle left), 26 days (middle right), 28.083 days (lower left) and 31 days (lower right) of continuous releases inside Parcel A under Amihan wind condition.

b) Scenario B – South-westerly (Habagat) Wind Condition

All the input parameters of the previous one is made similar to this present scenario except for wind direction which incorporate the influence of Habagat wind, on coastal current circulation and sediment plume transport and movement in the study area. A uniform wind forcing (southwesterly wind, ranging from 170 to 260 degrees from the north, with a speed of 4 m/s), representative of the southwest monsoon conditions is used as one of the model inputs to simulate hydrodynamic and sediment plume dispersion in the offshore area of the proposed project.

Unlike the case of Amihan wind, the influence of the prevailing coastal currents on the distribution of sediment plume suggests that the protruding land mass of Cagayan somehow 'shelter' to a certain extent the sediment movement during Habagat event. Because of that, the spreading of low-concentrated sediment plume somehow reaches the western portion of Gonzaga and Sta. Ana Cagayan, instead of transporting fully towards the open area of Babuyan Channel and out into the open sea.

The next series of figures illustrate the propagation of the sediment plume for 31 days of continuous sediment releases for the various time steps to illustrate how the sediment plume responds to dynamic temporal changes in the water movement as influenced by tidal fluctuations and gentle southwesterly wind breeze.

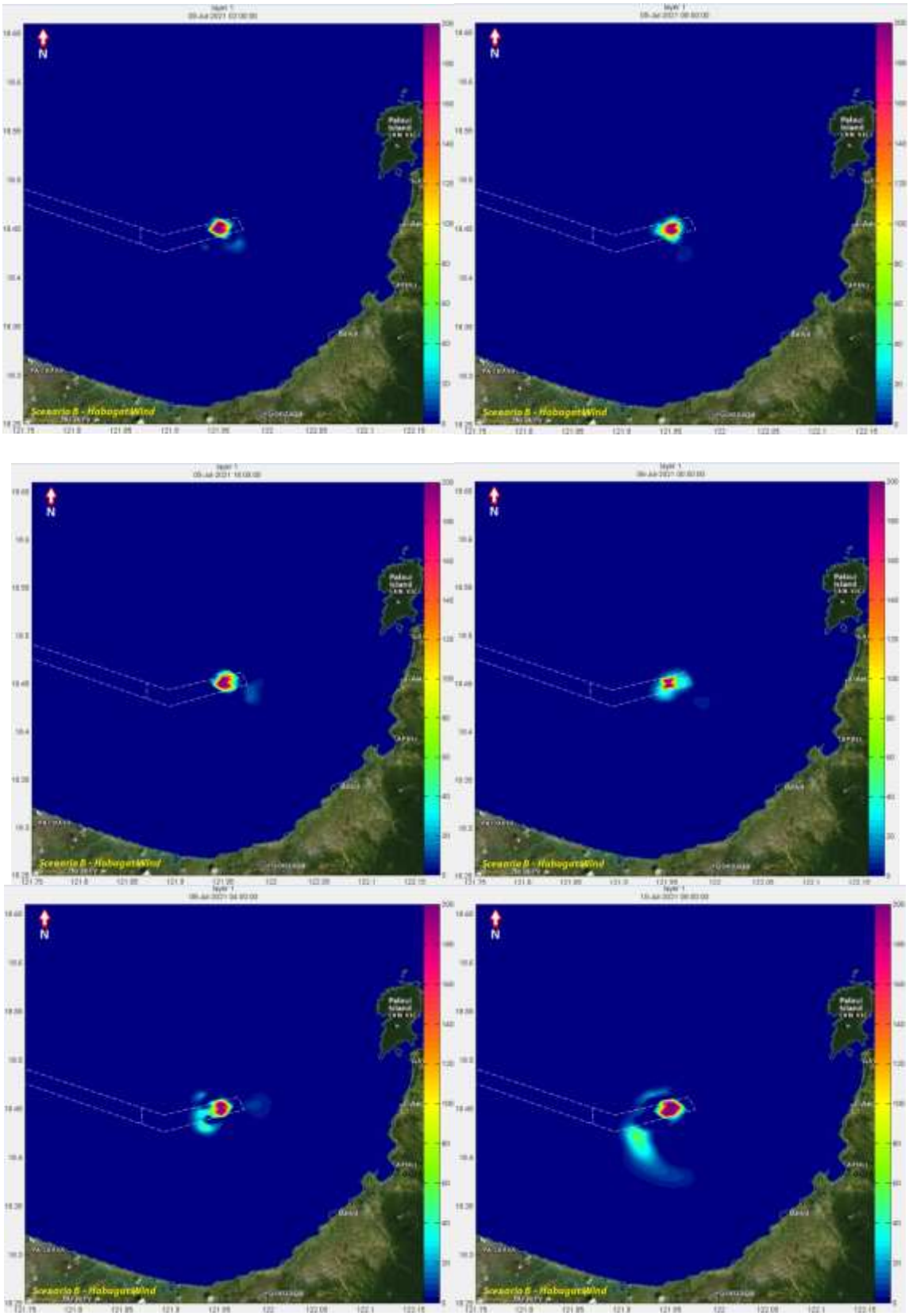


Figure 2.2-47. Predicted trajectory of sediment plume after 2 hours (upper left), 8 hours (upper right), 18 hours (middle left), 24 hours (middle right), 3.167 days (lower left) and 5.333 days (lower right) of continuous releases inside Parcel A under Habagat wind condition.

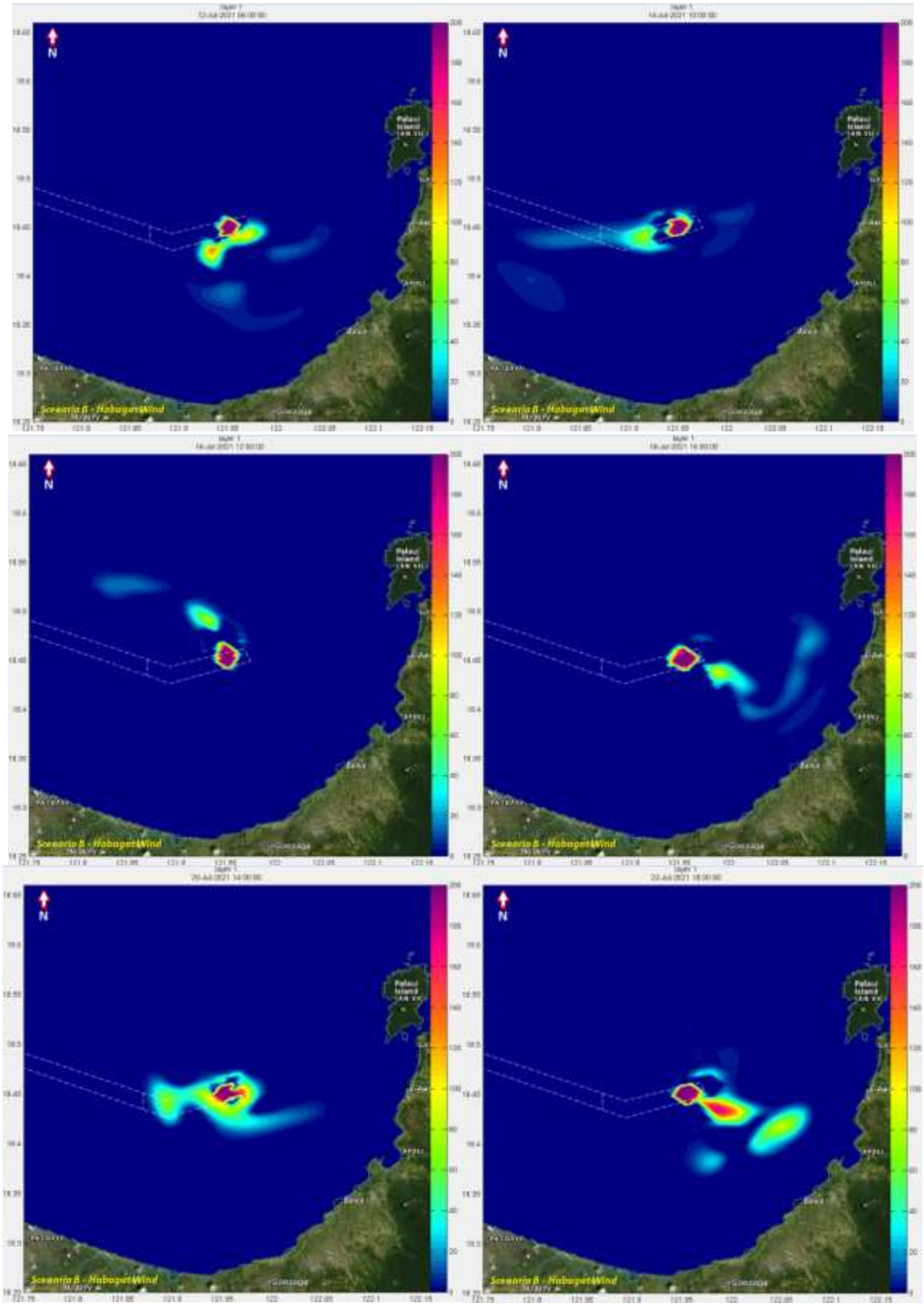


Figure2.2-48. Predicted trajectory of sediment plume after 7.25 days (upper left), 9.417 days (upper right), 11.5 days (middle left), 13.667 days (middle right), 15.583 days (lower left) and 17.75 days (lower right) of continuous releases inside Parcel A under Habagat wind condition.

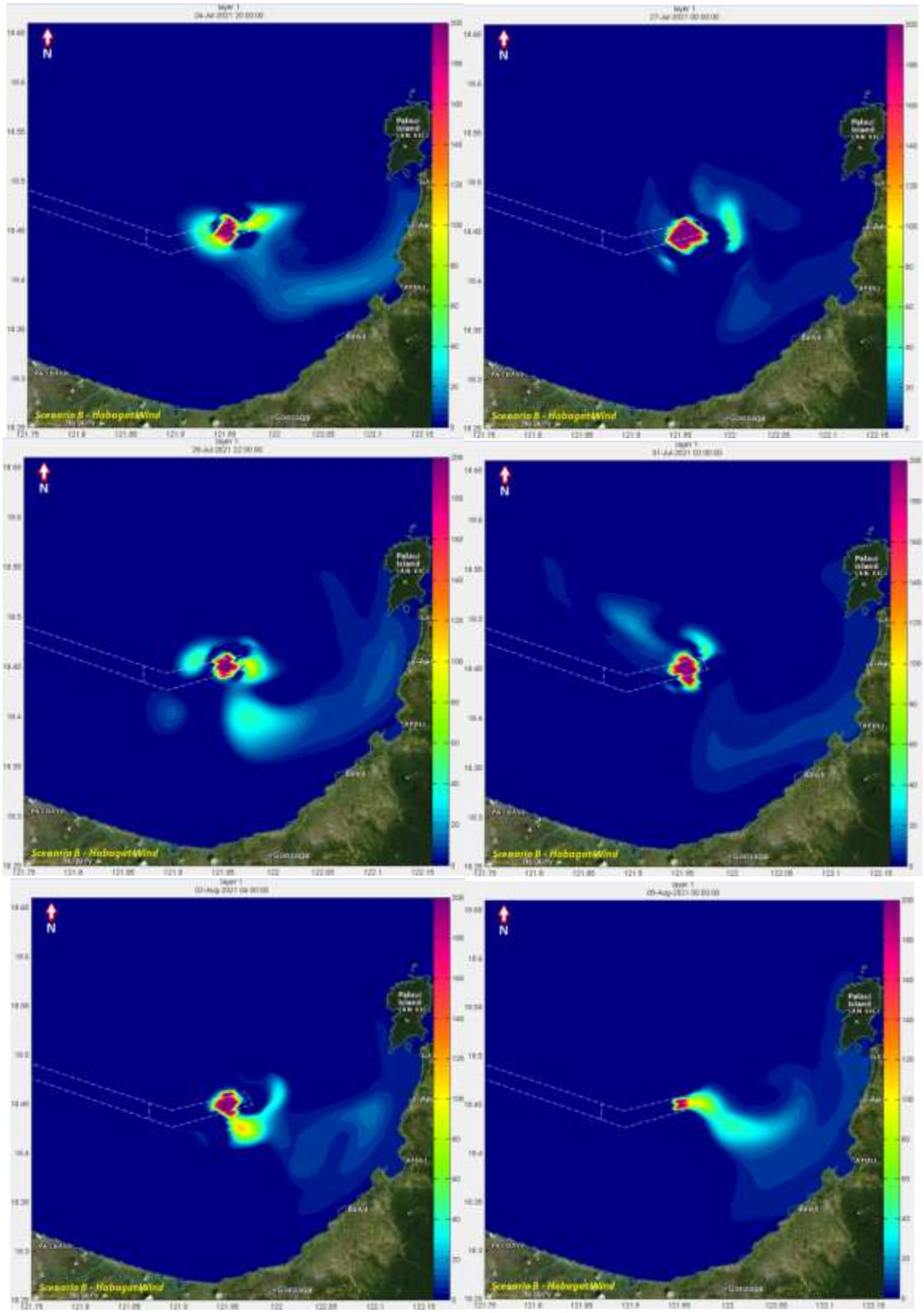


Figure 2.2-49. Predicted trajectory of sediment plume after 19.833 days (upper left), 22 days (upper right), 23.917 days (middle left), 26.083 days (middle right), 28.167 days (lower left) and 31 days (lower right) of continuous releases inside Parcel A under Habagat wind condition.

The next two figures show the comparison of predicted sediment plume for the same time step but different wind conditions. The first set represents the sediment dispersal during a particular low tidal event where the general direction of currents near the surface is towards the east in areas near the project. Because of the additional stirring brought by Amihan wind blowing from the open sea, the predicted concentration of sediment plume is somewhat lower than what is predicted during Habagat wind episode. The same trend can be said during tidal flooding, where the flow direction is towards the west; higher sediment concentrations are predicted in Babuyan Channel during Habagat wind scenario, as the fetch of the wind is rather short thereby limiting the mixing processes in the area. Fetch is a term used for the unobstructed distance that wind can travel over water in a constant direction.

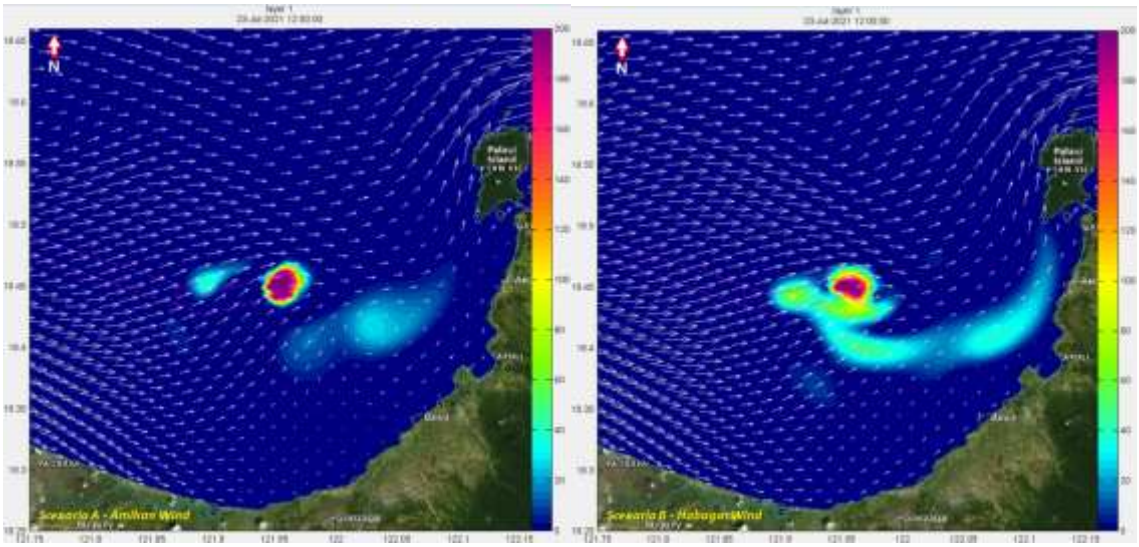


Figure 2.2-50. Comparison of predicted sediment plume during low tidal event for Amihan (left) and Habagat (right) wind scenarios.

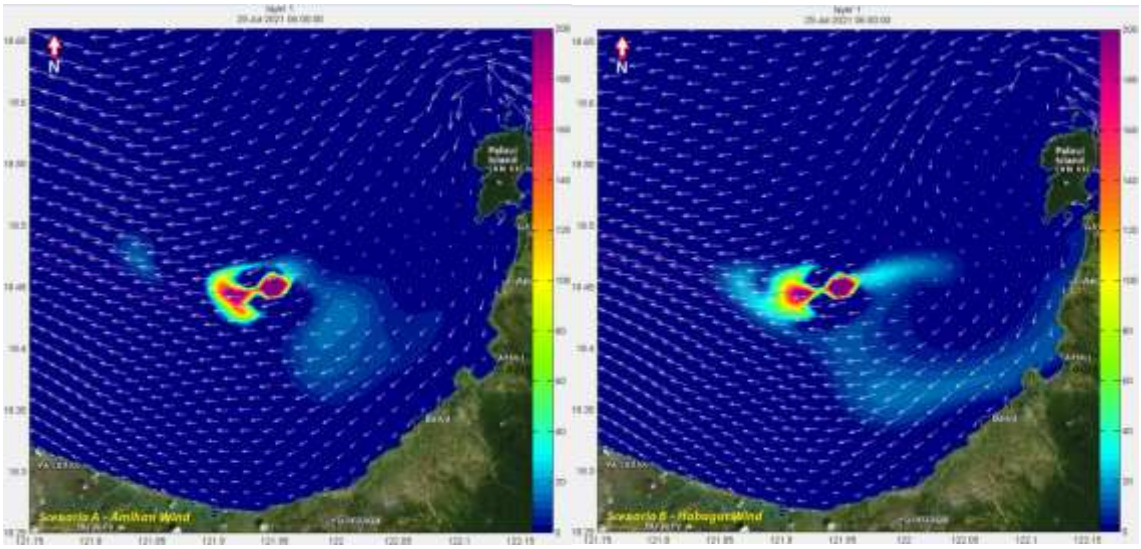


Figure 2.2-51. Comparison of predicted sediment plume during tidal flooding for Amihan (left) and Habagat (right) wind scenarios.

2.2.2.2.3 Impact Assessment and Mitigating Measures for Accidental Releases

The numerical modeling study investigated the circulation and transport features of the project's offshore and coastal environments with scenario analysis on the possible impacts of continuous releases of water pollutant, represented by sediment plume from potential stirring of bottom sediment and spillages from returned sand materials after magnetite extraction of the Offshore Mining Project of JDVC.

Scenario simulations revealed that the continuous release of sediment plume around Parcel A were transported to, and that patches of sediment plumes moves in the surrounding area albeit with low concentrations depending on wind conditions.

The predicted sediment concentration is based on the moderate wind breeze of 4 m/s with different wind directions (Amihan and Habagat) which is imposed for the whole 31-day simulation period. The fact that moderate concentrations of sediment plumes are predicted for gentle winds occurring for 31-days, therefore, the extent of plume presented in the map may be higher than what is to be expected during the actual accidental releases of water pollutant. Gentle winds to strong gale may provide significant mixing in the open area of Babuyan Channel which may significantly reduce the extent of the sediment plume predicted by this study.

Also, using the hydraulic structure model parameter 'local weir' with crest height of up to the mean sea level, spillages from the silt curtain surrounding portion inside Parcel A is considered if the velocity point at 'local weir' point is wet during the drying and flooding algorithm of the model. In actual setting, the extend of silt curtains at the water surface usually rise and fall with the waves through floaters. Thus, the predicted extend of sediment plumes may be larger than what is to be expected during actual operations of the Project.

As mitigating options, however, given the rather large sediment materials that will be returned back to the seabed after extraction of magnetite sand, coupled with potential sources of pollutants from ships and barges that will be deployed as part of the project, the project proponent may wish to consider during the operational phase of the project to provide standby spill boom (for oil spills) and maintain the efficiency of the proposed silt curtain to be deployed (to contain the returned sediments and for accidental spillages of fine suspended materials) to prevent spreading of such plumes in the nearby coastal areas.

2.2.2.3 Natural Hazards

Based on the Geohazard mapping conducted by the Mines and Geosciences Bureau (MGB) Central Office (CO), the coastal barangay covering the municipalities are mainly impacted by the hazard of flooding due to the topography and the area is considered low lying flood plains**.** The topography of the coastal municipalities of the province is generally flat with elevation less than 100 meters above sea level and slope gradient ranging from 0-3%.

The northeastern coastal portion of Gonzaga is high susceptible to flooding, areas with greater than 1-meter flood height are usually flooded for several hours during heavy rains. Included landforms of topographic lows such as active river channels, abandoned river channels, and areas along riverbanks, also prone to flash floods. This is very evident due to the presence of river and creeks such as the Cuitabang creek, Amunitan creek, Danac river, Malamnay creek, Tapel river, Cabatagan creek, and Cabatagan creek. The central part going to Santa Teresita is characterized by low to moderate susceptibility to flooding (areas with less than 1-meter flood height). These are usually inundated during prolonged and extensive heavy rainfall or extreme weather condition during the months of May to November. The major portion of the coastal area of Buguey is highly susceptible to flooding due to the presence of Buguey lagoon and other small creeks of water. The coastal area of Aparri, particularly at the eastern portion (eastern side of Cagayan River), is low susceptible to flooding while the western part (west side of Cagayan River) is highly susceptible to flooding.

Based on the flood susceptibility map from NEDA Region 2, areas located near the Cagayan River and its tributaries are highly vulnerable to flood **(Figure 2.2-54).** About 40% of the total land area of the region is susceptible to flooding. High-risk areas to flood have about 250,000 hectares and 650,000 hectares are moderately susceptible. Flood risk areas are usually located near the Cagayan River

system. Relatively, highly susceptible areas to landslide in the region, as indicated by prominent red patches in the map, are commonly situated in hilly and mountainous arts of the region. The high susceptibility of these areas depends on factors such as land cover, soil type and slope gradient (NEDA Region 2RDP, 2011-2016). The coastal areas are susceptible to flooding as shown also in **Figure 2.2-54**.

Tsunami, a Japanese word meaning "harbor wave", is a series of water waves generated by sudden displacement of the ocean or other body of water. It is commonly generated by a strong earthquake with shallow focal depth and/or causes a rupture on the ocean floor. It can also be generated by massive submarine or coastal landslides and volcanic eruptions near a coastline. In the deep ocean or in open water, a tsunami wave may only be a few centimeters high, but as it approaches a coast, the wave may increase in height and become a fast-moving wall of turbulent water that may reach a height of several meters. Though tsunamis cannot be prevented, community preparedness, timely warnings and appropriate evacuation plans can help mitigate the impact of tsunamis on coastal communities. Based on the tsunami hazard map **(Figure 2.2-55),** the coastal areas of the province are prone to tsunamis with wave height ranging from 5.74 to 7.70 meters.

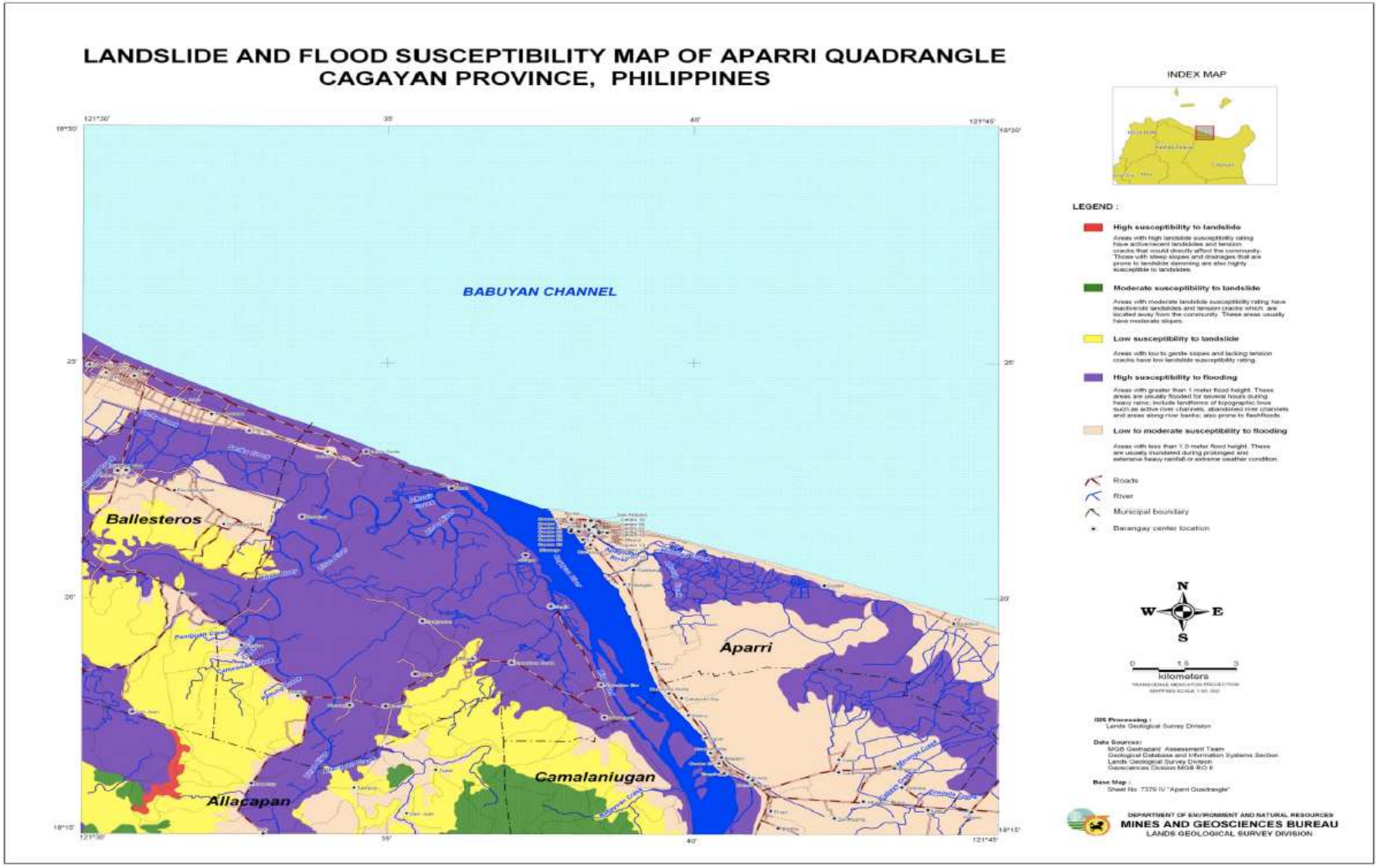


Figure 2.2-52. Landslide and Flood Susceptibility Map of Aparri Quadrangle Cagayan Province *(adopted after MGB Central Office, 2008)*

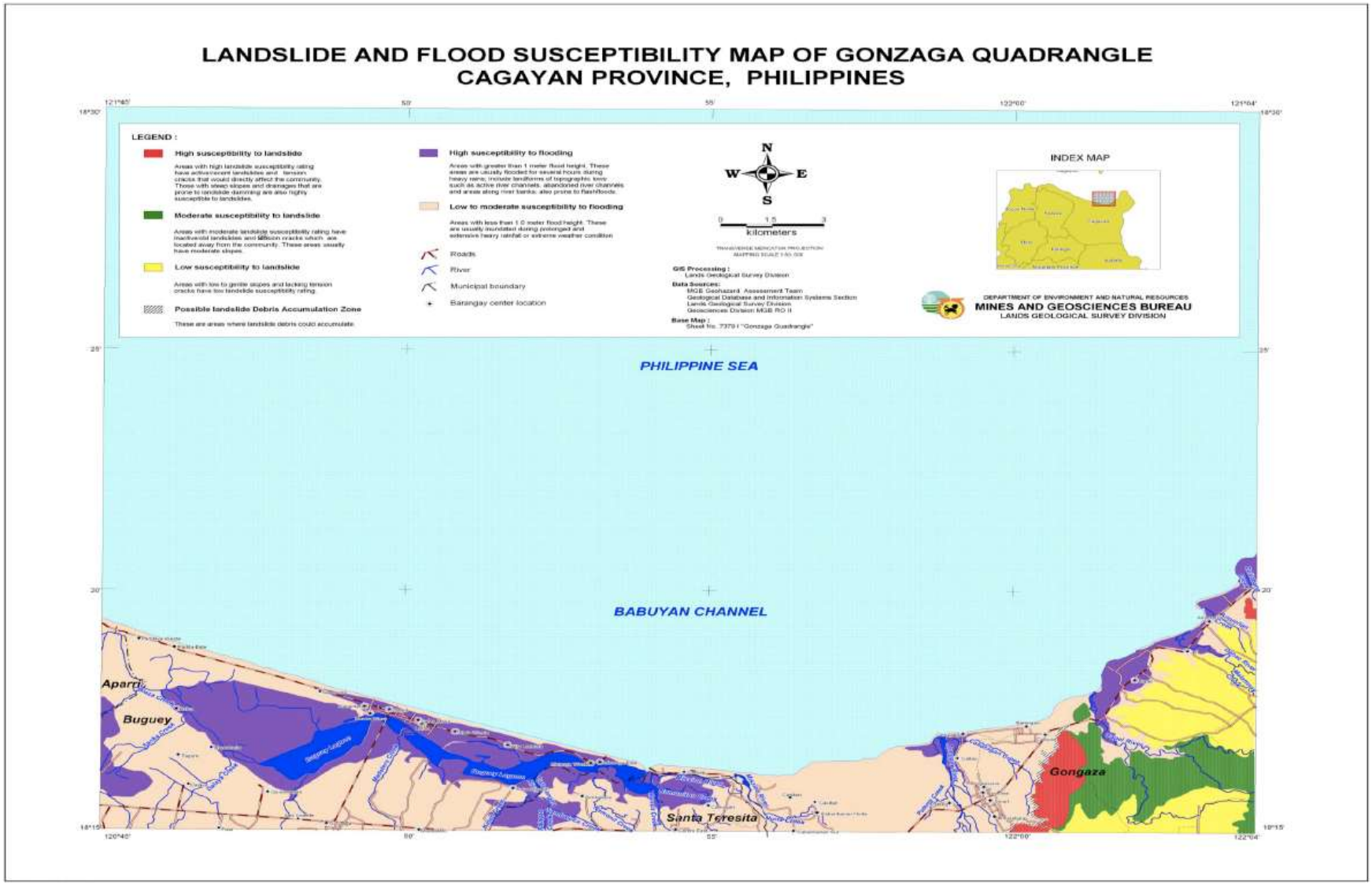


Figure 2.2-53. Landslide and Flood Susceptibility Map of Aparri Quadrangle Cagayan Province *(adopted after MGB Central Office, 2008)*

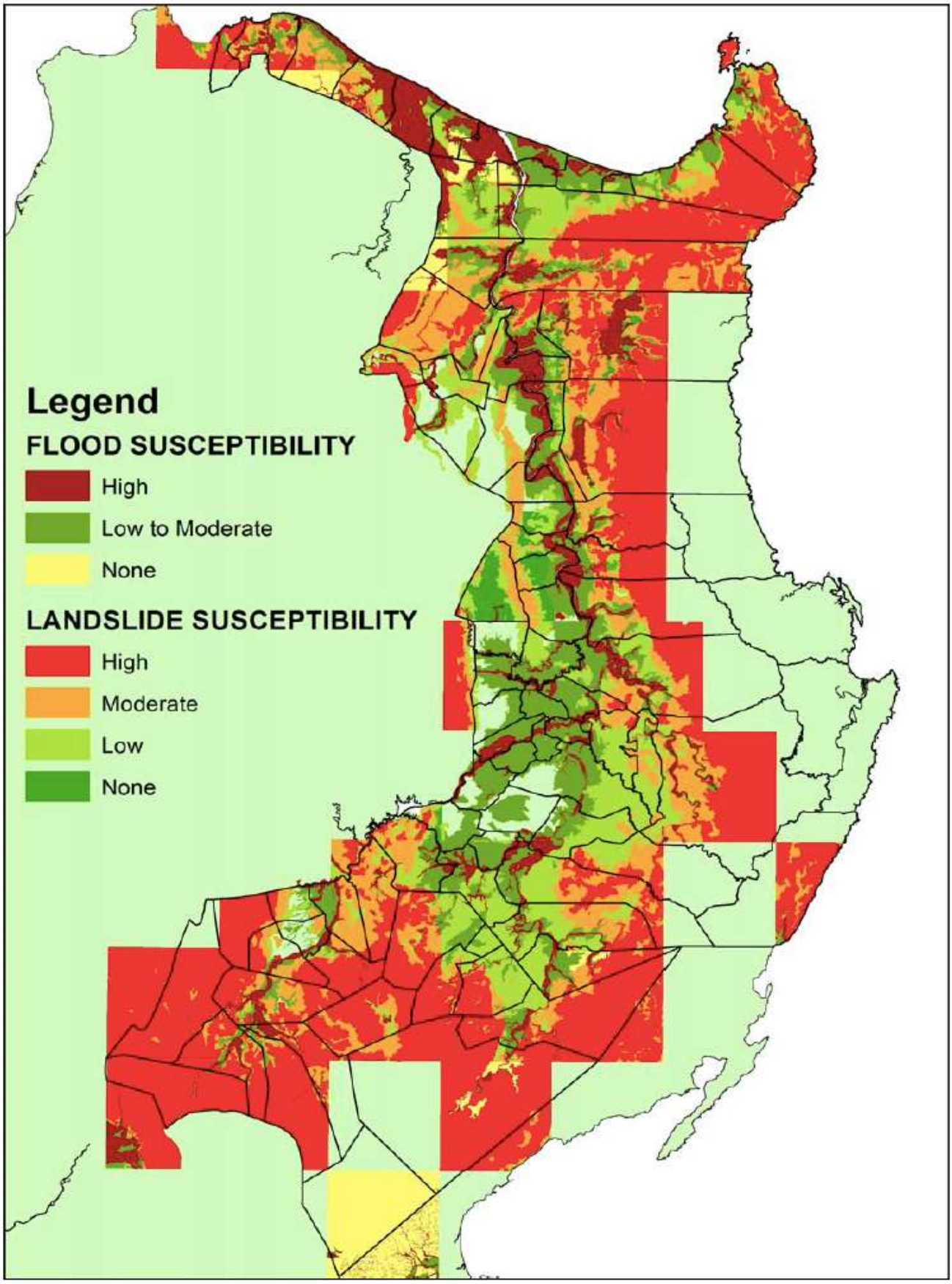


Figure 2.2-54. Flood and Landslide Susceptibility Map of Region 2

Source: RDC2 RGIN, NEDA

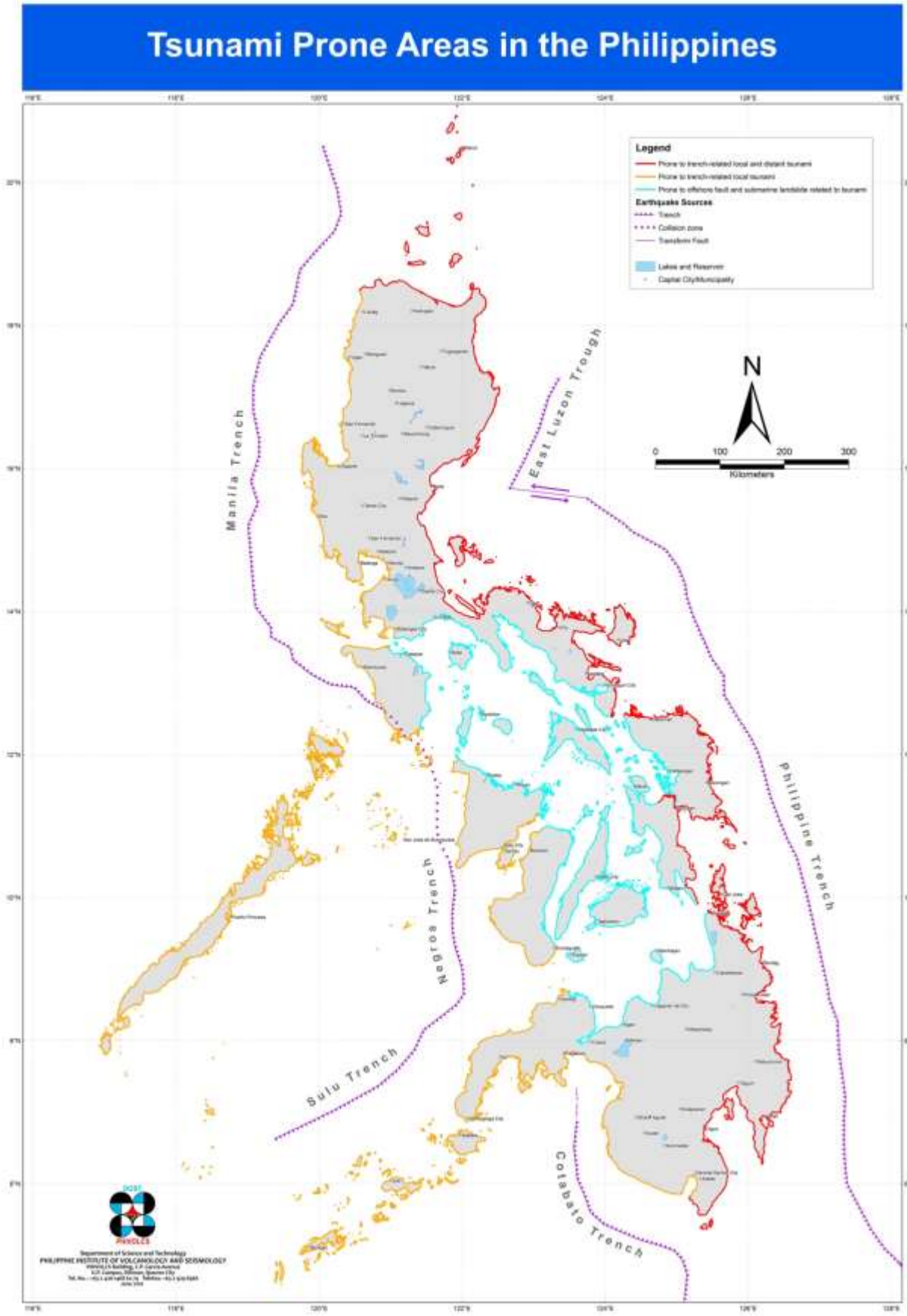


Figure 2.2-55. Tsunami Prone Areas in the Philippines *Source: PHIVOLCS 2016*

Figure 2.2-56. Map showing the Tsunami Prone Areas of the affected Municipalities *Source: GeoRiskPH NAMRIA Map 2016*

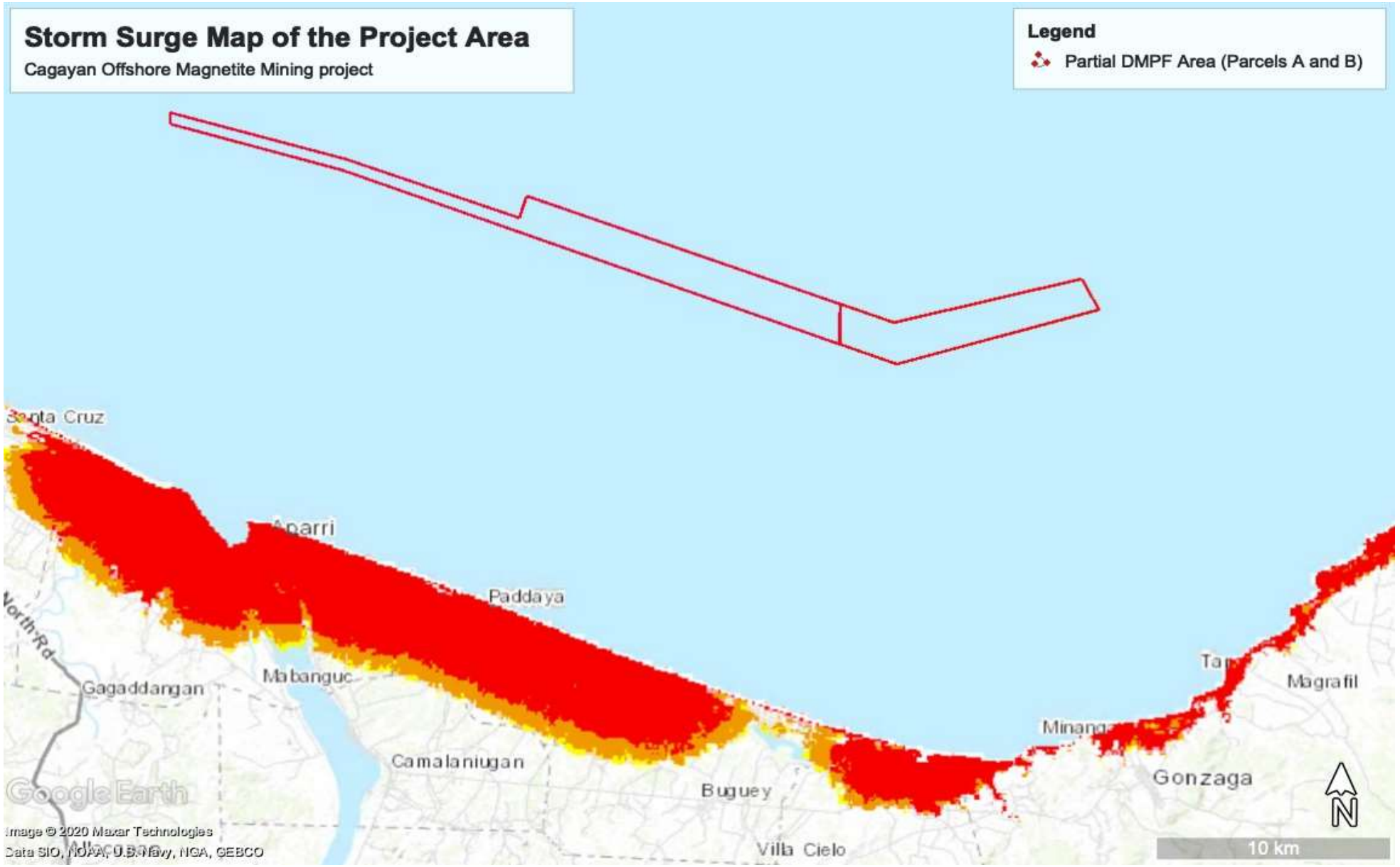


Figure 2.2-57. Map showing the areas prone to Storm Surge *Source: ArcGIS Project NOAH ArcGIS NAMRIA Topo Map 2016*

2.2.3 Marine Water Quality

The water quality assessment includes marine water quality assessment of nine (9) sampling stations pre-determined based on the project's proximity and operations in Cagayan Province. The purpose of the assessment is to obtain quantitative information on the physical, chemical, and biological characteristics of the water in the project site. Sampling was conducted on August 9, 2020.

2.2.3.1 Sampling Stations

Nine (9) sampling stations were selected for water quality assessment of marine water in the project site. The locations of sampling points were strategically located in the extent of the project site. The stations serve as representatives that will generate data that could reflect the overall water characteristics in the area.

Table 2.2-3. Geographical Coordinates of Marine Water Quality Sampling Stations

Station	Latitude	Longitude
WQ 1	18° 26' 52" N	121° 56' 59" E
WQ 2	18° 25' 59" N	121° 53' 24" E
WQ 3	18° 30' 8.46" N	121° 38' 44.77" E
WQ 4	18° 28' 17" N	121° 46' 30" E
WQ 5	18° 29' 45.10" N	121° 41' 58. 27" E
WQ6	18° 31' 0.59" N	121° 37' 24.24" E
WQ Control 1	18° 25' 27" N	121° 56' 07" E
WQ Control 2	18° 28' 31" N	121° 49' 01" E
WQ Control 3	18° 29' 42" N	121° 38' 35" E

Figure 2.2-58. Marine Water Quality Sampling Map

2.2.3.2 Methods of Sampling and Analysis

The Department of Environment and Natural Resources (DENR) through its Administrative Order (DAO) 2016 – 08, sees to it that the quality of Philippine waters shall be maintained according to their best usages. Effluents should be treated and monitored before they could be released to any body of water ensuring that negative impacts to the receiving water ecosystem are deterred. For this purpose, water samples from the sampling stations were collected and analyzed based on the acceptable method of collection and analyses set by the abovementioned DENR administrative order.

To further assess the water quality of the sampling stations, below is the summary of water quality parameters considered during the sampling analyses along with the method of analysis:

Table 2.2-4. Methods of Water Sampling and Analysis

Parameter	Analysis
pH	Direct reading, in-situ
Temperature	Direct reading, in-situ
Turbidity	Direct reading, in-situ
Dissolved Oxygen	Direct reading, in-situ
Color	Visual Comparison
Oil and Grease	Liquid-Liquid, Partition – Gravimetric
Total Suspended Solids	Gravimetric
Thermotolerant (Fecal) Coliform	Multiple Tube Fermentation Technique – Fecal Coliform Procedure
Total Coliform	Multiple Tube Fermentation Technique – Std. Total Coliform Fermentation Technique

Source: USEPA 40 CFR, part 50 & 53

2.2.3.2.1 Background of Parameters

pH

pH is a measure of how acidic or basic the water is. It ranges from 0 to 14 being 7 as the neutral and less than that indicates acidity while higher implies basicity. It is essential in monitoring environmental conditions since it dictates the metabolic rate in the system. Too high or too low pH of the water could cause the aquatic organisms living within it to die. Some biological effects that come with extreme pH levels are reduction in hatching and survival rates. The farther it drops or raises, the greater it affects the mortality rate of organisms. It also increases the solubility of elements and compounds, promoting “mobility” of toxic chemicals. Although change in pH can be a natural process (i.e. interactions with surrounding rocks which are in carbonate forms), pH can also fluctuate with wastewater or mining discharges.

Temperature

Water temperature is vital in a water body since it highly influences biological processes. It determines the organisms that thrive in an aquatic system given that some species are temperature sensitive in nature. Temperature also affects the water chemistry as a driver of chemical reactions such as the dissolution of minerals that are present in the water. It also defines the dissolved oxygen capacity of the water. Warm waters have less dissolved oxygen in comparison to cold water bodies.

Turbidity

Turbidity is used as a visual indicator in assessing water quality. It is described as a result of suspended solids in the waterbody in the form of silt, clay, chemical precipitates, and organic particles that affect

the overall clarity of the water. The constituent particulates are oftentimes harmless but there are instances that turbid water may indicate the presence of hazardous chemicals or microbial contaminants. It is measured through the scattering and absorption of transmitted light and is typically expressed in nephelometric turbidity units (NTU). Increase in turbidity measurement may signal water pollution in a watershed (WHO, 2017).

Dissolved Oxygen

Dissolved oxygen is another important measurement to assess aquatic life. It measures the amount of oxygen dissolved in the water that is readily available for consumption of aquatic organisms. Anoxic conditions or oxygen-deficient waters are the dead zones wherein organisms are less likely to survive. Dissolved oxygen of a water column is a function of temperature, depth, and biological activities.

Color

Color of the water body is affected by the presence of organic matter such as humic and fulvic acid, dissolved metal compounds, and a result of chemical reactions (i.e. oxidation of iron). It can be measured using a spectrophotometer (Hazen Unit, HU) or through visual comparison (True Color Unit, TCU). The color of the water is monitored since it serves as a visual indicator of possible water pollution or contamination (WHO, 2011).

Oil and Grease

The concentration of dispersed oil and grease is an important parameter for water quality and safety. Oil and grease in water can cause surface films and shoreline deposits leading to environmental degradation and can induce human health risks when discharged in surface or ground waters. Additionally, it may interfere with aerobic and anaerobic biological processes and lead to decreased wastewater treatment efficiency. Regulatory bodies worldwide set limits in order to control the amount of oil and grease entering in natural bodies of water or reservoirs through industrial discharges, and to also limit the amount present in drinking water.

Total Suspended Solids

Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.

High TSS can block light from reaching submerged vegetation, causing the process of photosynthesis to slow down. Reduced rates of photosynthesis result to less dissolved oxygen to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water. Low dissolved oxygen can lead to fish kills. High TSS can also cause an increase in surface water temperature because the suspended particles absorb heat from sunlight. This can cause dissolved oxygen (DO) levels to fall even further (Mitchell and Stapp, 1992; KanCRN website).

Thermotolerant (Fecal) Coliform

Fecal coliform has been used in water microbiology to denote coliform organisms which grow at 44 or 45.5 C. The presence of coliforms nearly always indicates fecal contamination. Usually, more than 95% of thermotolerant coliforms isolated from water are the gut organism Escherichia coli. The presence of which is a definitive proof of fecal contamination. Waterborne pathogenic diseases include typhoid

fever, viral and bacterial gastroenteritis and hepatitis A. Fecal contamination pose a potential health risk for individuals exposed to this water.

Total Coliform

Total coliform bacteria are rod-shaped bacteria that share several characteristics. These bacteria are common in the environment mostly in soil or in vegetation. High count of these bacteria in a specific water body may be brought by run-offs during rainy season which intensifies soil deposition. Such presence of the bacteria does not necessarily indicate the presence of fecal contamination. It might be caused by entry of soil or organic matter into the water or by conditions suitable for the other types of coliform to grow.

2.2.3.3 Meteorological Observations

Meteorological conditions were recorded during the water sampling activity to determine the environmental conditions that may affect the results of the assessment. Weather observations can be correlated in the interpretation of the results considering that it can affect the mechanisms in aquatic ecosystems.

Wind Direction

Wind direction is the direction to which the wind is heading. It is reported in the cardinal directions. The wind direction in a certain station is determined by observing the motion of the wind from field observation of objects such as trees, grasses, smoke, etc. using a compass as a reference.

Wind Speed

Wind speed describes how fast the air is moving past a certain point. Wind speeds were recorded during the sampling activity using the Beaufort Wind Scale as a guide. Devised by Britain's Admiral Francis Beaufort, this was one of the first scales used to estimate and report wind speeds via visual observations. Table 3 details a brief categorization of the Beaufort wind forces along with the corresponding equivalent speeds, wind descriptions, and land observations.

Table 2.2-5. Beaufort Wind Scale

Wind Description	Units in KpH	Units in KNOTS	Description as Observed
Light Winds	19 or less	10 or less	• The wind felt on face • Ordinary wind vanes moved by wind • Leaves rustle
Moderate Winds	20 – 29	11 – 16	• Wind raises dust and loses the paper • Small branches are moved
Moderate to Occasionally Strong			• Moderate winds mostly persist, but there are instances during the forecast period that it reaches strong wind force.
Fresh Winds	30 – 39	17 – 21	• Small trees in leaf begin to sway • Crested wavelets appear on inland waters
Strong Winds	40 – 50	22 – 27	• Large branches in motion • Whistling heard in telephone wires • Umbrellas used with difficulty
Gale: 1. Near Gale 2. Gale 3. Strong Gale	51 – 62 63 – 75 76 – 87	28 – 33 34 – 40 41 – 47	• Whole trees in motion • Inconvenience felt when walking against the wind • Twigs break off-road • Cars veer on road

Wind Description	Units in KpH	Units in KNOTS	Description as Observed
			• Larger branches break off • Slight structural damage occurs-roofing dislodged
Stormy: 1. Storm 2. Violent Storm 3. Typhoon	88 – 102 103 – 117 118 or more	48 – 55 53 – 63 64 or more	• Trees uprooted • Considerable structural damage • Widespread damage

Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

Cloud Description

The system used to describe sky conditions during the sampling period is outlined below. The terminologies below were adopted and used by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Table 2.2-6. Sky Conditions and its Descriptions

Sky Condition	Definition / Description
Clear or Sunny Skies	• State of the sky when it is cloudless, totally clear or with a few small light clouds visible • Has a total cloud cover of less than one okta
Partly Cloudy	• State of the sky is within 2 – 5 oktas total cloud cover or has between 30% to 70% cover of the celestial dome
Partly Cloudy to at Times Cloudy	• Mostly partly cloudy but there are times when more than 70% of the celestial dome us covered with clouds
Mostly or Mainly Cloudy	• The sky is mostly covered with clouds but with possible brief periods of sunshine • The sky is covered with clouds between 6 to 8 oktas
Cloudy	• The sky is covered with clouds between 6 to 8 oktas or has more than 70% cloud cover • Predominantly more clouds than clear sky • For a longer period during the day, the sun is obscured by clouds
Overcast	• The sky is totally or completely covered with thick and opaque clouds, 8 oktas, or around 100% cloud cover

2.2.3.4 Results and Discussion

2.2.3.4.1 Marine Water Quality Assessment

Nine established sampling stations were assessed for marine water monitoring in the project site last August 9, 2020. All sampling stations are located in the vicinity of the project site. Samples were submitted to Elarsi Inc., a Department of Environment and Natural Resources (DENR) accredited laboratory for analysis. The results of the analysis were released on August 20, 2020.

The results for each parameter are presented in the table below, together with the DENR Water Quality Standard for Class SC water body classification.

Table 2.2-7. Marine Water Quality Assessment Results

Parameter	WQ 1	WQ 2	WQ 3	WQ 4	WQ 5	WQ 6	WQ Control 1	WQ Control 2	WQ Control 3	DAO Standard Class SC
pH	8.0	8.2	8.4	8.4	8.4	8.3	8.3	8.4	8.4	6.5 – 8.5
Temperature (°C)	28.5	28.7	28.1	29.3	28.7	28.1	26.8	27.4	28.3	25 – 31
Turbidity (NTU)	0.36	0.27	0.31	0.23	0.28	0.35	0.32	0.21	0.38	-

Parameter	WQ 1	WQ 2	WQ 3	WQ 4	WQ 5	WQ 6	WQ Control 1	WQ Control 2	WQ Control 3	DAO Standard Class SC
Dissolved Oxygen (mg/L)	6.6	6.8	6.5	6.5	6.3	6.5	6.5	7.2	6.8	5
Color (TCU)	<5	<5	<5	<5	<5	<5	<5	<5	<5	75
Oil and Grease (mg/L)	1	<1	<1	<1	<1	<1	1	1	1	1
Total Suspended Solids (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	80
Fecal Coliform (MPN/100mL)	<1.8	<1.8	4.0	11	49	2.0	6.8	27	2.0	200
Total Coliform (MPN/100mL)	4.5	2.0	330	700	170	2.0	130	230	13	5000 (m)

** (m) – Geometric mean of the most probable number of coliform organisms during a 3-month period and that the limit indicated shall not be exceeded in 20% of the samples taken during the same period*

The marine water sampling stations are all located within the Babuyan Channel where Gonzaga Bay and Santa Ana bay are found. Per the water body classification set by EMB DENR, Gonzaga Bay and Santa Ana bay are both under unclassified water bodies. As indicated in DAO 2016 08, the classification for unclassified water bodies shall be based on the beneficial use as determined by EMB. Class SC was adopted in this assessment given that the existing use of the water body coincide with intended use of Class SC, identified as Fishery Water Class III (for propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing), Recreational Water Class II (for boating, fishing, and other similar activities), and marshy and/or mangrove areas declared as fish and wildlife sanctuaries.

The results of marine water quality assessment show that all parameters in all sampling stations are within the standard of a Class SC marine water body set in DAO 2016 08 The level of dissolved oxygen of the sampling sites has been maintained and did not go below the minimum level of 5 mg/L for the identified classification. This indicates that the water body has enough oxygen to sustain aquatic life. The total coliform count as well, did not exceed 20% (1000 MPN/100mL) of the standard of 5000 MPN/100mL for a 3-month period set by DENR Administrative Order No. 34 of 1990. Thus, results presented an acceptable water quality measurement for Class SC water body.

2.2.3.4.1 Meteorological Observations

Meteorological conditions in all sampling stations were assessed. These observations can have implications on the results in the water quality assessment. In the whole duration of the sampling activity, there is no precipitation that was recorded. The sky condition is described to have clear to partly cloudy skies, ranging from 1-2 oktas. Overall, the wind direction is heading northward with some areas having northeastward and northwestward directions. Light winds are felt all stations with estimated wind speed of less than 5 meters per second.

Table 2.2-8. Meteorological Observations during the Sampling Period

Station	Date and Time of Sampling	Cloud (Okta)	Wind Condition	Wind Direction
WQ 1	August 9, 2020 12:06 PM	2	Light Winds	N
WQ 2	August 9, 2020 10:15 AM	2	Light Winds	N
WQ 3	August 9, 2020 7:45 AM	1	Light Winds	NE
WQ 4	August 9, 2020 9:46 AM	1	Light Winds	N
WQ 5	August 9, 2020	1	Light Winds	NE

Station	Date and Time of Sampling	Cloud (Okta)	Wind Condition	Wind Direction
	9:28 AM			
WQ6	August 9, 2020 6:13 AM	1	Light Winds	NW
WQ Control 1	August 9, 2020 11:12 AM	2	Light Winds	N
WQ Control 2	August 9, 2020 9:58 AM	1	Light Winds	N
WQ Control 3	August 9, 2020 8:21 AM	1	Light Winds	NE

2.2.5 Marine Ecology

2.2.5.1 Sampling Stations

Mangroves

The locations of the sampling stations for mangrove assessment are shown below. This study was conducted in Barangay Linao, Appari and Barangay Minanga Este, Buguey in the Province of Cagayan. The mangrove assessment was done last November 7 and 8, 2020.

Table 2.2-9. Geographical Coordinates of Mangroves Sampling Stations

Sampling Stations	Latitude	Longitude
MS1	18°22'09'' N	121°36'22'' E
MS2	18°15'56'' N	121°54'04'' E

Figure 2.2-59. Sampling Stations of Mangrove Assessment

Seagrass

This study was conducted within the vicinity of the Barangay Santa Cruz in the Municipal of Gonzaga, Province of Cagayan last November 8, 2020. There was a total of two sampling stations assessed for seagrasses.

Table 2.2-10. Geographical Coordinates of Seagrass Sampling Stations

Sampling Stations	Latitude	Longitude
SS1	18°20'20'' N	122°03'43'' E
SS2	18°19'41'' N	122°03'06'' E

Table 2.2-60. Sampling Stations of Seagrass Assessment

Plankton

There are Nine (9) sampling stations were selected for plankton assessment. The locations of sampling points were strategically located within the project area. The stations serve as representatives that will generate data that could reflect the overall plankton assessment characteristics in the area.

Table 2.2-11. Geographical Coordinates of Plankton Sampling Stations

Sampling Stations	Latitude	Longitude
PL1	18°26'52'' N	121°56'59'' E
PL2	18°25'59'' N	121°53'24'' E
PL3	18°30'8.46'' N	121°38'44.77'' E
PL4	18°28'17'' N	121°46'30'' E
PL5	18°47'34.43'' N	121°12'22.67'' E
PL6	18°47'27.08'' N	121°12'13.52'' E

Sampling Stations	Latitude	Longitude
PL7	18°25'27'' N	121°56'07'' E
PL8	18°28'31'' N	121°49'01'' E
PL9	18°29'42'' N	121°38'35'' E

2.2.5.2 Sampling Method

Mangroves

Plot method was used to assess the mangroves in Barangay Linao, Appari and Barangay Minanga Este, Buguey. In each plot the bearing of the baseline coordinates were established using GPS. Within every 10 x 10 m^2 plot all mature mangrove tree species were counted and their girth measured at breast height or at a standard 1.3 meters from the base. At the corner of the plot a 5 x 5 m quadrat was established to count and identify the number of saplings; and within each quadrat a 1 x 1 m quadrat was used count and identify the seedlings. Leaf, fruit, and flower samples from each Mangrove species were collected and were photo documented for further identification in the lab. Samples collected were identified based on Calumpong, Hilconida P. and Ernani G. Meñez. 1997. Field Guide to the Common Mangroves of the Philippines by Calumpong et. al and The Field Guide to the Identification of Some Mangrove Species in the Philippines by DENR.

Photo 1. Establishment of Plots

Seagrass and Algae

Seagrass and seaweed assessment were done by the transect quadrat method. For the transect quadrant method, a 50-meter transect line was established and laid perpendicular to the shoreline in which a 0.25 x 0.25-meter quadrat was placed along the transect line and recording was done at a 5-meter interval. Species recorded were identified to its lowest taxonomic level and estimated its percentage cover.

Photo 2. Transect-quadrat Method

Plankton Assessment

Vertical tows of 20-µm mesh 50-meter diameter plankton net at varying depths were carried out in 9 stations throughout the study area to assess the community structure, species richness, and abundance of the different plankton in the project site. Samples were transferred to 1.5-liter plastic containers, labelled accordingly, and immediately fixed by adding 100 ml of 5% buffered and filtered seawater-formalin solution. All samples were concentrated to a final volume of 650 ml. Plankton density was determined using three aliquots per sample examined microscopically using a Sedgewick-Rafter cell.

Fishery Survey

Interviews were conducted on local fisherfolks with regards to their fishing activities. The interview questions included the type of gears they use, number of fishers in a trip, total fish catch per trip (kilograms/person/trip), number of hours per fishing trip and species of fishes caught.

2.2.5.3 Results and Discussion

2.2.5.3.1 Mangroves

Mangrove forests are among the world's most productive ecosystems. They are highly valuable ecosystems as they enrich coastal waters, protect coastlines, and support coastal fisheries. Mangroves exist under conditions of high salinity, extreme tides, strong winds, high temperatures and muddy soils. Usually, mangroves are defined as a tree, shrub, palm, or woody plants that grow at the interface between land and sea in tropical and sub-tropical latitudes. Generally exceeding one-half meter in height and which normally grows above mean sea level in the intertidal zone of marine coastal environments or estuarine margins.

There are 54 species of mangroves and 60 mangrove associates worldwide. The Philippines has around 44 "true mangroves", true mangrove species are those that are exclusively restricted to tropical intertidal habitats and do not extend into terrestrial plant community and are adapted to saline and anaerobic condition. However, the status of mangrove areas in the country has been alarming due to anthropogenic activities that lead to establishment of stress, bringing out deleterious effects and such changes. Habitat destruction, invasive species, overpopulation, over exploitation and pollution are some

of the problems that mangrove areas have been facing. Also, human impacts reduce the capacity of mangrove ecosystems to withstand natural and environmental changes.

Mangrove species inhabit in intertidal zone of the tropics. Mangroves flourish shorelines and on natural rates of sedimentation. However, accreted rates of sediments within the location lead to sediment burial in mangrove environments that cause adverse effects especially decreasing in mortality rate. Mining involves significant environmental repercussions, such as environmental interferences connected with extracting minerals, industrial activity to process the minerals, transportation infrastructure required, and the disposal of mining waste. However, proper mitigating measures during operations phase, adverse impacts to mangroves can be prevented.

Species Identification

There are a total of 5 mangrove species that were present in the area belonging to different families. However, one (1) of the identified species of mangroves is an associate mangrove species and the other four (4) are true mangrove species. The true mangrove species include *Avicennia marina, Xylocarpus granatum, Rhizophora mucronate* and *Sonneratia caseolaris*. Meanwhile, *Nypa fruticans* is considered as mangrove associate species.

Table 2.2-12. Species Present in the Area

Family	Species	Common Name
Arecaceae	*Nypa fruticans**	Nipa
Avicenniaceae	*Avicennia marina*	Piapi
Meliaceae	*Xylocarpus granatum*	Tabigi
Rhizophoraceae	*Rhizophora mucronata*	Bakhaw Babae
Sonneratiaceae	*Sonneratia caseolaris*	Pedada

** mangrove associate species*

Photo 3. Rhizophora mucronata

Occurrence

All of the mangrove species were present in both stations.

Table 2.2-13. Species Occurrence of Mangroves

Species	Station 1	Station 2
Nypa fruticans	✓	✓
Avicennia marina	✓	✓
Xylocarpus granatum	✓	✓
Rhizophora mucronata	✓	✓
Sonneratia caseolaris	✓	✓

Species Diversity

The table below shows the diversity indices in the different stations of the mangroves present. Based on the table, there are both five (5) taxa of mangroves in both stations, however, there more individual mangroves in station 2 than in station 1. Station 1 has a Shannon (H) value of 1.347. This value belonged to the category of very low diversity by the scale of Fernando Qualitative Biodiversity Scale. Station 2, on the other hand, was not categorized on the Fernando Qualitative Biodiversity Scale since it less than 1 Shannon (H) value.

Table 2.2-14. Diversity Indices of Mangroves

	Station 1	Station 2
Taxa	5	5
Individuals	29	38
Dominance	0.2961	0.5305
Simpson	0.7039	0.4695
Shannon (H)	1.347	0.9675
Evenness	0.7691	0.5263

Relative Abundance

Over-all Relative Abundance

There are a total of 67 individual mangroves that were present in both stations. The mangrove species with the highest relative abundance is *Sonneratia caseolaris* which comprised 58% of the total number of individuals present in both stations and 39 individuals. Meanwhile, the species with the least abundance is *Avicennia marina* with 5% relative abundance, or 3 individuals observed. Other species of mangroves are *Nypa fruticans* which has 18% relative abundance comprising of 12 individuals, followed by *Rhizophora mucronata* and *Xylocarpus granatum* with 10% or 7 individuals and 9% or 6 individuals, respectively.

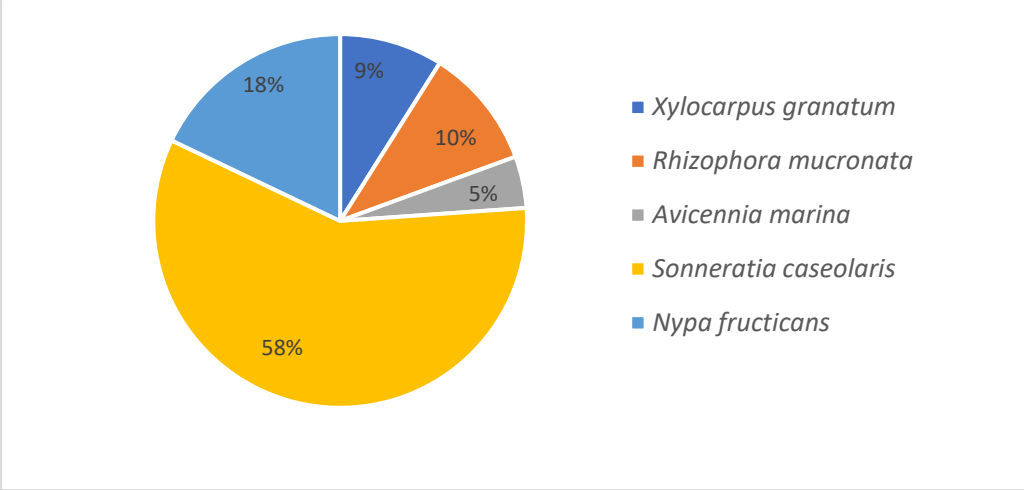


Figure 2.2-61. Relative Abundance of Mangrove Species in both stations

Station 1

The figure below shows the relative abundance of mangrove species in station 1. Based on the figure, *Sonneratia caseolaris* has the highest relative abundance of 41.38%, comprising of 12 individuals. It was followed by species *Nypa fruticans* and *Rhizophora mucronata* with relative abundance of 27.59% or 8 individuals and 20.69% or 6 individuals, respectively. Meanwhile, *Xylocarpus granatum* and *Avicennia marina* were the species with the least relative abundance in this station. *Xylocarpus granatum* has 6.90% relative abundance which comprise of 2 individuals and *Avicennia marina* has 3.45% relative abundance composing of only an individual.

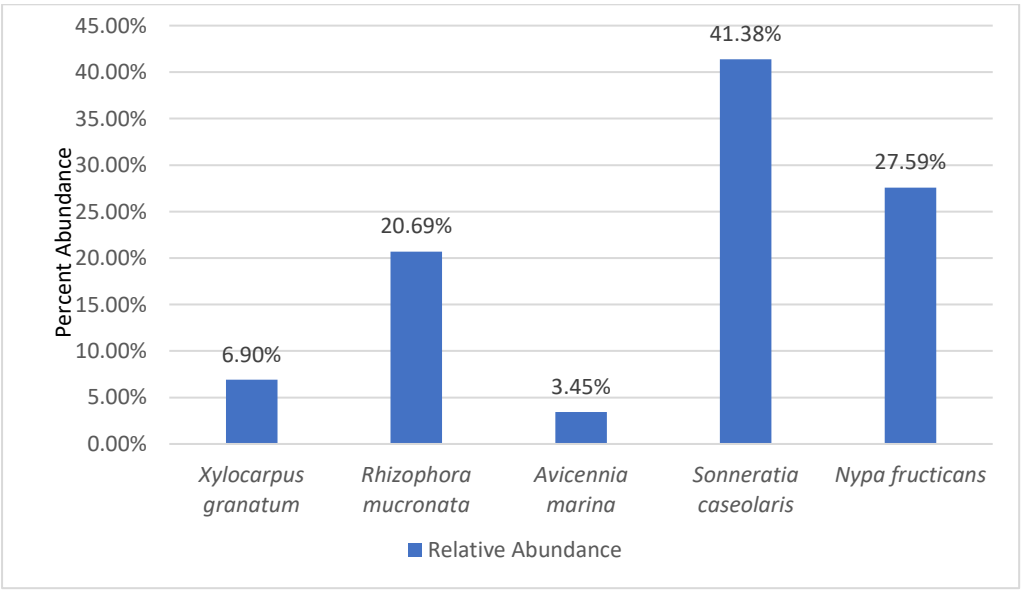


Figure 2.2-62. Relative Abundance of Mangrove Species in Station 1

Station 2

In station 2, the species with the highest relative abundance is *Sonneratia caseolaris* with a value of 71.05% or 27 individuals, it was followed by *Xylocarpus granatum* and *Nypa fruticans* with 10.53% relative abundance comprising 4. In addition, *Avicennia marina* has 5.26% relative abundance with 2 individuals. MEanwhile, the least relative abundance value was 2.63% for the species *Rhizophora mucronata* which comprises of only 1 individual.

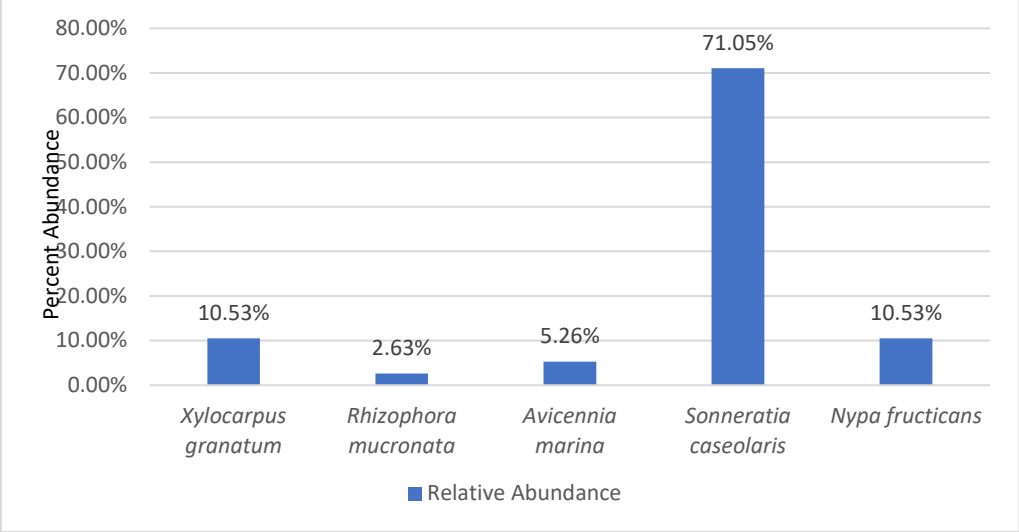


Figure 2.2-63. Relative Abundance of Mangrove Species in station 2

2.2.5.3.2 Seagrass and Algae

Plants such as seagrass and algae have a high capacity to accumulate a range of elements. They are indicators of marine pollution and shows considerable tolerance to fluctuations in environmental conditions. Seagrasses are primary produces and may be used as first level indicator to trace metal levels in marine environment. The project may gradually affect the seagrass and algae ecosystem through the runoffs and sediment deposition that causes the sediment or silt covers the seagrass and algae and prevent the penetration of the sunlight.

Seagrasses are flowering plants are found in shallow coastal areas. They survive and tolerate a wide range of salinity. These plants are important in biodiversity and support the production of marine organisms especially economically important fishes, crustaceans and shellfishes.

Algae are a diverse group composed of autotrophic (producers of their own food) organism that ranges from unicellular to multicellular forms. Algae are commonly termed as seaweeds. Algae are classified based on their body pigments which are commonly called as red algae (Rhodophyta), brown algae (Phaeophyta) and green algae (Chlorophyta).

Species Identification

Seagrass

There is a total of 3 seagrass species belonging to 2 families that were present in the study area. The family Hydrocharitaceae has 2 species of seagrass observed, consisting of the species *Halophilia ovalis* and *Thalassia hemprichii.* Meanwhile, the species *Syringodium isoetifolium* belongs to family Cymodoceaceae.

Table 2.2-15. Seagrass Species Identification

Family	Species	Common Name
Cymodoceaceae	*Syringodium isoetifolium*	Noodle Seagrass
Hydrocharitaceae	*Halophila ovalis*	Oval Leaf Seagrass
	Thalassia hemprichii	Sickle Seagrass

The following photos below is the representation of the seagrass species observed:

Photo 4. *Syringodium isoetifolium*

Photo 5*. Thalassia hemprichii*

Algae

There are a total of three (3) species of macroalgae which includes *Padina* sp., *Sargassum* spp. and *Halimeda* sp. There are two (2) species which belongs to the group Phaeophyta or the brown algae and this are *Padina* sp. and *Sargassum* spp. There is only one species of green algae or Chlorophyta which is *Halimeda* sp.

Table 2.2-16. Algae Species Identification

Group	Family	Species
Phaeophyta	Dictyotaceae	*Padina sp.*
	Sargassaceae	*Sargassum spp.*
Chlorophyta	Halimedaceae	*Halimeda sp.*

Photo 6. *Padina sp.*

Photo 7. *Halimeda sp.*

Photo 8. *Sargassum sp.*

Occurrence

Seagrass

There were three (3) species were observed in station 1 while there were only two (2) species observed in station 2. The species that was not present in station 2 is *Halophila ovalis*.

Table 2.2-17. Species Occurrence of Seagrass

Species	Common Name	Station 1	Station 2
Syringodium isoetifolium	Noodle Seagrass	✓	✓
Halophila ovalis	Oval Leaf Seagrass	✓	
Thalassia hemprichii	Sickle Seagrass	✓	✓

Species Diversity

The table below shows the diversity indices of seagrass present in the two different stations. There were three (3) taxa of seagrass found in station 1 while there were only two (2) in station 2. In addition,

there were also more individuals observed in station 1 (48) than in station 2 (28). However, the diversity in both stations was not categorized in the Fernando Qualitative Biodiversity Scale since the Shannon (H) values in both stations were less than 1.

Table 2.2-18. Diversity Indices of Seagrass

	Station 1	Station 2
Taxa	3	2
Individuals	48	28
Dominance	0.4227	0.5408
Simpson	0.5773	0.4592
Shannon (H)	0.9435	0.6518
Evenness	0.856	0.9595

Relative Abundance by Percent Cover

Over-all Relative Abundance

A total of 76 individuals that were present in both stations. The seagrass with the highest relative abundance is *Thalassia hemprichii* which has an abundance of 56% comprising of 43 individuals. It was followed by *Syringodium isoetifolium* with 37% relative abundance comprising of 28 individuals. Meanwhile, the least abundant species is *Halophila ovalis* with 7% relative abundance or 5 individuals observed.

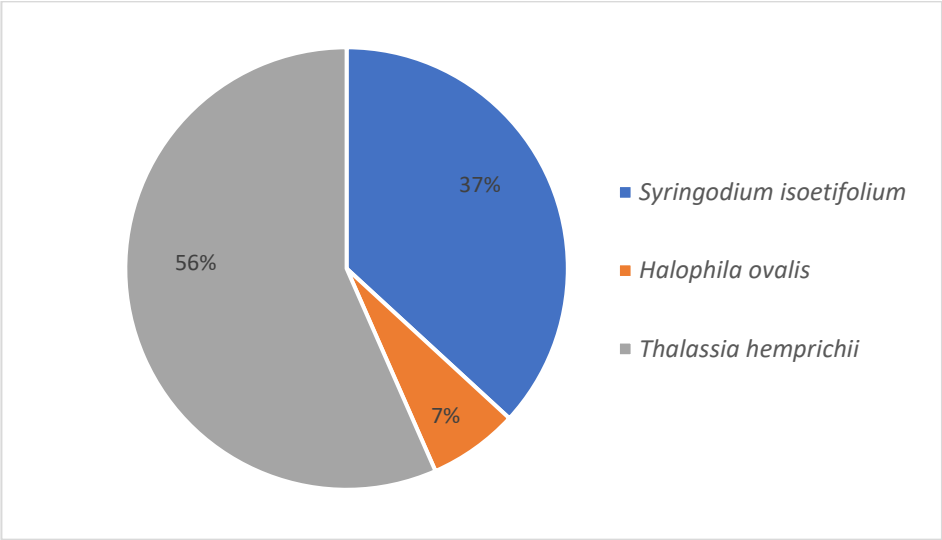


Figure 2.2-64. Relative Abundance of Seagrass Species

Station 1

The figure below shows the relative abundance of seagrass species in station 1. Based on the figure, *Thalassia hemprichii* showed the highest relative abundance of 52.08% which comprises of 25 individuals. It was followed by species *Syringodium* with relative abundance of 37.50% or 18 individuals. Meanwhile, *Halophila ovalis* has the least relative abundance of seagrass species in this station with 10.42% relative abundance or 5 individuals.

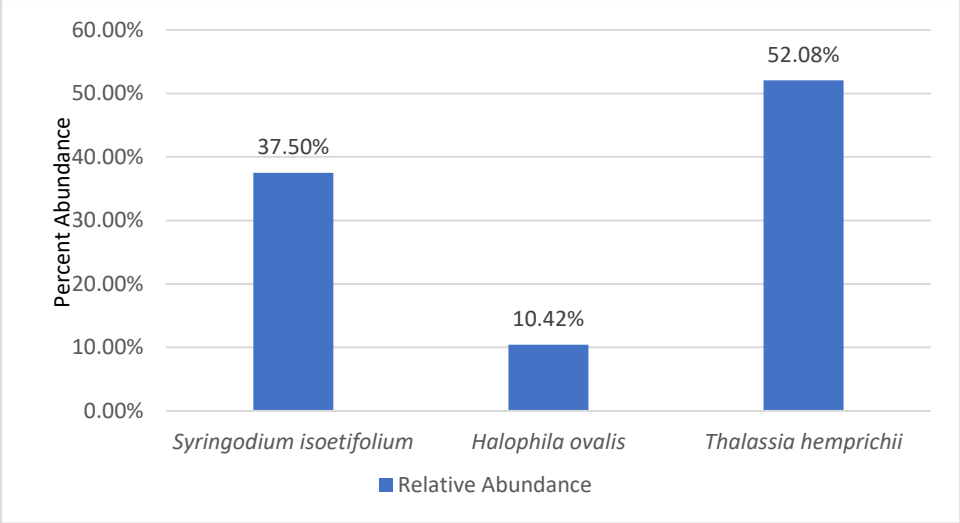


Figure 2.2-65. Relative Abundance of Seagrass Species in Station 1

Station 2

A total of 28 individuals were observed in station 2. 64.29% of the total number of individuals were comprised of *Thalassia hemprichii* or 18 individuals. Meanwhile, *Syringodium isoetifolium* has only 35.71% of the total count which is 10 individuals.

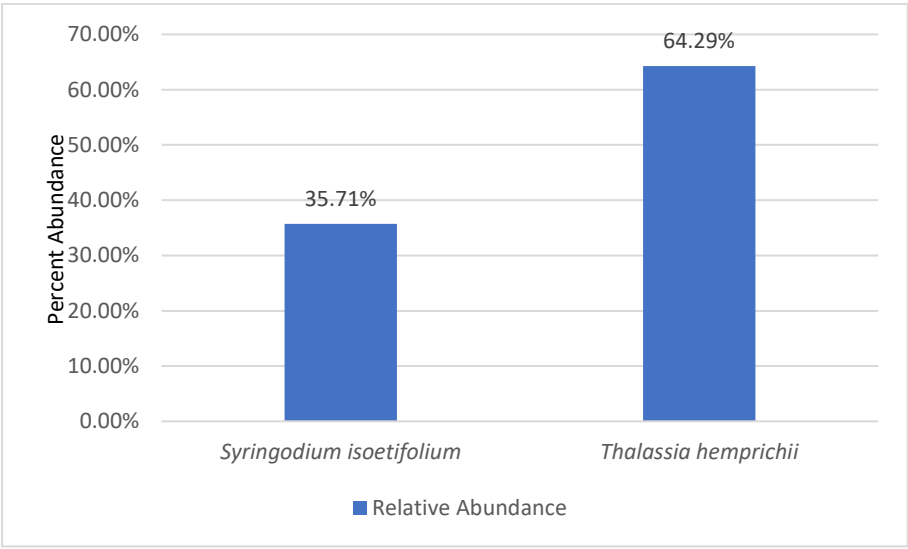


Figure 2.2-66. Relative Abundance of Seagrass Species in Station 2

2.2.5.3.3 Plankton

Species Composition and Abundance

Phytoplankton

Diatoms were the most abundant phytoplankton group observed in the study area composing of 60.8% relative abundance followed by cyanobacteria (blue-green algae) with 33.06% relative abundance. The group with the least abundance is dinoflagellates representing 6.13%. Among the species identified, *Trichodesmium* sp. has the highest relative abundance of phytoplankton recorded with 33.06%. Meanwhile, the recorded species with the least relative abundance was *Ceratium* sp. with 1.37%

relative abundance. The species *Synedra* sp. was the only species observed in station 1 while the in station 9, an unidentified species, “unidentified species 1” was present.

Table 2.2-19. Species Composition and Abundance of Phytoplankton at the Sampling Stations

Taxa	Stations (cells/ m^3)									RA%
	1	2	3	4	5	6	7	8	9	
Diatoms										
Chaetoceros		142								**3.97%**
Cossinodiscus		54		192		107				**9.87%**
Ditylum		112				238				**9.79%**
Navicula		62								**1.73%**
Nostoc		65								**1.82%**
Nitzschia		276		210	115					**16.81%**
Synedra	128									**3.58%**
Thalassionema		335					53			**10.85%**
Unidentified 1									85	**2.38%**
Cyanobacteria										
Trichodesmium		43	190			376	256	317		**33.06%**
Dinoflagellate										
Ceratium					49				36	**1.37%**
Gonyaulax						97		73		**4.76%**
Total:	**128**	**1089**	**190**	**402**	**164**	**818**	**309**	**390**	**121**	**100%**

According to the figure below, in station 1 all species identified belong to the abundant group diatoms with a total of 128 cells/m^3. On the other hand, the groups diatoms and cyanobacteria were found in stations 2 and 7. Meanwhile, station 6 shows the presence of the three groups present of which cyanobacteria has 376 cells/m^3 and followed by diatoms of 345 cells/m^3.

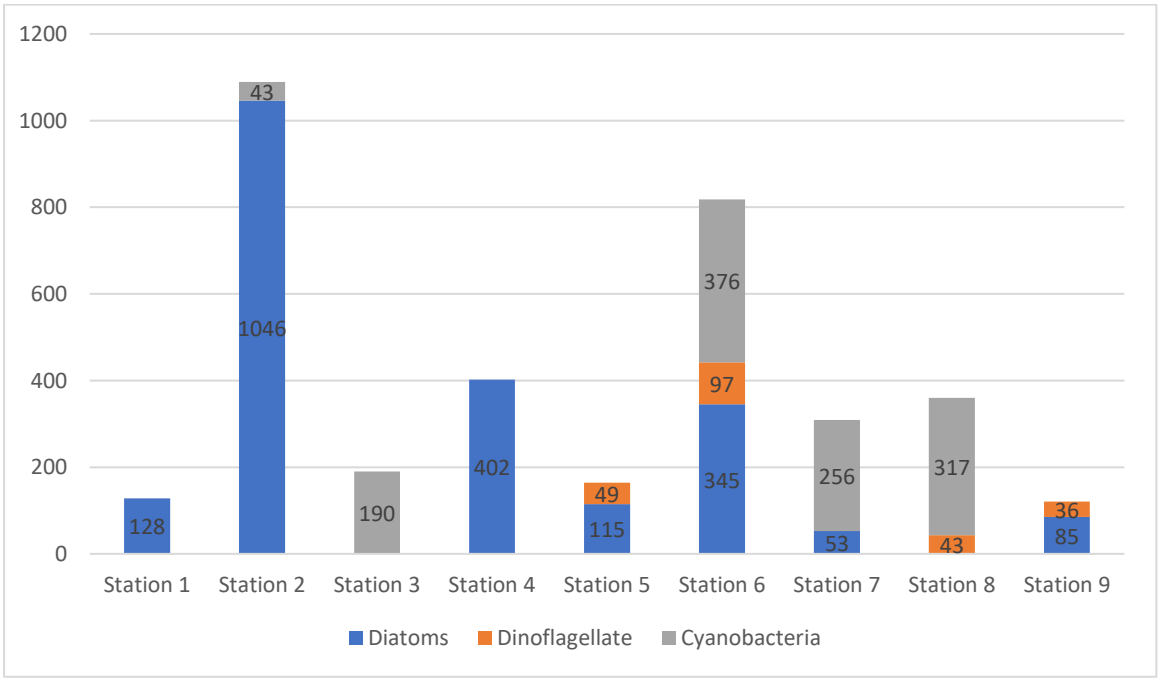


Figure 2.2-20. Abundance of Major Phytoplankton Groups at the Stations

Zooplankton

Among zooplanktons, copepods (adult, nauplius and egg stages) were the highest in relative abundance. Adult copepods were the most abundant with mean relative abundance of 36.66%. This was followed by Oikopleura, tintinnids, and the unidentified species representing 24.24%, 8.51% and 6.30% of the zooplankton population, respectively. Other zooplankton organisms such as fish larva, siphonophore, zoea and polychaete larva were also observed but were poorly represented in the plankton samples.

Table 2.2-21. Species Composition and Abundance of Zooplankton at the Sampling Stations

Taxa	Stations (Individuals/ m³)									RA%
	1	2	3	4	5	6	7	8	9	
Copepod (Adult)	71		175			153	196	121	128	**36.66%**
Oikopleura		79		110	93		85	89	102	**24.24%**
Tintinnid				90		106				**8.51%**
Sagitta		38								**1.65%**
Copepod nauplius	43			102						**6.30%**
Unidentified		112								**4.87%**
Copepod egg	27			65						**4.0%**
Fish larva					84					**3.65%**
Siphonophore								63		**2.74%**
Zoea	31							74		**4.56%**
Polychaete larva							32		33	**2.82%**
Total:	**172**	**229**	**175**	**367**	**177**	**259**	**313**	**347**	**263**	**100%**

Based on the figure below, station 3 was only composed of adult copepods comprising 175 individuals/ m³. Meanwhile, station 4 and 8 has the highest number of species counts. For individual counts, station 4 was the highest with a total of 367 individuals/m³. It was followed by station 8 with a total of 347 individuals/ m³.

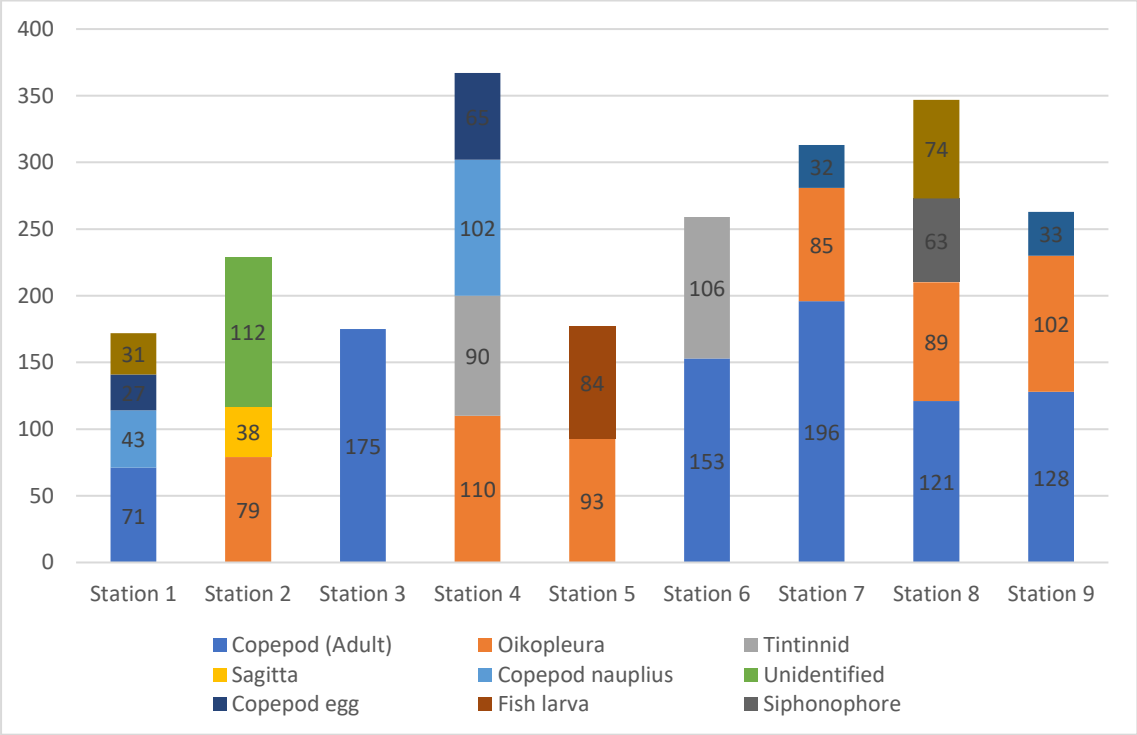


Figure 2.2-68. Abundance of Zooplankton at the Stations

2.2.5.3.4 Fisheries Survey

Coastal Fishery

One major source of income in the three municipalities is fishing. Payao system was not observed in the 3 municipalities. Majority of the respondents in 3 municipalities set out once a day or 7 times a week. Each trip usually takes 6 to 7 hours long. Though majority of them fish within the municipal waters, some of the respondents' fish beyond 15 km away from the shore in hope for more catch. In Aparri alone, 16 respondents set out 16 km to 18 km away. In Buguey, 14 respondents' fish within 3 km, and another 13 of them also fish between 21 km to 25 km. In Gonzaga, 5 respondents went as far as 21 km to 50 km. The distance of their fishing ground also hinders them from going out every day as it takes longer hours. There are usually two individuals per boat, however, there are also boats that set out with three (3) or five (5) persons per boat. According to the respondents, their average catch is 20kg, but this could go as high as 50 kg in good days or as low as 3 kg in some days.

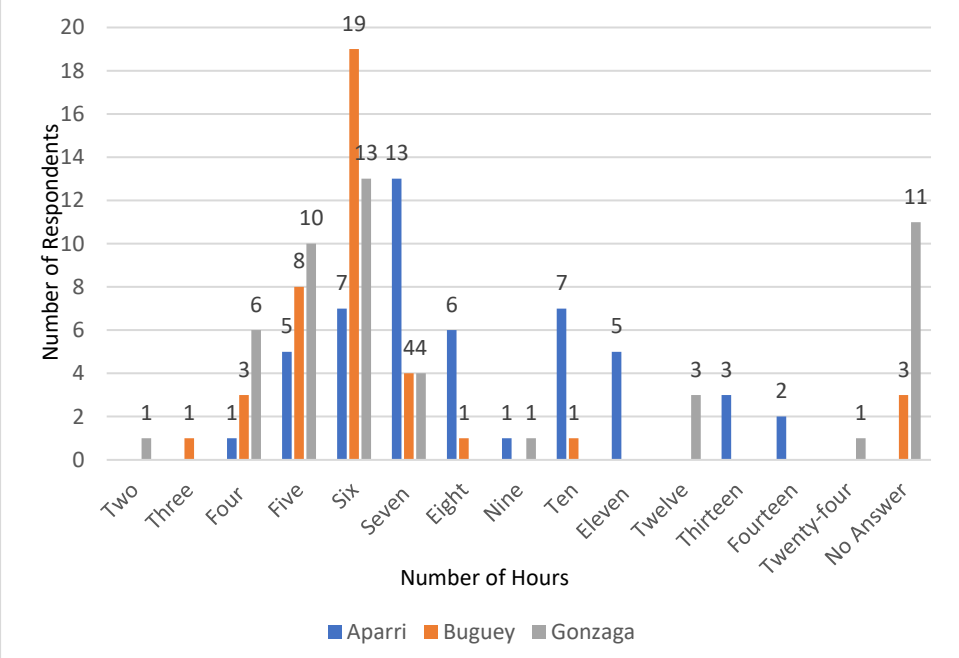


Figure 2.2-69. Hours per Trip

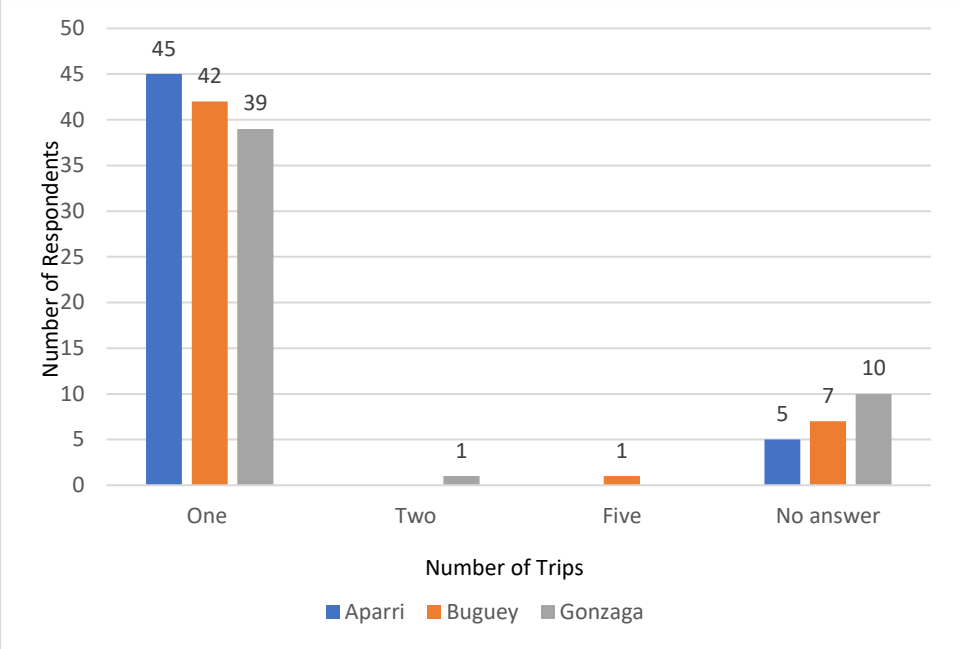


Figure 2.2-70. Trips in a Day

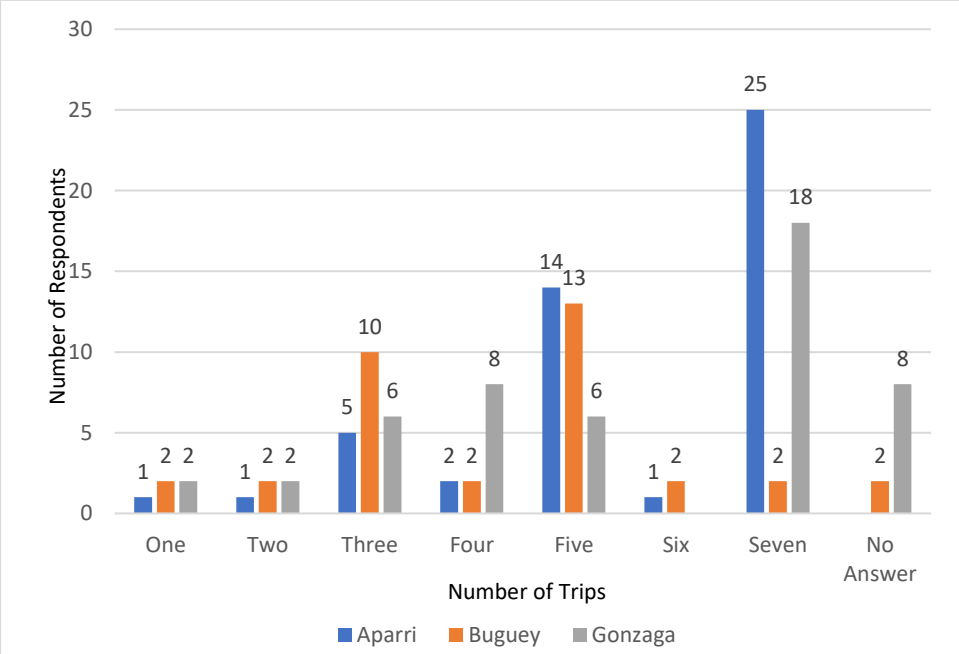


Figure 2.2-71. Trips in a Week

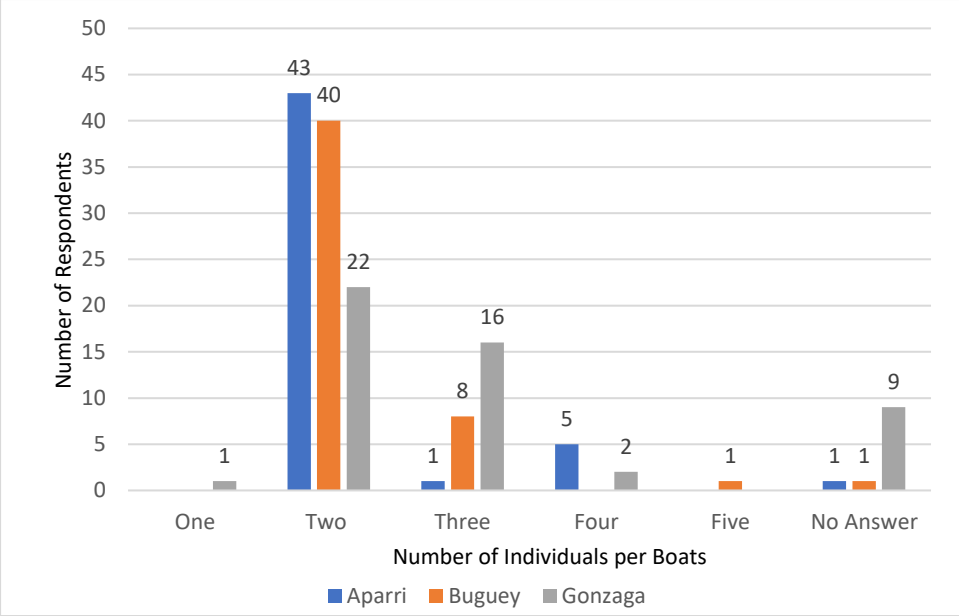


Figure 2.2-72. Individuals per Boat

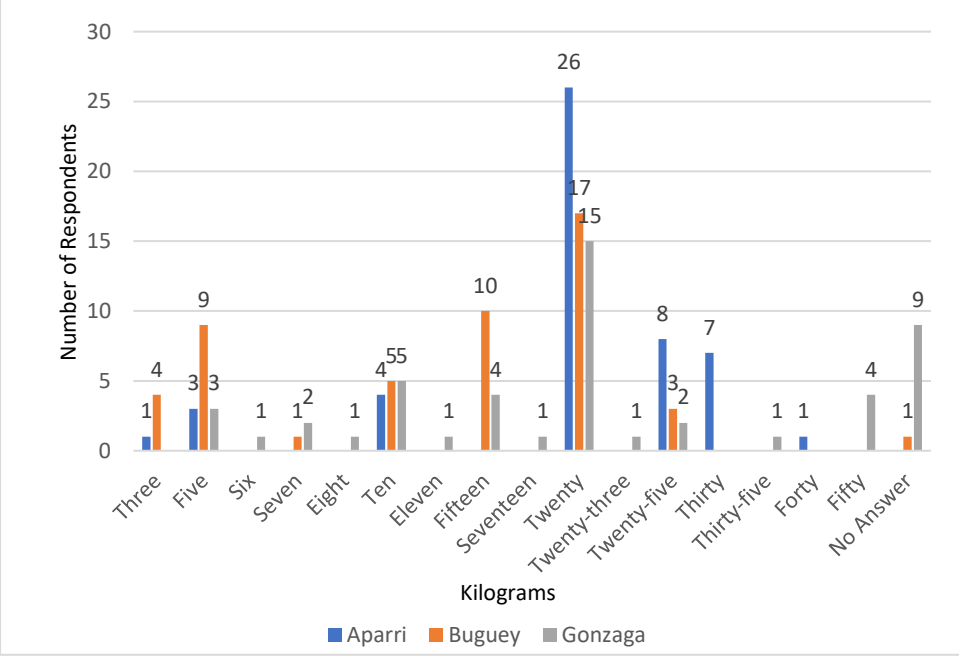


Figure 2.2-73. Average Catch (in kg)

Monthly Income

Majority of the fishermen in all three municipalities only earns P1,000 to P1,499 a month. Some earn around P5,000 to P9,999 while others earn below P1,000 for the whole month. Only two respondents coming from Municipality of Gonzaga were able to earn above P20,000. Given that, most of the household monthly income is below P10,000. According to the Philippine Authority, the poverty incidence of municipal fisherfolk is the highest in the country at 39.2%, compared to the national average of 25.2%.

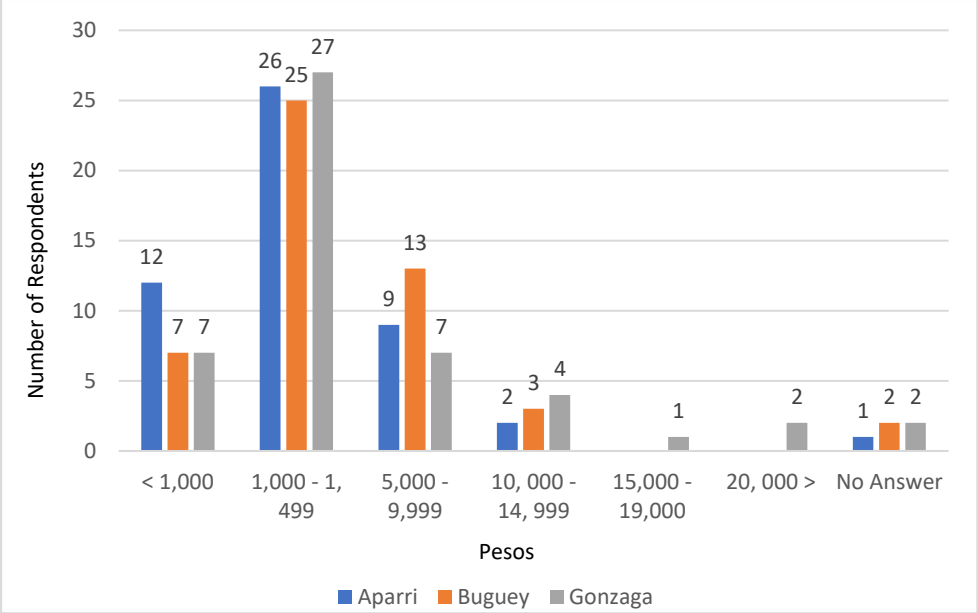


Figure 2.2-74. Monthly Income

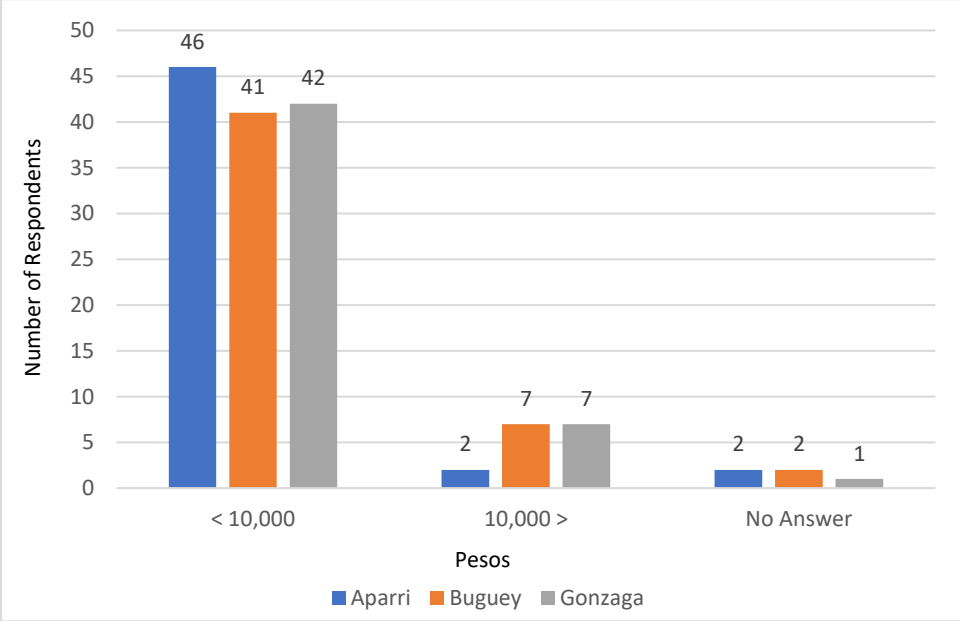


Figure 2.2-75. Household Monthly Income

Years of Residency

The figure below shows that majority of the respondents across the three municipalities were residing in the area for more than 20 years.

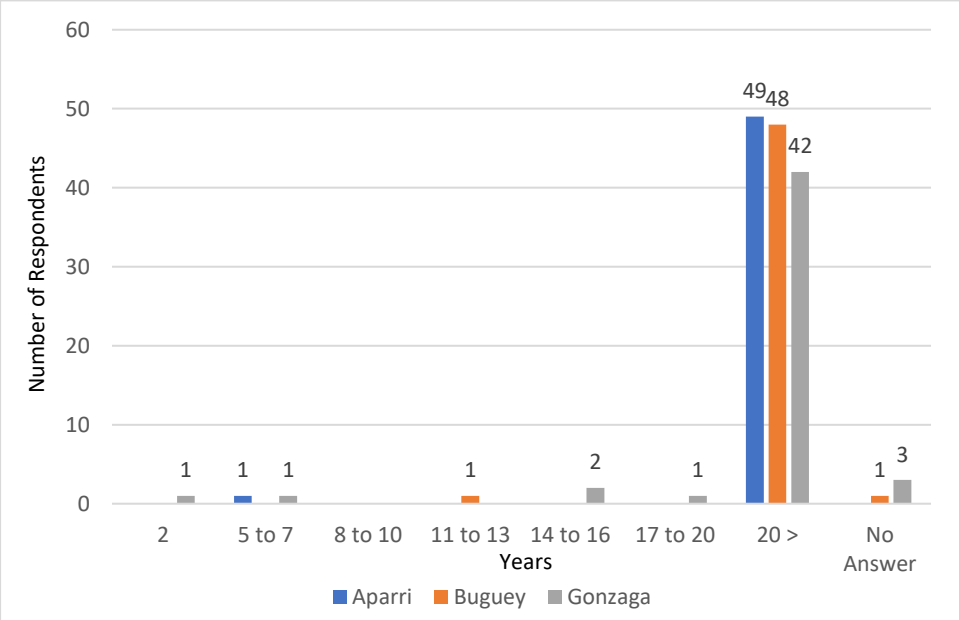


Figure 2.2-76. Years of Residency

Fishing Gears

The fisherfolks use five (5) types of fishing gears including fishhooks, fish nets, fishing lines, landing nets and fish and crab nets. The table below shows the fishing gears and specifications of the fishing equipment the fisherfolks use.

Table 2.2-22. Fishing Gears Used

Fishing Gears	Specifications
Fishhooks: • Modified handline • Harpoons	 4 hooks at the end point, 10m nylon string 7 hooks, 2 rolls of nylon string
Fishing nets: • Gill nets • Seine	 2-2.5 inches mesh size 6-10 inches mesh size 5-7 inches mesh size
Dip nets	Dip net; huge dip net with 6-7 inches mesh size
Crab nets/ Dredges	Made of 6-10 inches mesh size with sticks or metal on the sides

The usual fishing gears that the fishermen used in the municipalities of Aparri, Buguey, and Gonzaga are fishing hooks (modified handlines and harpoons), fish nets (gill nets and seine fishing), dipnets and dredges. According to the local fishermen, the fishes shown in **Table 2.2-23** are the typical fish they catch. These species are demersal and pelagic fishes.

Economic Importance

In the Philippines, the fisheries are critical to the general economy as well as the social re-structuring of local communities. Most of the fish catch in the three municipalities served as for food consumption within the community since the fishers are directly selling their catch to a final customer. Fish are one

of the most significant vertebrate groups for human consumption. They are valuable in terms of economic, nutrition, medicine, industry, and aesthetics, as well as providing jobs for the people. They help to provide food security in many parts of the world by serving as a beneficial supplement to a well-balanced and nutritious diet.

Traditional Fishing Ground

Traditional fishing ground is an area or body of water where fishes congregate, and fishing is profitable. According to the survey, most of fisherfolk in the three municipalities have a traditional fishing ground of 25 kilometers from the shoreline. The maps below show the traditional fishing ground of the three municipalities and the over-all area of the three municipalities. See **Figures 2.2-77** to **80** for the map of the traditional fishing ground in each municipality.

Fish resources are greatly affected by natural forces and human interferences. The population of the fishes, successful reproduction and increasing fish stocks is governed by nasality, mortality, and dispersion. Different species inhabits different ecosystem for breeding. Generally, fish breeding areas transpire in the area where corals are successfully propagating, seagrass beds with good water quality and mangrove areas. Most fish species tend to have long spawning seasons and intensively reproduce during strong monsoon winds of October to late March. Pelagic fishes produce large numbers of small pelagic eggs. It is the released in the water to drift with the currents. Based on the interview conducted, the greatest fish catch the fishers usually caught happen on the months of May to August.

Illegal, unreported, and unregulated (IUU) fishing ranges from unlawful activities of domestic small-scale fishing to more complex operations carried out by industrial fishing fleets. The Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR) has been addressing the IUU fishing issues in the Babuyan Channel using metrics based on input and effort, including number of patrols conducted, number of apprehensions, and fines collected. As of 2019 (latest data), there were apprehension of 2 Vietnamese fishing vessels. Moreover, according to the BFAR-Region II overfishing levels have not yet determine in the Babuyan Channel.

Photo 9. Fish Hooks

Photo 10. Fish Nets and Fish Landing

Photo 11. Fish and Crab Net

Photo 12. Landing Net or Dip Net

Table 2.2-23. Types of Fishes Catch by the Fishing Gears Used

Family	Species Name	Common Name	Local Name	Type of Fish
Nemipteridae	Nemipterus virgatus	Gold threadfin bream	Bisugo	Demersal
Synodontidae	Synodus spp	Lizardfish	Al-alibot	
Leiognathidae	Leiognathus spp.	Slipmouth	Talikbukno/sapsap	
Lutjanidae	Lutjanus spp.	Red snappers	Maya-maya	
Carangidae	Alectis indicus	Indian threadfish	Talakitok	Pelagic
Clupeidae	Pellona ditchela	Indian pellona	Mamata	
Carangidae	Decapterus kurroides	Redtail Scad	Mataan	
Scombridae	Rastrelliger brachysoma	Short mackerel	Kabalyas	
Scombridae	Thunnus albacares	Yellow fin tuna	Tulingan	
Carangidae	Scomberoides tol	Needlescaled queenfish	Dorado	
Clupeidae	Sardinella spp.	Sardines	Bilis	
Istiophoridae	Makaira mazara	Indo-pacific blue marlin	Blue marlin	
Scombridae	Katsuwonus pelamis	Skipjack tuna	Tangi	
Trichiuridae	Aphanopus carbo	Black scabbard fish	Espada	
Scombridae	Scomberomorus commerson	Spanish Mackerel	Tangigue	
Caridae	-	Shrimp	Pasayan	-

All of the aforementioned types of gear come in a huge variety, with each variety being determined by local circumstances such as target species, availability of materials (at an acceptable cost), sea bottom, usual sea state, nature of the coastline, fishing-boat requirements, level of mechanization, and so on. Drift gillnets are typically rectangular, with a float (or cork) line running along the upper edge and a lead (weight) line running along the lower edge. They are intended to be submerged vertically. The design of gill nets such as surrounding floaters and the visibility of the nets are intended for pelagic fishes. These pelagic fishes are scads, tuna, sprat, sardines, mackerels, swordfish and anchovy. Fish seems to not notice the net; they push their heads through the mesh as far as it will go, only to discover that their bodies are usually deeper than their heads. The gillnet string passes under their gill cover (or operculum) and traps them as they try to back out. Fish lacking opercula (such as sharks) or with uniformly wide bodies (such as eels) are less likely to be caught.

Seine fishing are designed to surround schooling fish, commonly caught are sardines, groupers (demersal), snappers and mackerels. It is used in the open ocean to target dense school of fish. The seine nets have no contact to the seabed but can reach mesopelagic zone where demersal fishes are commonly found and caught. Moreover, dip nets are held by hand to scoop and catch fish near the surface water. Modified crab nets or dredges are formed by bamboo sticks or metallic frame or cage to which a strong netting is attached. The dredge is towed all over a soft seabed, which is inhabited by bivalve mollusks and gastropods. Modified crab nets are also set within the mangrove area where crabs usually dwell.

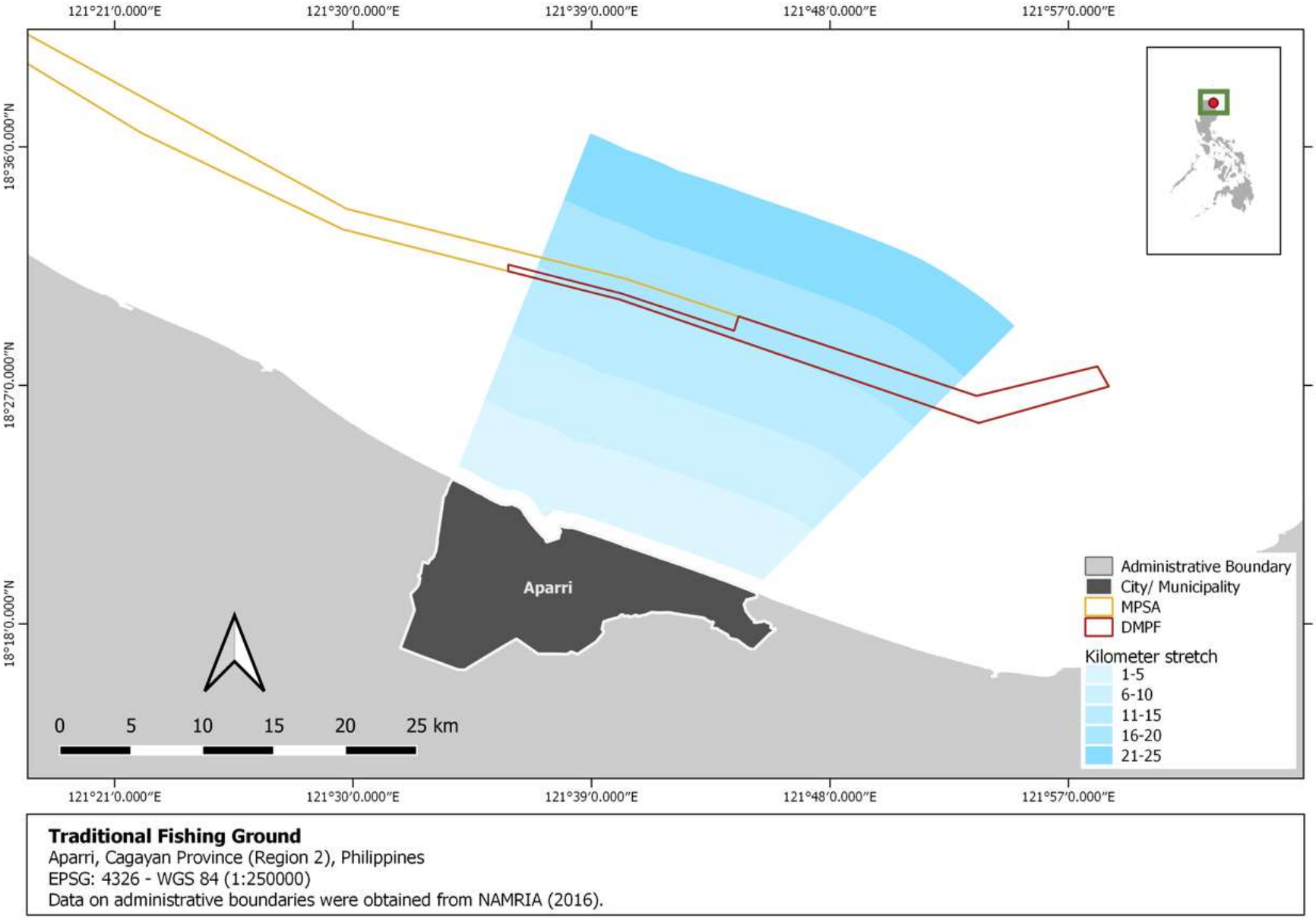


Figure 2.2-77. Traditional Fishing Ground in the Municipality of Aparri generated in QGIS Software using NAMRIA Map (2016) and Google Earth

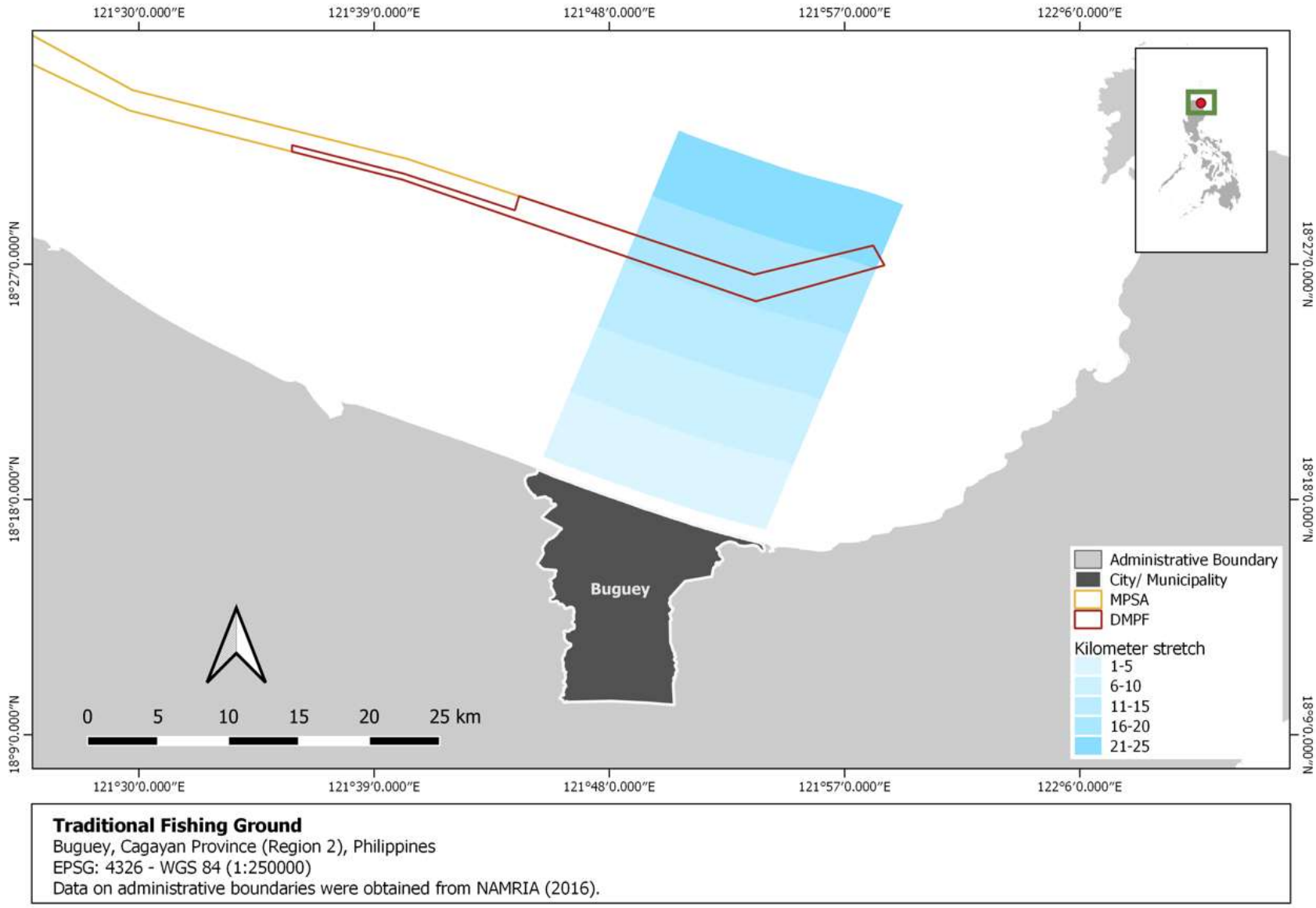


Figure 2.2-78. Traditional Fishing Ground in the Municipality of Buguey generated in QGIS Software using NAMRIA Map (2016) and Google Earth

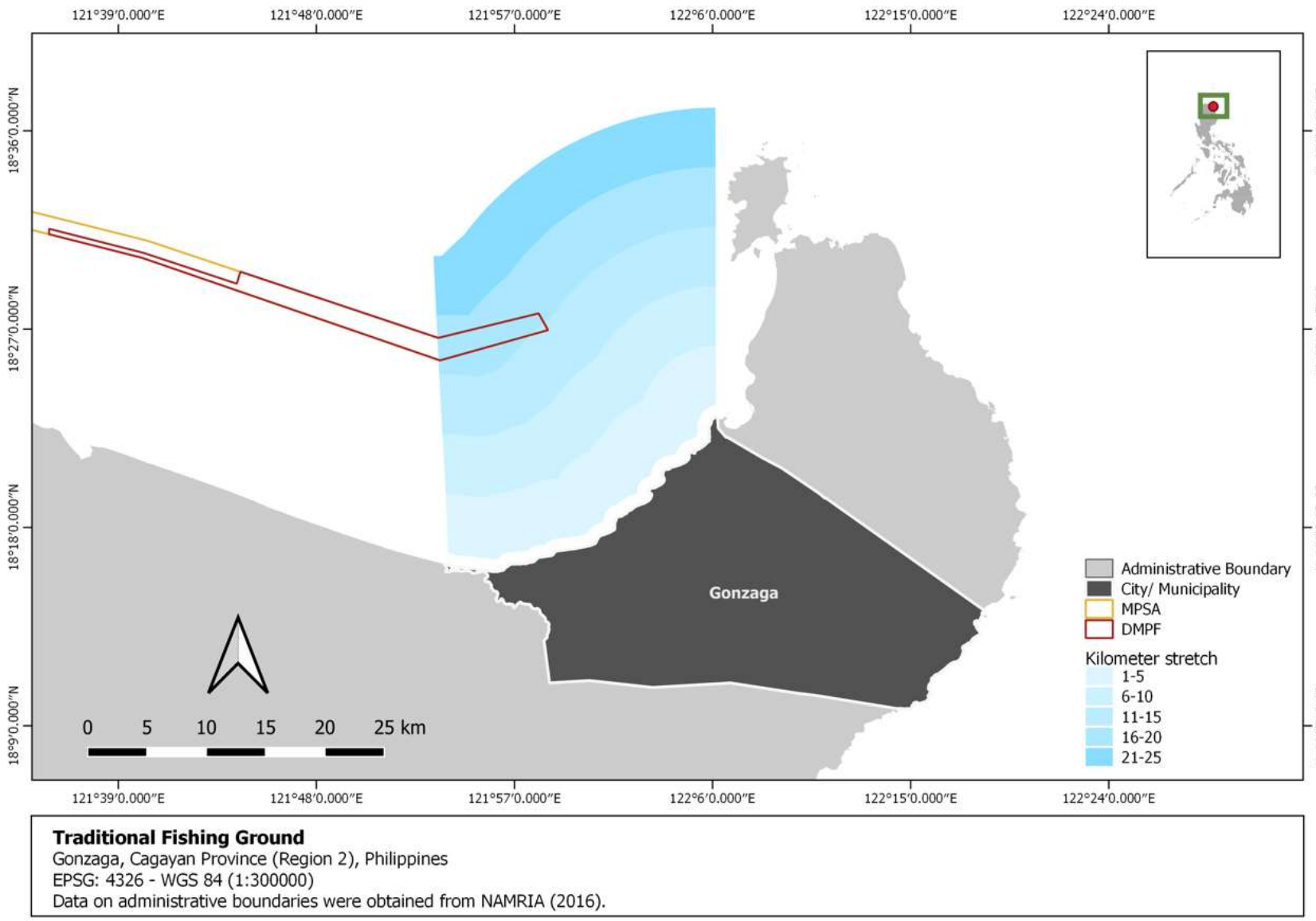


Figure 2.2-79. Traditional Fishing ground in the Municipality of Gonzaga generated in QGIS Software using NAMRIA Map (2016) and Google Earth

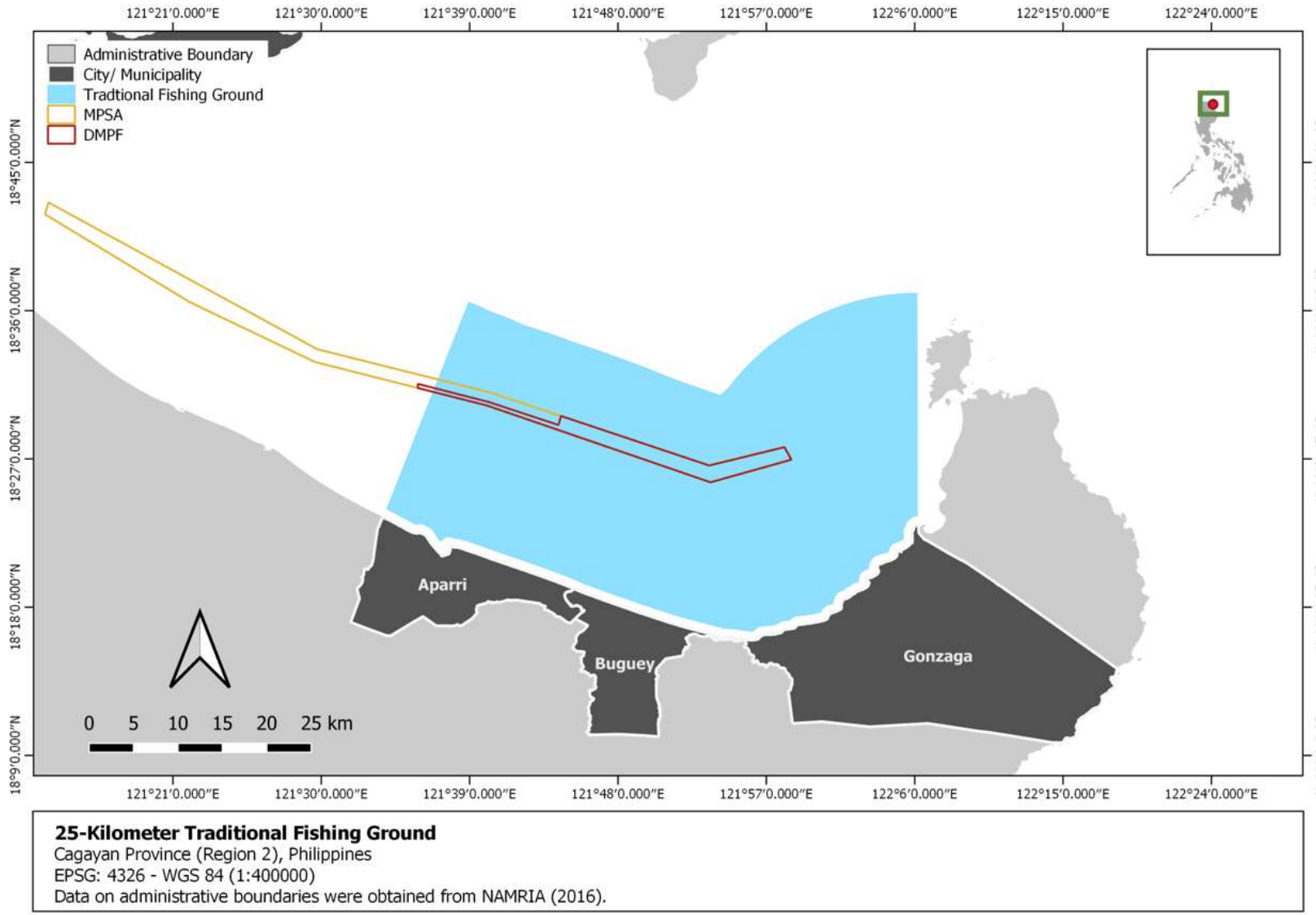


Figure 2.2-80. the 25-kilometer Traditional Fishing Ground of the Three (3) Municipalities generated in QGIS Software using NAMRIA Map (2016) and Google Earth

2.2.5.4. Coastal Resource

Seagrass

Seagrasses are marine flowering plants which can be found along in the coast or in clear shallow marine waters which can be penetrated by light that allow for them to photosynthesis. They are the one of the most productive ecosystems in the world which provide food and shelter to diverse community of organisms. Mainly small invertebrates (i.e. as crabs, shrimps, and other crustaceans), small fish, and juveniles of larger fish species utilize seagrasses as nursery environment because of the leafy underwater canopy they provide. Sea cucumbers and sea urchins are usually found in seagrass beds. Other edible algae are sold in the market and serve as food. The abundance of seagrass and algae greatly contribute to the increasing growth, development, and production of the marine organisms. Hence, the higher the production of food in the marine ecosystem, the higher the productivity of the community.

The total seagrass area of the three (3) municipalities is 151.53 hectares (see **Figure 2.2-81)**. The Municipality of Aparri has an area of 51.46 hectares, while the Municipality of Gonzaga has 62.40 hectares. The municipality of Buguey has no presence of seagrass ecosystem.

Mangroves

Mangroves are either shrubs or trees that can tolerate and grow on saltwater areas. Many mangrove forests can be recognized by their dense tangle of prop roots which make them able to appear standing on stilts above the water. Mangrove forest also stabilize the coastlines, reduce erosion from storm surges, currents, waves, and tides. The root system attracts fish and other organisms which seek for food and shelter from predators. The three (3) municipalities that encompasses by the project has the total mangrove area of 3143.59 hectares. The municipalities Aparri, Buguey and Gonzaga has a mangrove area of 1627.21 hectares, 195.91 hectares, and 31.71 hectares, respectively.

Mangrove forests act as a carbon sink and a barrier against coastal flooding. The mangroves' dual ecosystem role is crucial for climate change mitigation and adaptation in coastal areas around the world. One way to conserve and protect the mangrove ecosystem is by replanting of the same abundant species. Replanting of species that occur at slightly higher elevations can be successful. Rehabilitation on mangrove ecosystem requires survey that can determine the exact location of the affected area. Plantation of mangroves offers possible livelihood or income to locals by appointing them as the cultivators. Aesthetically enhancing the mangrove ecosystem as ecotourism with reservations such as proper waste management can contribute as alternative livelihood to the people. The income generating tourist spot will greatly help the economic level of the area. Moreover, a one way to successfully protect the environment is that the local government unit (LGU) can have partnership to a non-government organization’s project that aims to help on conservation and protection of the environment.

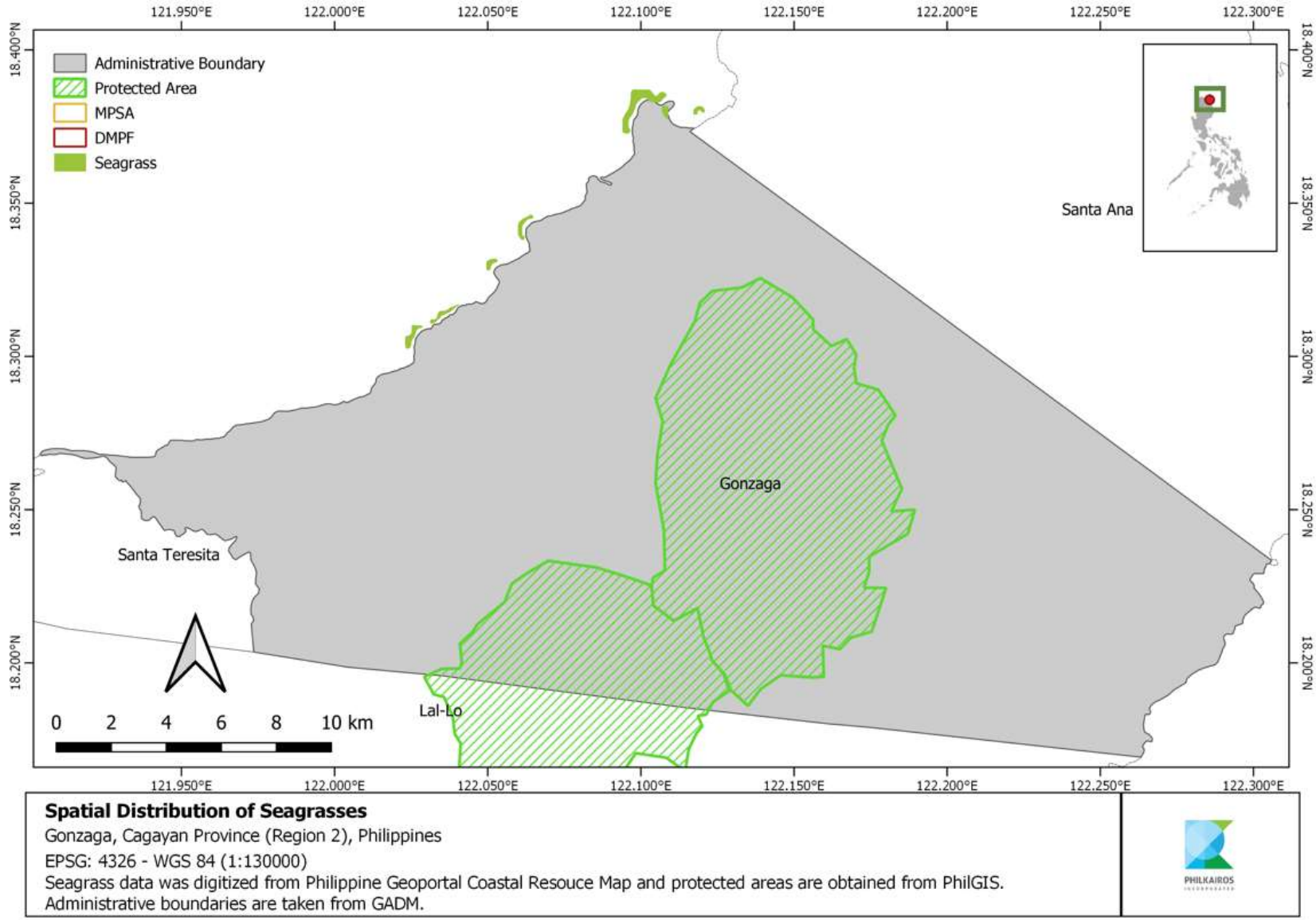


Figure 2.2-81. Seagrass Resources in the area generated in QGIS Software using NAMRIA Map (2016) and Google Earth

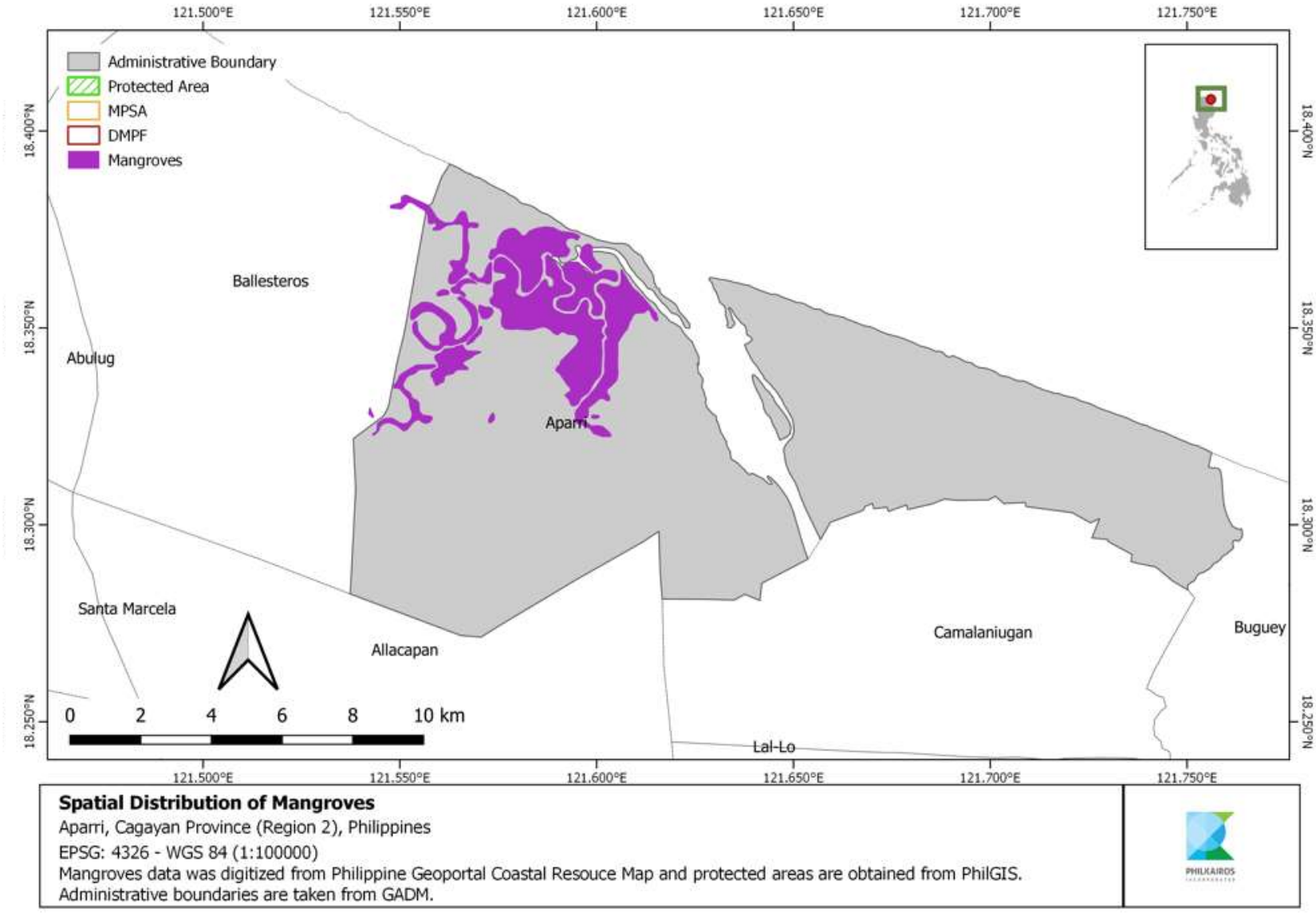


Figure 2.2-82. Mangrove Resources in Aparri Area generated in QGIS Software using NAMRIA Map (2016) and Google Earth

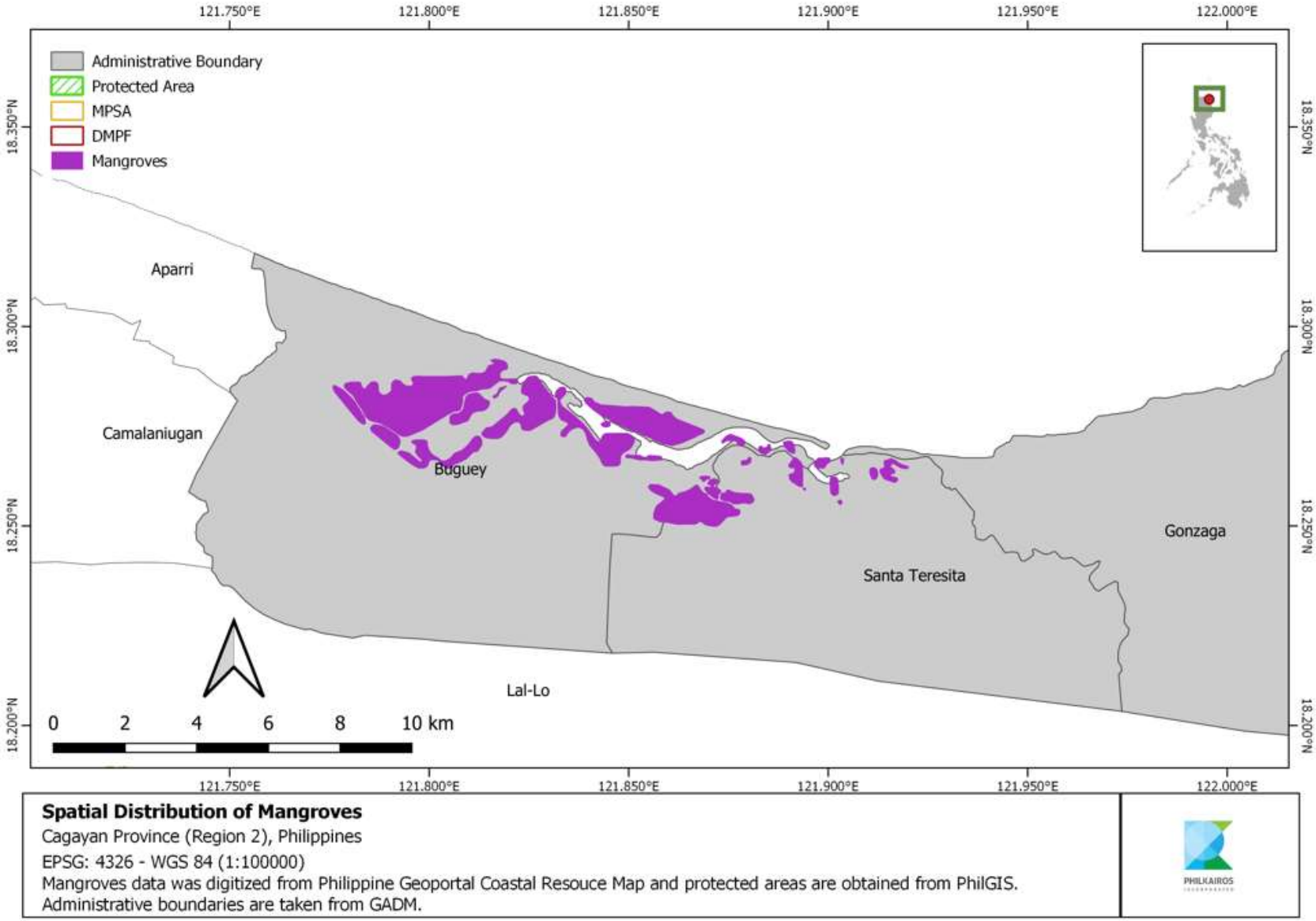


Figure 2.2-83. Mangrove Resources in Buguey Area generated in QGIS Software using NAMRIA Map (2016) and Google Earth

2.2.5.5 Historical Occurrences of Red tide and Fish Kills

Based on the National Water Quality Status Report of DENR-EMB (2006 – 2013), red tide is a natural and seasonal phenomenon identified by the presence of a reddish-brown discoloration of sea water. These discolorations are the result of high concentrations of single cell micro-organisms, called dinoflagellates; and, under high concentrations, can threaten the health of both marine organisms and humans. The Philippine Government have established the National Red Tide Management Program. Under this program, 705 monitoring activities resulting to 6,934 samples, have been conducted to safeguard the public's well-being. Complementary to this, Red Tide Bulletins/Updates have also been prepared and disseminated by the NRTTF in coordination with government agencies and local government units (LGUs). BFAR's shellfish bulletin, which details the results of the analyses conducted under the program, informs the public of areas affected by red tide.

Based on the figure below, the coastal area most susceptible to red tide is Dumanquilas Bay in Zamboanga del Sur. It has been reported as having incidences of red tide in 115 out of the 118 bulletins.

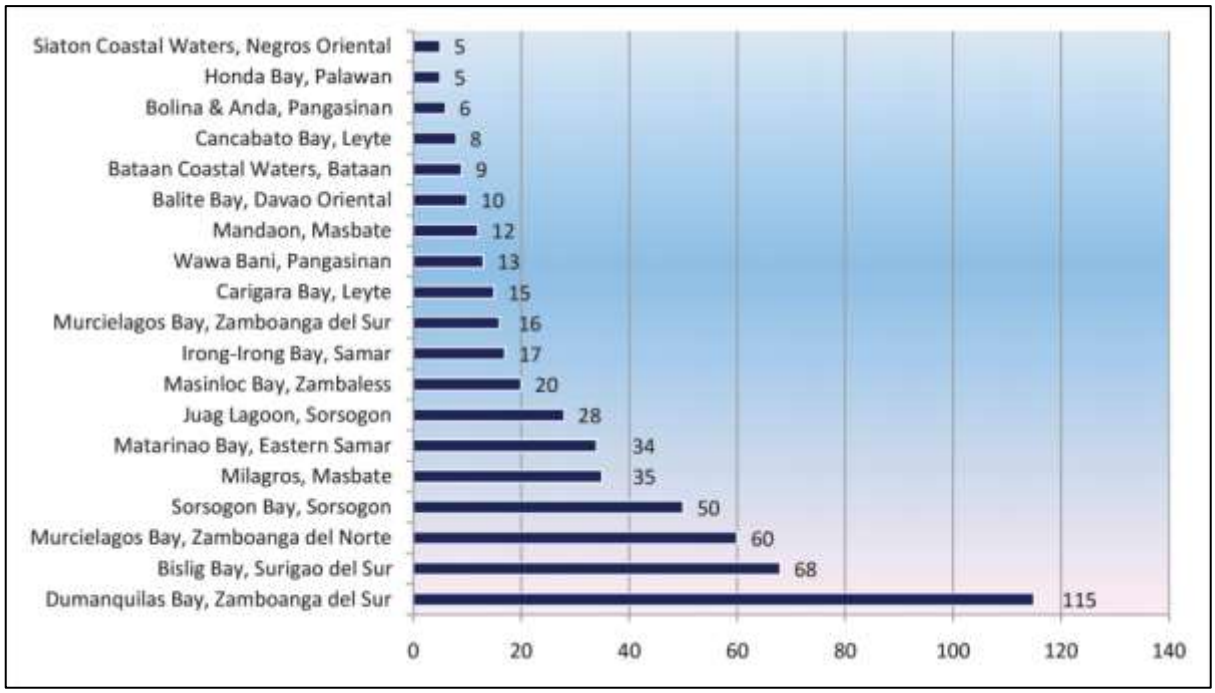


Figure 2.2-84. Incidences of Red Tide in Coastal Areas (2007 – 2013) *Source: DA-BFAR, 2013*

According to the study conducted by A.T. Yñiguez, et al. (2020), the first documented fish kill was in the far south of the country, Tawi-Tawi, in 1976. Most of the fish kills that have been documented in the Philippines were in the northwestern Philippine coastal waters of the towns of Bolinao and Anda, which are the sites of extensive fish cages and fish pens for milkfish *(Chanos chanos)*. Twelve out of 20 documented fish kills occurred there. Apart from the year 2002, most of the fish kill events have occurred at most once in a year in a site. Fish kills can happen yearly or skip one or a few years. In recent years, blooms of small dinoflagellates have been observed in this area. In May 2016, *Takayama* species booms resulted in a massive fish kill (Benico et al., 2019). Since then, blooms of *Takayama* species have recurred in Bolinao in 2017 and 2018, in which the latter coincided with another massive fish kill (Benico et al., 2018). There have also been occasions in Bolinao-Anda, Pangasinan where phytoplankton such as Karenia mikimotoi (Azanza and Benico, 2017) had very high abundances yet no fish kills were reported.

There were no recorded historical occurrences of red tide and fish kill near the project area.

2.2.6 Impact Assessment and Mitigation

Potential Hazards/Impacts	Impact Analysis	Options for Prevention or Mitigation or Enhancement
Change in Drainage morphology / inducement of flooding / Reduction in stream volumetric flow. Change in stream, lake water depth		Since the project site is located approximately 14-15 km away from the shoreline of the coastal municipalities and from the outfall of the river, the project will not have a significant impact on the depth and drainage of the river.
Depletion of Water Resources / Competition in Water Use	The host municipalities are endowed with deep wells and productive aquifers.	Water supply, both for drinking and for utilities, will be sourced and processed onshore. Estimated daily domestic consumption is 30 cubic meters. No water requirement is needed for the operation.
Chance in Bathymetry	The bathymetry of the areas within and around the MPSA area is greatly influenced by the land-based drainage systems that are unloading their load into the depositional basin and by the current that passes through the Babuyan Channel. Along the shoreline stretch, the seashore is characterized by gradually dropping bathymetric profile, which allows giant waves from the rough sea to break continuously into the beaches.	There would be a minimal to insignificant impact of the project to the bathymetry of channel considering the distance of the project site to the shoreline. Also, 90% of the extracted sand will be returned to the area of extraction.
Threat to the existence and/or loss of species of important local species and habitat Threat to the abundance, frequency and distribution of species	Disturbance to marine biodiversity and local fishing grounds	Limiting the movement of the vessels in the marked project / mining area once positioned per block. Operational area will be set on an annual basis so as to better identify the municipality affected. The proponent and it's CRU in cooperation with the LGU will identify projects that will be included in the SDMP to be implemented by the project. Buffer zones from the vessel to allowable distance of 500 m for fishing boats. Consultation with the affected local fisherfolks shall be done and mandated government agencies

Potential Hazards/Impacts	Impact Analysis	Options for Prevention or Mitigation or Enhancement
		regarding the operation of this project.
Water Quality	Increased water turbidity which can result to sedimentation due to extraction of magnetite sand from the seafloor and non-magnetic sands returned to the sea Contamination of water due to oil spills from equipment/vessels	Use of suction pipe to extract the sand and return the non-magnetic sand to the seafloor. A pollution prevention curtain or screen / silt curtain will be used to lessen the impact of turbidity to marine water. As mitigating options, the project proponent should consider, during the operational phase of the project, to provide standby spill boom (for oil spills) and maintain the efficiency of the proposed silt curtain to be deployed (to contain the returned sediments and for accidental spillages of fine suspended materials) to prevent spreading of such plumes in the nearby coastal areas. Quarterly water quality monitoring to mitigate and prevent negative impacts of pollution to marine water. Implementation of Oil Spill Contingency Plan of the Proponent to minimize impact to water quality and marine environment.

2.3 AIR

2.3.1 Meteorology / Climatology

2.3.1.1 Local Climate

Climate

The Province of Cagayan has three types of climate based on the Modified Coronas Classification (**Figure 2.3-1**). Type I, which prevails in the areas of Sta. Praxedes and Westerns Claveria, which has two (2) pronounced seasons: dry from November to April and wet the rest of the year. Only a small portion of the province has this type of climate.

Type II climate, which is characterized by the absence of a dry season, but with a very pronounced maximum rainy period from November to January, is predominant from Calveria to Buguey and Sta. Teresita towards the east, then to the general direction of Tuo in the southwest.

Type III climate, on the other hand, where the seasons are not very pronounced but are relatively dry from November to April and wet during the rest of the year, covers the general area in the Sierra Madre Mountain Range and its foothills in the east and the town of Gonzaga and Sta. Ana in the north.

Cagayan Province lies on the sheltered side of both Sierra Madre and the Cordillera Mountains, hence, it receives smaller amount of rainfall compared to the Ilocos coast in the west and the Pacific coast in the east.

The Municipality of Aparri falls under the radii of the third type of climate in the Philippines under the Corona Classification of Climate which is described as the weather are not very pronounced and relatively dry from November to April and wet during the rest of the year. However, for the last five (5) years the annual rainfall, humidity and temperature do not follow a regular pattern that pronounces the most wet and driest, coldest and warmest and most humid and least humid part of the year. The town is partly sheltered from the northeast monsoon and trade winds but open to southeast monsoon and frequent storms. Rainfall is mostly brought in by the occurrence of typhoons and the rest of the monsoon rains. From the data gathered from PAGASA, year 2011 poured the highest average rainfall of 193.55 mm and year 2013 the least average rainfall of 128.11 mm. Year 2011 has the highest average mean temperature of 27.71°C and relative humidity was also highest on 2011 at 85.08°C.

Municipality of Buguey has a mild climate **(Figure 2.3-1)**. Average rainfall ranges from 24.5 mm to 436.2 mm. The amount of rainfall usually increases from May to November then decreases from December to April. Generally, it is warm from April to September and cold from December to February. An average of 18 typhoons annually visits the area and is most frequent during October. The mean annual temperature of the municipality is 27.6°C. It is coolest in the month of January and hottest in the month of June. Based on the available data from the Philippine Atmospheric Geophysical and Astronomical Administration (PAGASA), the average range of relative humidity of Buguey from 2006 to 2012 is 82.8 to 84.7 while the municipality's average annual rainfall for the past seven years ranges from 102.9 to 193.5 mm.

The climate classification in the Municipality of Gonzaga as identified by the coronas climate classification is type I: it is characterized by two (2) pronounced seasons dry from November to April and wet during the rest of the year **(Figure 2.3-2)**. This type is purely influenced by its major topography hilly to mountainous relief and forest cover vegetation. The weather in the lowlands is both extremes, too hot during summer and too cold during rainy seasons. Hot months are from March to August and cool from September to February. In the highlands the weather is very temperate relatively cool the

whole year round. The prevailing wind direction is from the northwest during the month of October to December and southwest from August and the rest of the year.

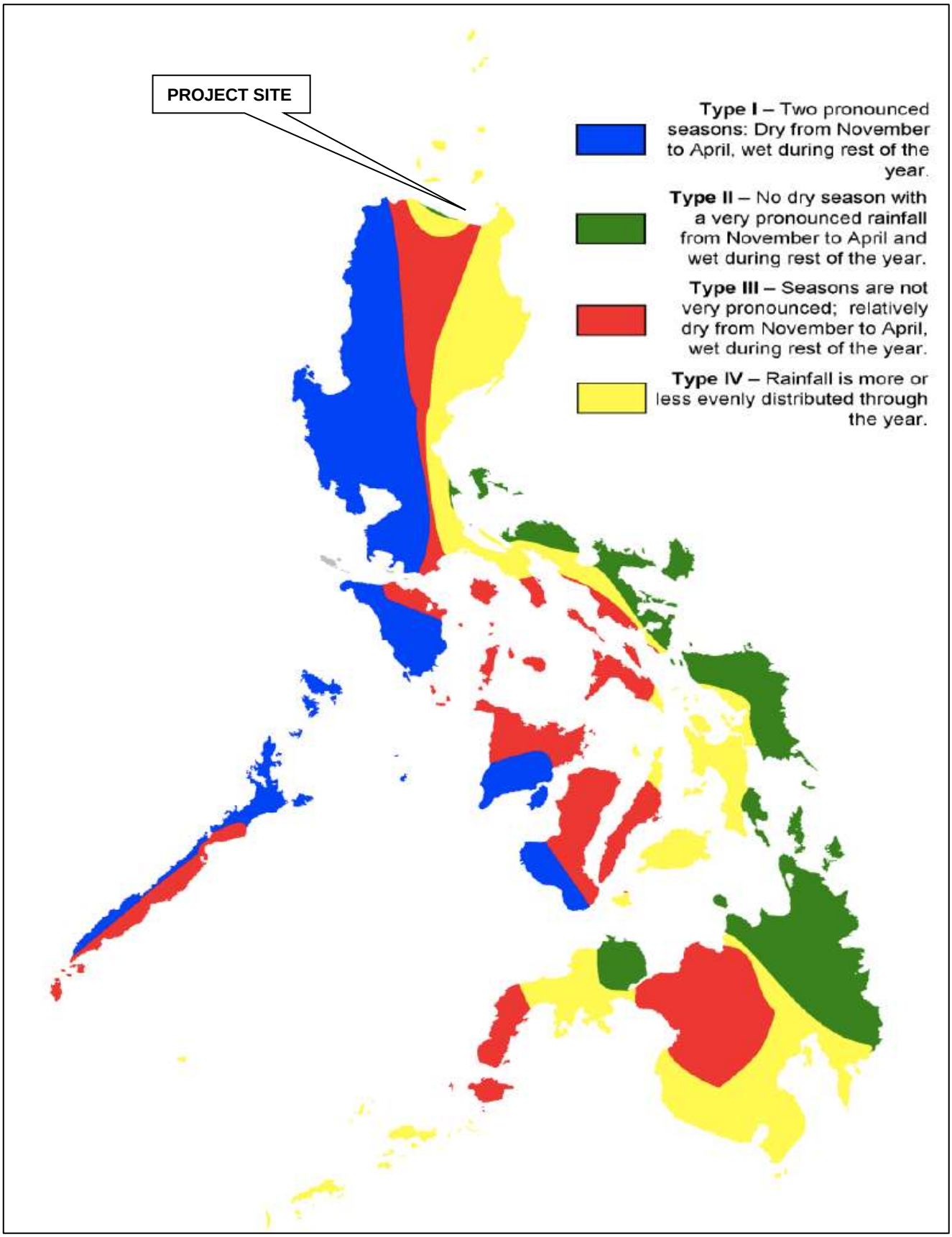


Figure 2.3-1: Climate Map of the Philippines Based on the Modified Coronas Classification

Source: Climatological and Agro-meteorological Division, PAGASA

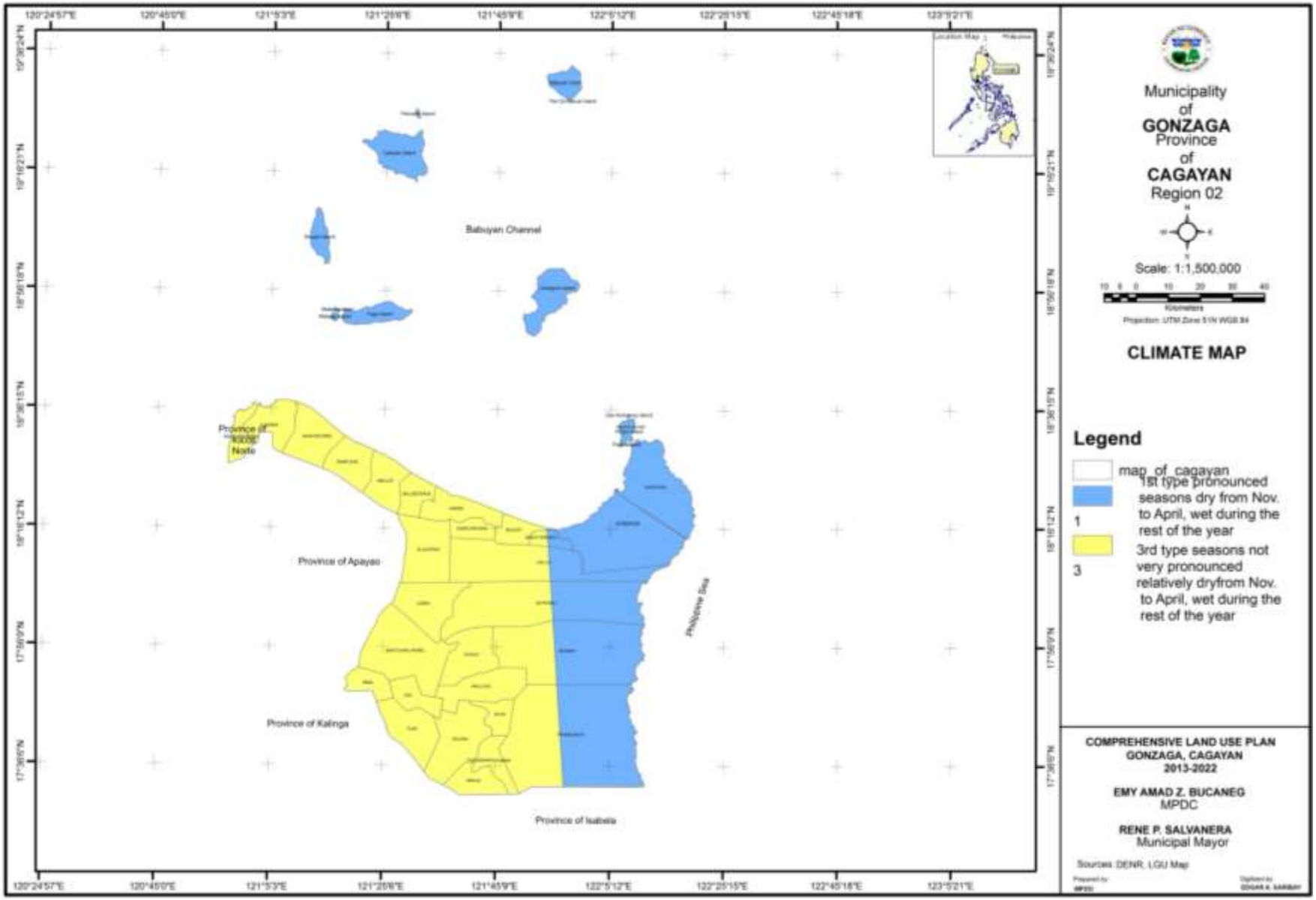


Figure 2.3-2: Climate Map of Gonzaga, Cagayan *Source: CLUP, 2013*

Rainfall

Based on climatological data gathered from PAGASA Aparri Station, the mean annual rainfall in the area from 1981 to 2010 is 1,888.1 mm and average number of rainy days is 127 days with October as the rainiest month having a monthly average rainfall of 295.9 mm and 15 rainy days and the month of March as the driest with 39 mm and 5 rainy days **(Table 2.3-1).**

Temperature

Based on the climatological data from PAGASA, the annual mean temperature in the area is 27.1°C. The warmest month is June with mean monthly temperature of 29.1°C while the coldest is January at 24.1°C **(Table 2.3-1).**

Relative Humidity

The annual mean relative humidity in the project site is expected to be around 84%. December is the most humid month with a monthly average relative humidity of 87% while the least humid month is from May to August with 82%, respectively **(Table 2.3-1).**

Wind Speed Direction

There are two (2) prevailing wind directions recorded at the Aparri station, namely: northeasterly winds and the southerly winds. Northeasterly winds are the most dominant and it prevails during the months of September to April with a monthly average wind speed of 3-4 meters per second. Rate of wind is generally light all throughout the year with an average wind speed of 3 meters per second. The annual and monthly wind rose diagrams applicable to the project site were taken from the Aparri Station and presented in **Figure 2.3-3**.

Trade Winds

In meteorology, the trade winds act as the steering flow for tropical storms that form over the Atlantic, Pacific, and southern Indian Oceans and make landfall in North America, Southeast Asia, and Madagascar and eastern Africa, respectively.

The trade winds are the prevailing pattern of easterly surface found in the tropics, within the lower portion of the earth's atmosphere, in the lower section of the troposphere near the earth's equator. (American Meteorological Society).

Tropical Cyclones

As shown in **Table 2.3-2**, there are already 34 typhoons that passed the Cagayan Valley Region from 2015 to 2019, in which 18 typhoons traversed the Babuyan Channel and hit the coastal municipalities of Gonzaga, Aparri and Buguey, Province of Cagayan. In the same table, 2015 and 2019 recorded the highest number of typhoons that passed thru the area. Further, the months of May up to November are considered typhoon seasons ranging from one (1) to three (3) typhoons per month. Tropical cyclone tracks from JAXA/EQRC Tropical Cyclone Database for the years 2015 to 2019 are shown in the succeeding figures **(Figure 2.3-4a to 2.3-4e)**. In terms of mine operations, JDVC will only mine out the area preferably during the non-typhoon season.

Table 2.3-1: Climatological Normals (Aparri Station, 1981 – 2010)

MONTH	RAIN-FALL MM	NO OF RD	TEMPERATURE °C						VP MBS.	RD %	MSLP MBS	WIND		CLD OKTA	DAYS TSTM	WITH LTNG
			MAX.	MIN.	MEAN	DRY BULB	WET BULB	DEW PT.				DIR	SPD MPS			
January	95	11	27.6	20.5	24.1	24.1	22.4	21.7	25.9	86	1014.2	NE	4	6	0	0
February	56.5	7	28.8	20.9	24.9	24.8	22.9	22.1	26.6	85	1014.1	NE	4	5	0	0
March	39	5	30.6	22.3	26.5	26.2	24.1	23.3	28.6	84	1012.7	NE	4	4	0	0
April	40.2	4	32.4	23.7	28	27.7	25.5	24.7	31.1	84	1011.1	NE	3	4	3	2
May	115.7	8	33.1	24.4	28.7	28.4	26.1	25.3	32.2	83	1008.7	S	3	5	8	7
June	157.6	10	33.5	24.7	29.1	28.8	26.4	25.6	32.7	83	1007.2	S	3	5	9	11
July	181.1	11	33.1	24.7	28.9	28.6	26.3	25.5	32.6	83	1006.8	S	3	5	7	10
August	191.1	12	32.7	24.5	28.6	28.4	26.1	25.3	32.2	83	1006.4	S	3	6	7	8
September	243.8	12	32.4	24.1	28.2	28.1	25.9	25.2	31.9	84	1008.1	NE	3	5	5	7
October	295.9	15	31.2	23.6	27.4	27.4	25.4	24.7	31	85	1009.5	NE	4	6	2	3
November	285.5	17	29.9	22.9	26.4	26.3	24.5	23.8	29.5	86	1012.2	NE	4	6	0	1
December	186.6	15	28	21.2	24.6	24.6	22.9	22.2	26.7	87	1014.2	NE	4	6	0	0
ANNUAL	1888.1	127	31.1	23.1	27.1	26.9	24.9	24.1	30.1	84	1010.4	NE	4	5	41	49

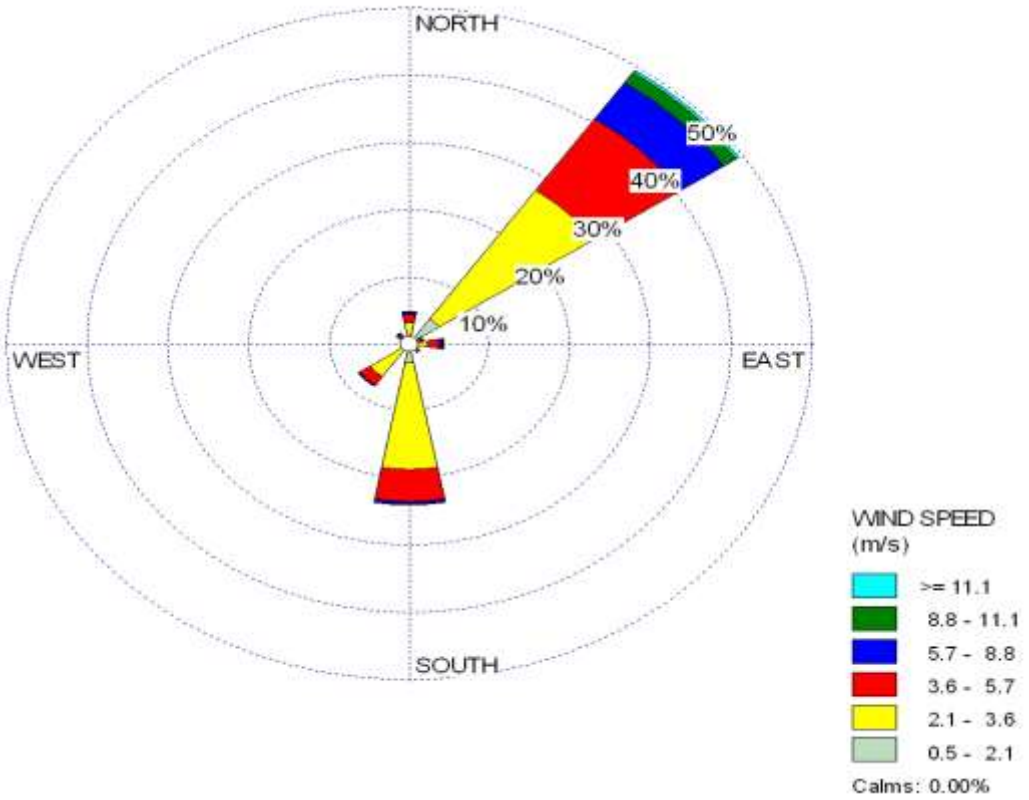


Figure 2.3-3: Annual and Monthly Wind Rose Diagram at Aparri, Cagayan Synoptic Station
(Period of Record: 1951-2006, PAGASA)

Table 2.3-2: Frequency distribution of typhoons per month in Region 2 (2015-2019)

	2015	2016	2017	2018	2019	TOTAL (per month)
January	0	0	0	0	0	**0**
February	0	0	0	0	0	**0**
March	1	0	0	0	0	**1**
April	0	0	0	0	0	**0**
May	1	0	0	0	1	**2**
June	0	0	0	2	1	**3**
July	2	1	2	2	1	**8**
August	1	0	2	0	2	**5**
September	1	2	1	1	3	**8**
October	2	3	1	1	0	**7**
November	0	0	0	0	2	**2**
December	0	0	0	0	0	**0**
TOTAL (per year)	**8**	**6**	**4**	**6**	**10**	

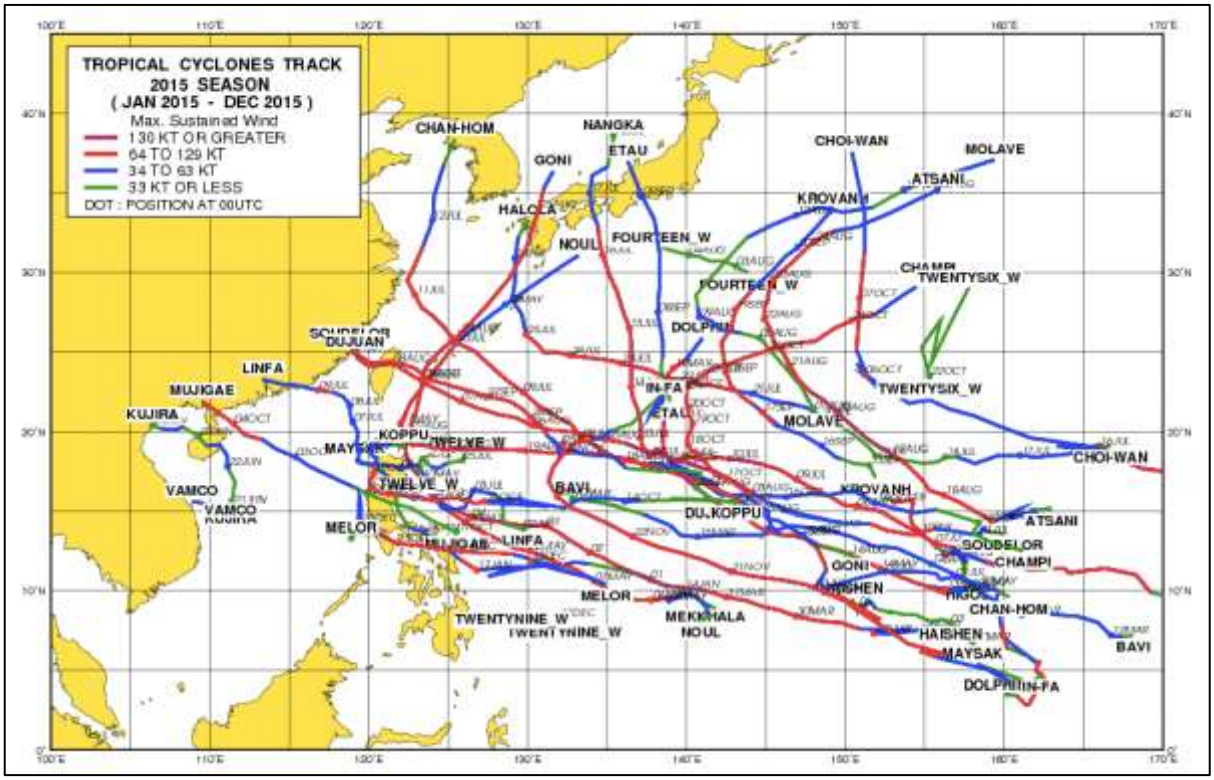


Figure 2.3-4a: Tropical Cyclones Track Year 2015

Source: JAXA/EORC Tropical Cyclone Database

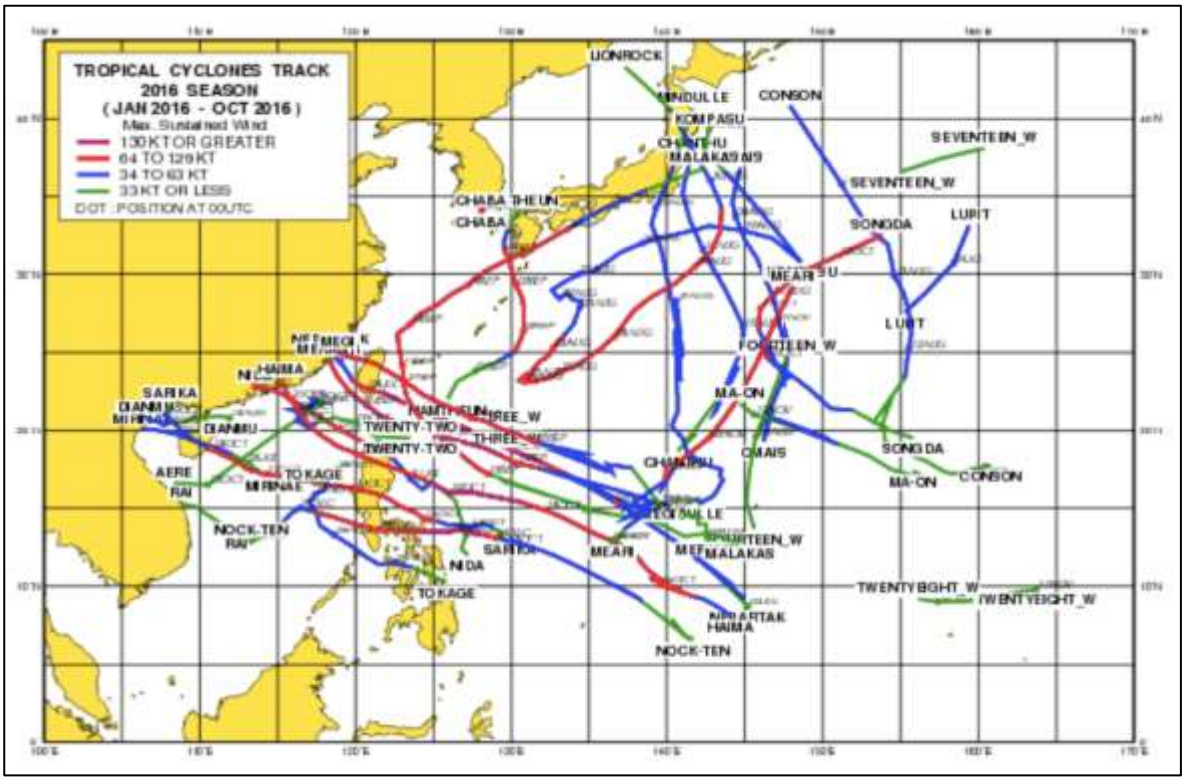


Figure 2.3-4b: Tropical Cyclones Track Year 2016

Source: JAXA/EORC Tropical Cyclone Database

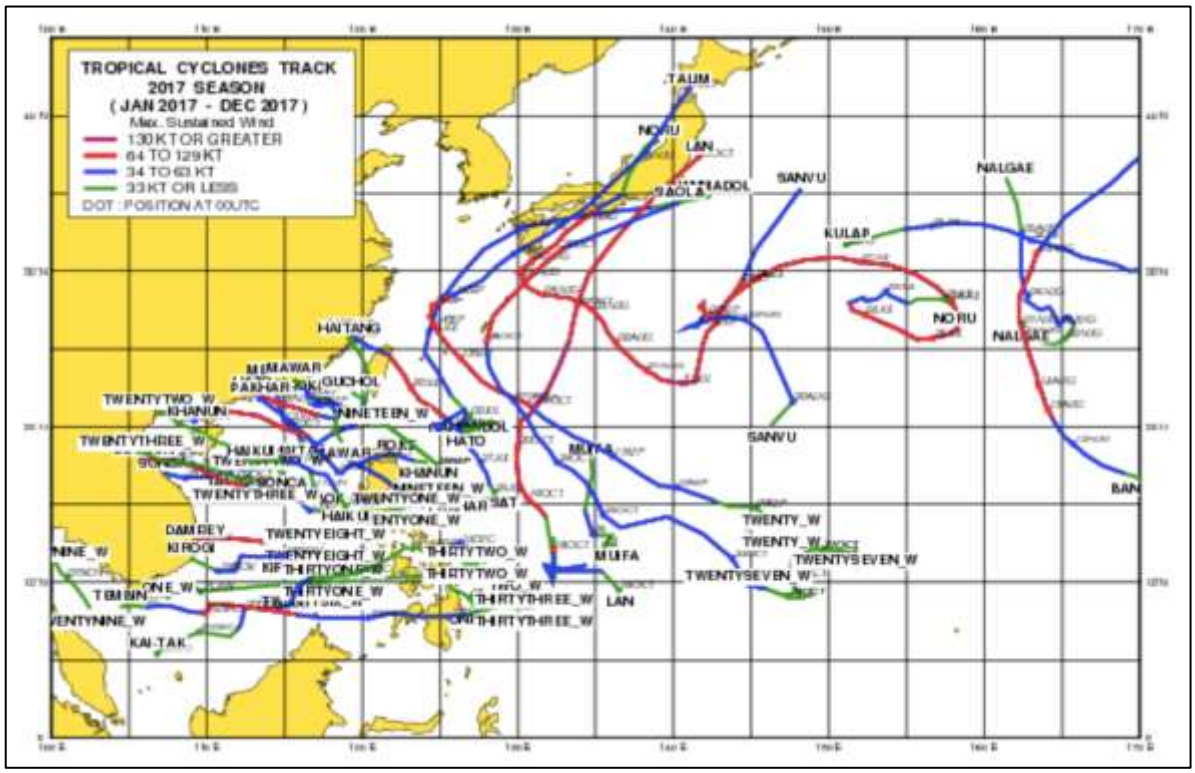


Figure 2.3-4c: Tropical Cyclones Track Year 2017

Source: JAXA/EORC Tropical Cyclone Database

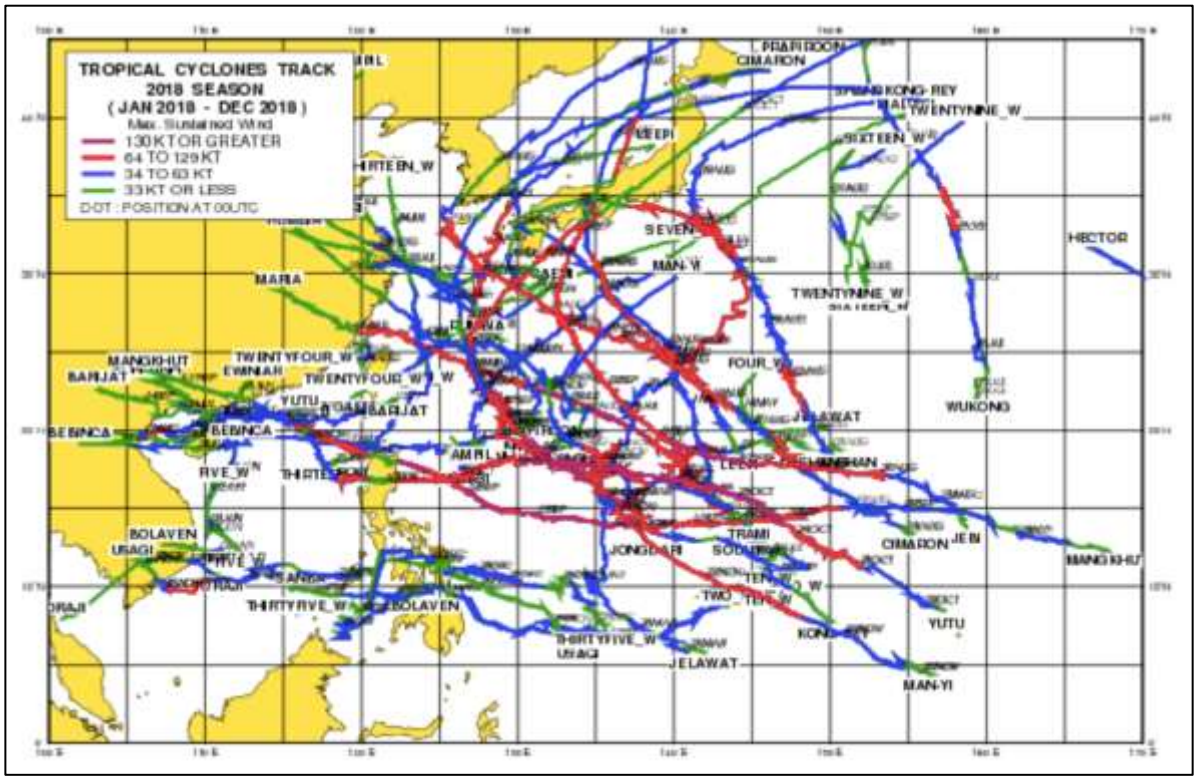


Figure 2.3-4d: Tropical Cyclones Track Year 2018

Source: JAXA/EORC Tropical Cyclone Database

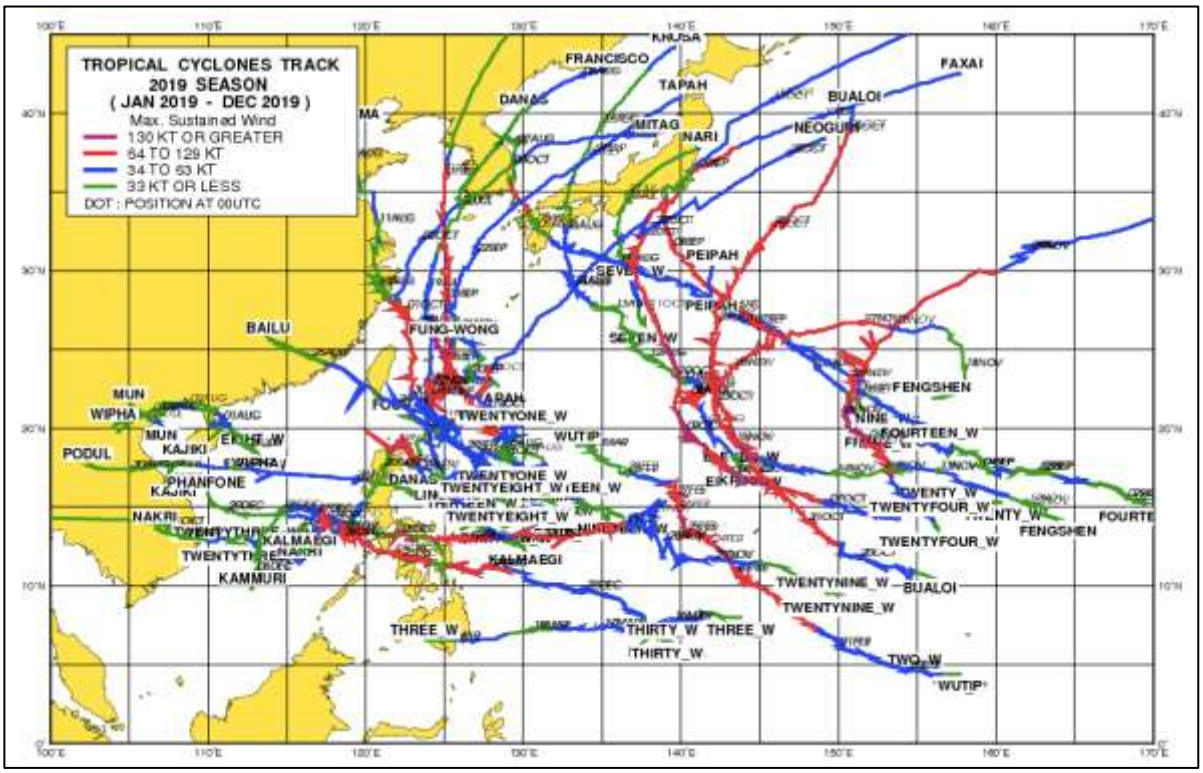


Figure 2.3-4e: Tropical Cyclones Track Year 2019

Source: JAXA/EORC Tropical Cyclone Database

2.3.2 Climate Change Projections

2.3.2.1 Change in Temperature

According to PAGASA, all areas of the Philippines will get warmer, more so, in the relatively warmer summer months. Mean temperatures in all areas in the Philippines are expected to rise by 0.9 °C to 1.1 °C in 2020 and by 1.8 °C to 2.2 °C in 2050 **(Figure 2.3-5).** Likewise, all seasonal mean temperature will also have increases in these time slices and these increases during the four seasons are quite consistent in all parts of the country. Largest temperature increase is projected during the summer (March-April-May) season. For Region 2 particularly in the province of Cagayan, the projected temperature increase during the March-April-May (MAM) season is 1.0 °C by 2020 and 2.2 °C by 2050 thus having projected temperatures of 29.1 °C and 30.3 °C, respectively from the observed baseline data of 28.1 °C for the province **(Table 2.3-3).**

2.3.2.2 Change in Precipitation

PAGASA states that, generally, there is reduction in rainfall in most parts of the country during the MAM season. However, rainfall increase is likely during the southwest monsoon June-July-August (JJA) season until the transition SON (September-October-November) season in most areas of Luzon and Visayas, and, during the northeast monsoon DJF (December-January-February) season, particularly, in provinces/areas characterized as Type II climate in 2020 and 2050. There is however, generally decreasing trend in rainfall in Mindanao by 2050 **(Figure 2.3-6).** As shown in **Table 2.3-4**, the projected increase in rainfall in the province of Cagayan in 2020 is 2.9% and increases further to 16.3% during the JJA and SON seasons, respectively. In 2050, the projected increase is 0.9% and decreases to 1.0% during the JJA and SON seasons, respectively. Thus, with an observed baseline data of 538.4mm during the JJA season, the amount of rainfall will increase to 554.01mm by 2020 and will decrease to 543.25mm by 2050. For the SON season with an observed baseline data of 832.1mm, the province will experience more rainfall with 967.73mm by 2020 and will further decrease to 533.02mm by 2050.

Table 2.3-3: Seasonal temperature increase (in °C) in 2020 and 2050 under medium-range emission scenario in provinces in Region 2

PROVINCES	OBSERVED BASELINE (1971-2000)				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 2												
CAGAYAN	24.5	28.1	28.9	27.1	0.8	1.0	0.9	0.8	2.0	2.2	2.0	1.8
ISABELA	24.1	27.9	28.7	26.8	0.8	0.9	0.9	0.8	2.0	2.1	2.1	1.9
NUEVA VIZCAYA	22.3	25.1	25.4	24.4	0.9	1.0	0.9	0.9	2.0	2.1	1.9	1.9
BATANES	23.0	26.7	28.8	26.9	0.7	0.6	0.6	0.7	1.8	1.6	1.4	1.5
QUIRINO	23.7	26.8	27.6	26.2	0.9	1.0	1.0	0.9	2.0	2.2	2.0	2.0

(Source: PAGASA, Climate Change in the Philippines, 2011)

Table 2.3-4: Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in provinces in Region 2

PROVINCES	OBSERVED BASELINE (1971-2000) mm				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 2												
CAGAYAN	284.4	207.7	538.4	832.1	6.9	-3.6	2.9	16.3	14.6	-23.3	0.9	-1.0
ISABELA	412.2	325.0	530.8	867.0	3.9	-8.6	5.1	13.5	25.1	-29.2	8.7	1.7
NUEVA VIZCAYA	180.9	416.8	1149.8	880.5	-3.5	-8.6	20.1	9.8	-7.8	-23.6	36.1	-0.5
BATANES	531.1	354.5	928.7	1057.8	-2.1	-7.8	6.4	-14.4	-4.9	-4.4	10.2	-7.4
QUIRINO	419.0	465.9	776.4	957.9	-5.7	-18.2	9.7	6.1	-0.9	-33.9	12.9	-5.8

(Source: PAGASA, Climate Change in the Philippines, 2011)

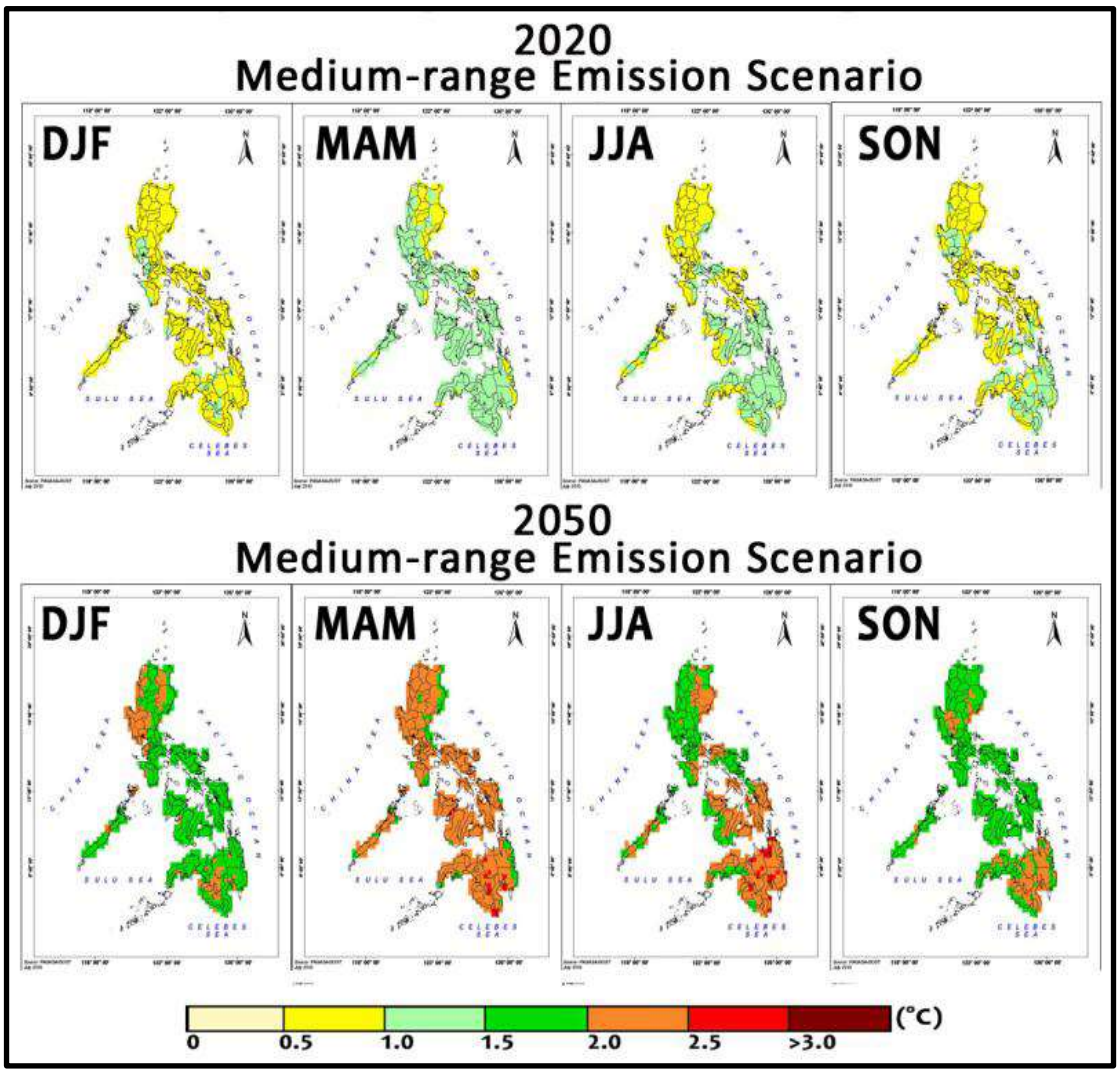


Figure 2.3-5: Projected Seasonal Temperature Increase (°C) in the Philippines in 2020 and 2050
(Source: PAGASA, Climate Change in the Philippines, 2011)

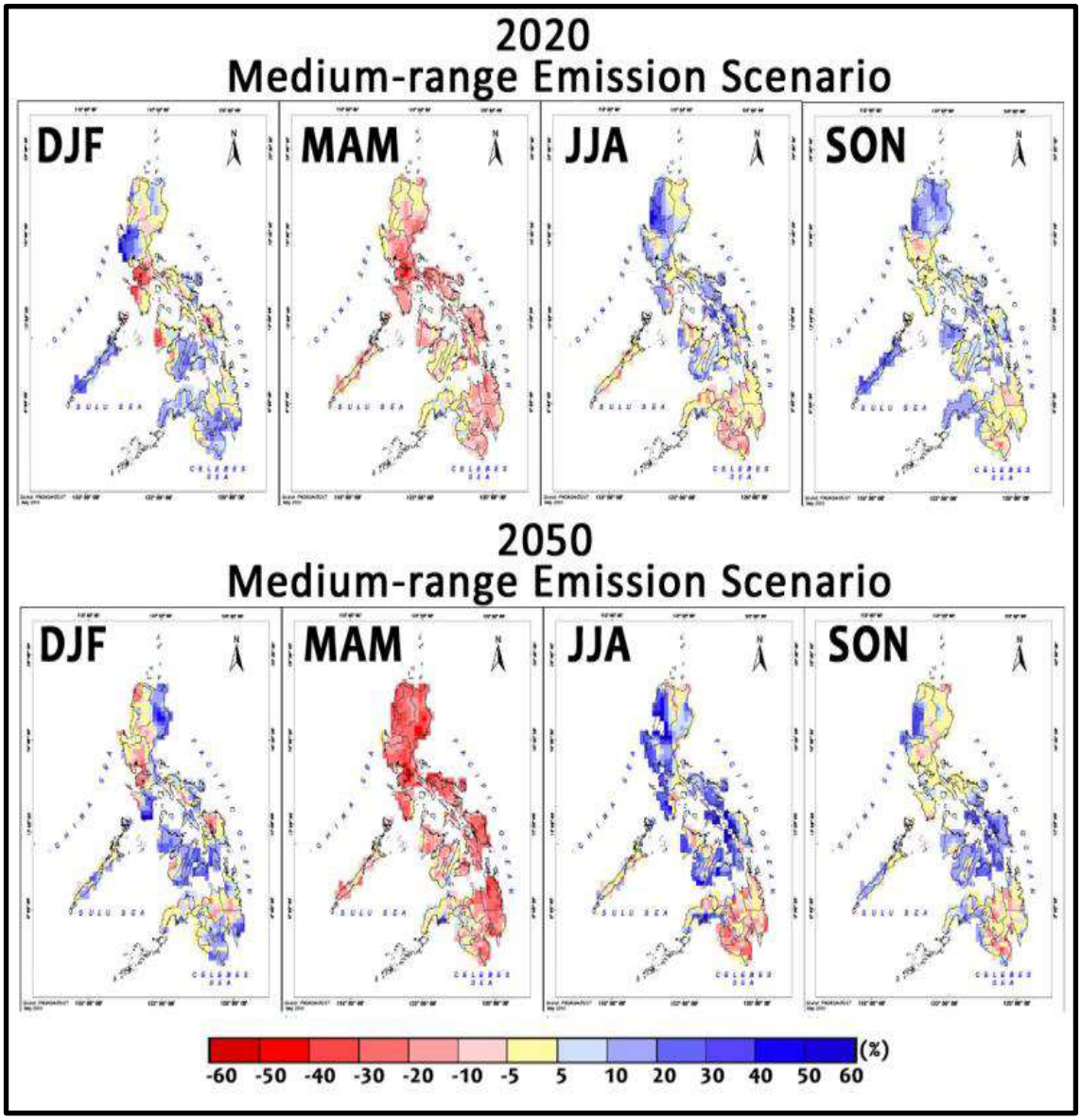


Figure 2.3-6: Map showing the projected rainfall change (increase/decrease) in % in 2020 and 2050 in the Philippines *(Source: PAGASA, Climate Change in the Philippines, 2011)*

2.3.2.3 Extreme Events

Climate change's impact on the country is most often associated with extreme weather disturbances such as warmer days, typhoons, and floods, which, in turn, affect many other sectors of economic life. Hot temperatures will continue to become more frequent in the future (**Figure 2.3-7**). Similarly, heavy daily rainfall will continue to become more frequent, extreme rainfall is projected to increase in Luzon and Visayas only (**Figure 2.3-8**), but number of dry days is expected to increase in all parts of the country in 2020 and 2050 (**Figure 2.3-9**). For the northern portion of the Cagayan province, reference data from Aparri Station will be used in determining frequency of extreme events.

In the northern portion of the Cagayan province, the number of days with maximum temperature greater than 35°C will increase from 273 days (observed baseline) to 1,276 days in 2020 and increases drastically to 2,403 in 2050 (**Table 2.3-5**). In the same table, the number of dry days is expected to decrease from the observed baseline data of 8,156 days to 6,598 days in 2020 and will slightly increase to 6770 days in 2050. The number of days with rainfall greater than 200mm will increase from 16 days to 33 days in 2020 and 24 days in 2050.

Table 2.3-5: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in Region 2

Provinces	Stations	No. of Days w/ Tmax >35 °C			No. of Dry Days			No. of Days w/ Rainfall >200mm		
		OBS (1971-2000)	2020	2050	OBS	2020	2050	OBS	2020	2050
CAGAYAN	Aparri	273	1276	2403	8156	6498	6770	16	33	24
	Tuguegarao	2769	3930	5119	8573	6513	6580	6	25	22
BATANES	Basco	51	1	24	7038	5112	5315	17	13	20

(Source: PAGASA, Climate Change in the Philippines, February 2011)

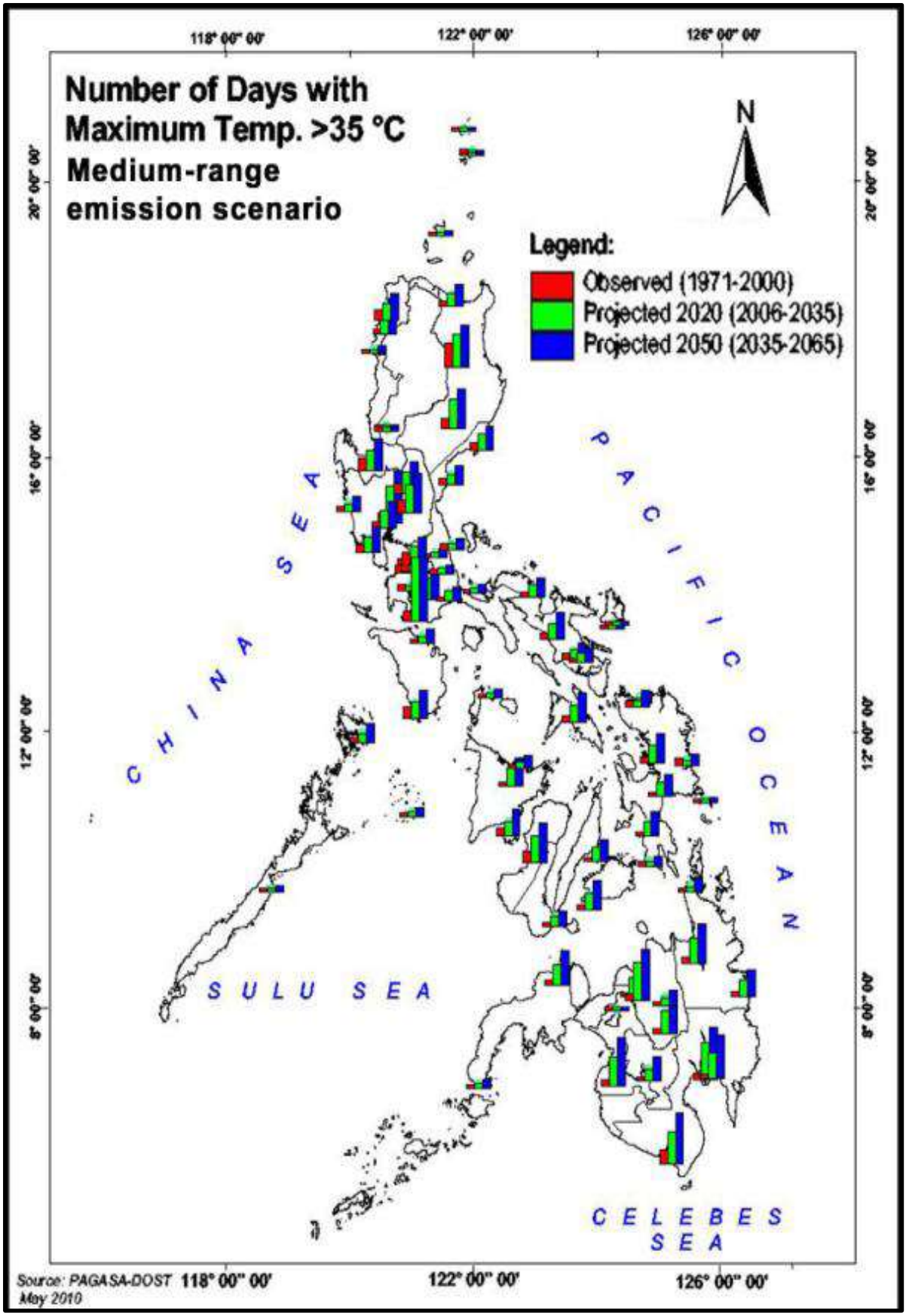


Figure 2.3-7: Number of days with maximum temperatures exceeding 35 °C (current or observed, in 2020 and in 2050) in the country under mid-range scenario.

(Source: PAGASA, 2010)

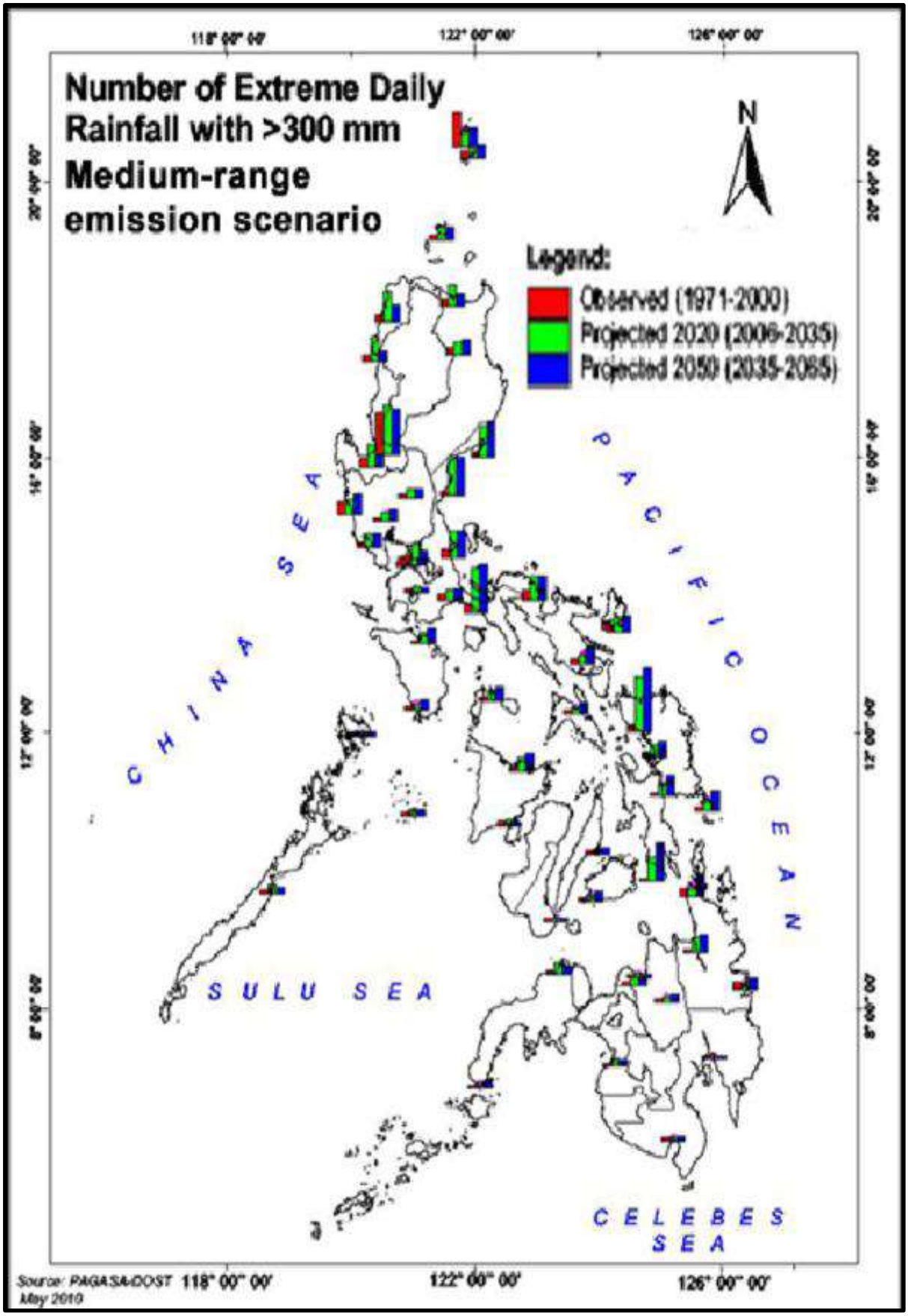


Figure 2.3-8: Current and projected extreme rainfall in the Philippines in 2020 and 2050 under mid-range scenario.
(Source: PAGASA, 2010)

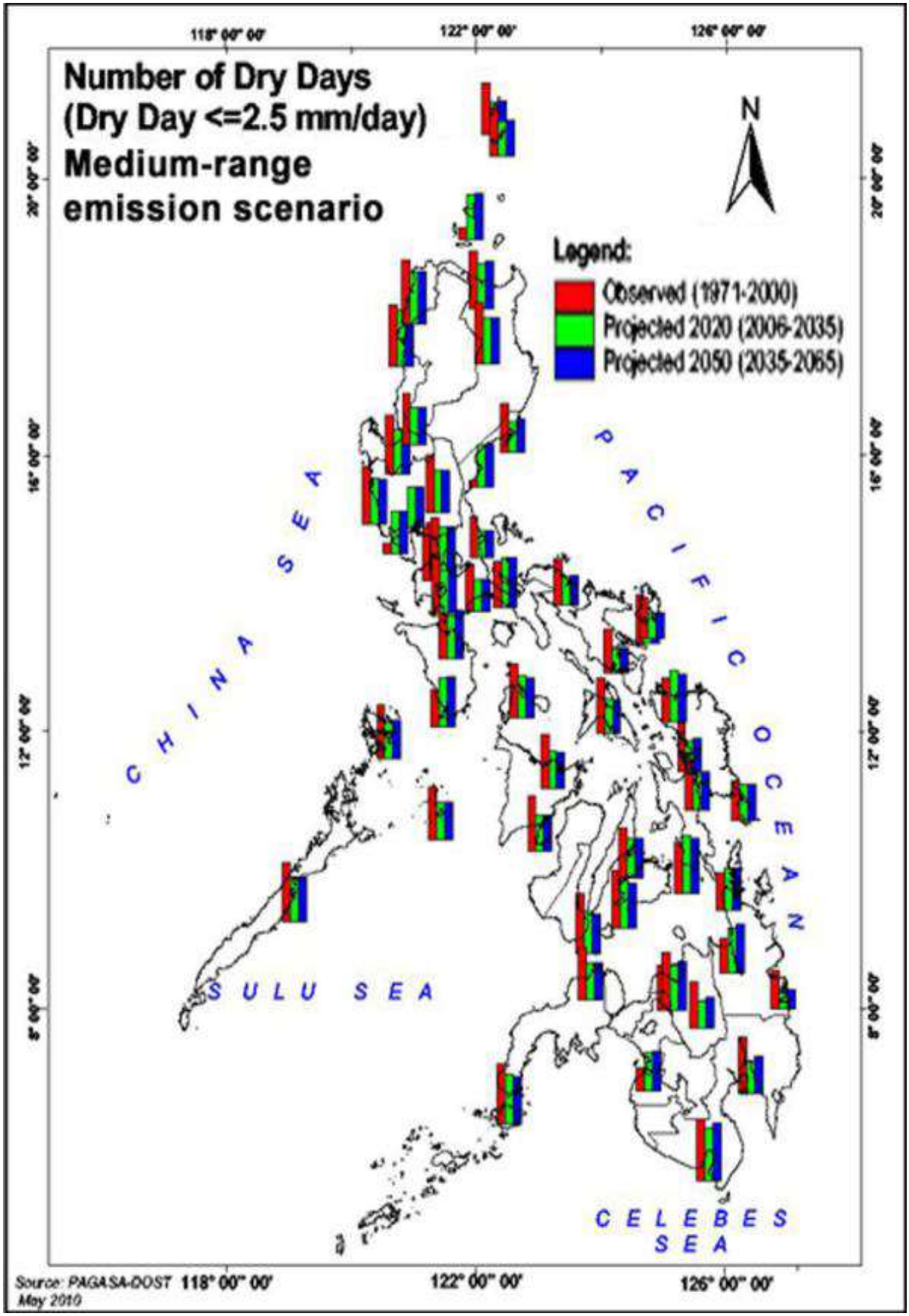


Figure 2.3-9. Current and projected number of dry days in the Philippines in 2020 and 2050 under mid-range scenario. *(Source: PAGASA, 2010)*

2.3.3 Contribution to Global Greenhouse Gases

The internationally accepted method of reporting on greenhouse gas emissions is separating emissions into scopes (WBCSD and WRI, 2004). There are three emission scopes:

Scope 1: Direct GHG Emissions
Emissions where the point of emission release is owned by the proponent, such as production of electricity, heat or steam; company owned vehicles used to transport materials, products, waste and employees; and fugitive emissions.

Scope 2: Indirect GHG Emissions
Indirect emissions associated from the purchase/import of electricity, heat or steam which is consumed by the proponent.

Scope 3: Other Indirect GHG Emissions
Indirect emissions that are a consequence of the activities of the proponent but occur from sources owned or controlled by another company or known as "sub-contractors". Examples of such are: employee business travel; transportation of products, materials, and waste; and employees commuting to and from work.

The purpose of differentiating between the scopes of emissions is to avoid the potential for double counting. Double counting occurs when two or more organizations assume responsibility for the same emissions. Reporting in line with the GHG Protocol requires that organizations report Scope 1 and Scope 2 emissions, but not Scope 3 emissions.

For this project, Scope 1 emission is estimated.

Calculation Approach for Inventory

GHG emission computed was based on the GHG Protocol Corporate Standard (2001), which is broadly accepted by NGOs, businesses, and governments. This has been used as the standard basis for accounting and reporting of GHG emissions. Computation for GHG emission was based on the tools and guidelines consistent with the Intergovernmental Panel on Climate Change (IPCC).

GHG emission from (diesel) fuel consumption

Inventory of mobile vehicles, power consumptions and stationary facilities that are run by fossil fuel were surveyed. Diesel is the only type of fuel being used in the mining activity. Table 2.3-6 shows the estimated diesel fuel consumption from use of mobile vehicles, heavy equipment, barge, and power generation (from generators run by diesel fuel) annually.

Table 2.3-6: Estimated Fuel Consumption of Equipment

No. of Equipment (pcs)	Type of Machinery	Estimated Fuel Consumption (L/year)
4	Daihatsu Diesel Engine 6DE-18 800kW/900rpm/200G/KwH	108,960
4	Airman Gen - PDSK10505328 kW 1800 rpm 29.7m3/min	75,120
1	Emergency Gen Engine Maker Cummins QSB7-DM	14,388
4	Liutech Portable Diesel Screw Air Compressor cap 780L LUY-400-25 G111 76L/hr	75,120
1	Caterpilar Engine	37,356
2	Volvo Fresh Water Ballast Water Transfer Pump D7C-BTA 1000m3/h	25,800
1	Dongfeng Capstan Diesel engine 4BT 3.9-C100 75kW, 2400 rpm full rated 78.6mm3/stroke	5,820
1	Fast rescue boat	35,604
	TOTAL:	**378,168 L/year**

An estimated total of 378,168 liters of diesel fuel will be consumed by the mining company for its project operation. Based on the computation in **Figure 2.3-10,** the project will emit 3,744 tons/year of CO_2 to the atmosphere per year during its operation phase in which 26,208 trees are needed to offset its CO_2 emissions every year.

Offsetting the CO_2 emissions can be done by planting trees. An estimate of seven (7) trees is needed to offset 1 ton of carbon dioxide over the lifetime of the tree. The project should adapt a tree planting and/or reforestation activities to address the matter on carbon offsetting considering the earth movement during the mine operations.

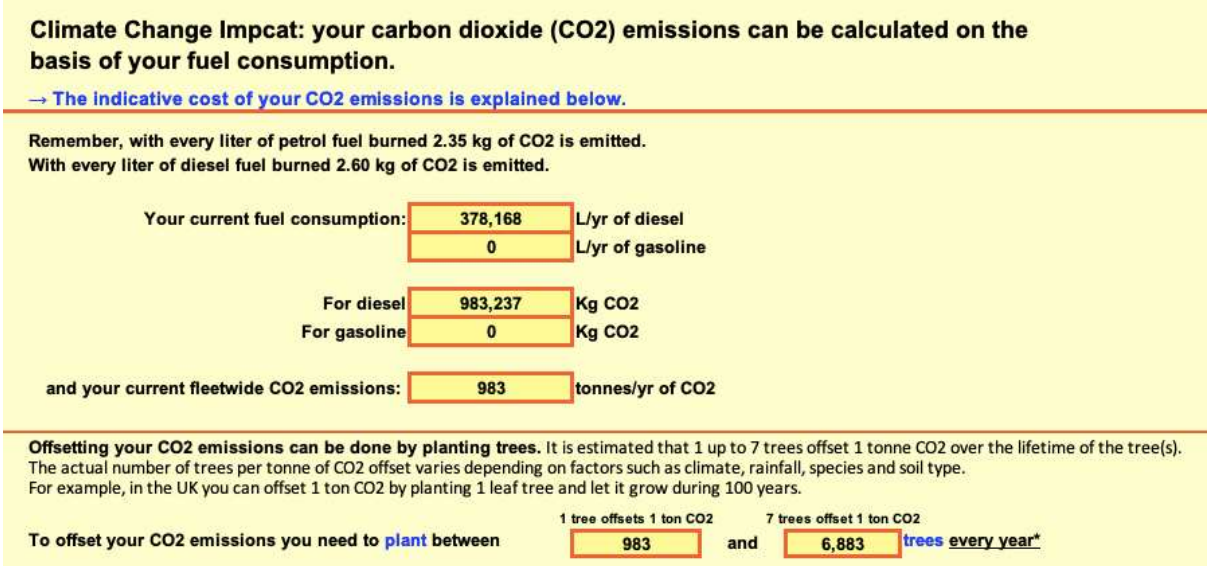


Figure 2.3-10. Carbon dioxide Cmissions Calculation Based on the Fuel Consumption of the Project
(Source: GHG Protocol Corporate Standard, 2001)

2.3.4 Air and Noise Quality

The pollutants considered for the ambient air quality assessment were Total Suspended Particulates (TSP), Particulate Matter less than 10 microns (PM_{10}), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), and Carbon Monoxide (CO). The ambient noise level was also measured during the assessment.

The purpose of the assessment is to identify the site's ambient air quality and noise level and compare it to the Department of Environment and Natural Resources (DENR) Administrative Order No. 2000 – 81 (Implementing Rules and Regulations of the Philippine Clean Air Act of 1999), and the ambient noise level standards of the National Pollution Control Commission (NPCC) Memorandum Circular 002 Series of 1980. This monitoring is limited only to the ambient air quality and noise level assessment of four (4) stations in the municipality of Santa Ana in Cagayan Province.

2.3.4.1 Sampling Stations

Four pre-determined sampling stations were selected for ambient air quality and noise level monitoring with assessment periods of 24 hours for stations 1 and 2, and 1 hour for stations 3 and 4. The sampling points were strategically located at the coast of the project site and where the proposed onshore facility or land-based office of the project will be located. Station 1 was setup in front of Port Irene where the proposed land-based office will be located, station 2 is in an open area near shore, station 3 is in the shore adjacent to the port, and station 4 is along the access road to the port. The stations served as representatives that will generate data that could reflect the concentrations of various pollutants and their variations in the area.

Table 2.3-6. Geographical Coordinates of the Ambient Air Quality and Noise Level Sampling Stations

Station	Latitude	Longitude
1	18° 22' 55.74" N	122° 06' 35.46' E
2	18° 22' 38.03" N	122° 06' 32/87" E
3	18° 22' 55.42" N	122° 06' 17.75" E
4	18° 22' 49.66" N	122° 06' 30.46" E

Figure 2.3-10. Ambient Air Quality and Noise Level Sampling Map

2.3.4.2 Methods of Sampling and Analysis

2.3.4.2.1 Ambient Air Quality Assessment

The methods of sampling and analysis of TSP, PM10, SO2, NO2, and CO for the ambient air quality assessment were based on the DENR standards. The methodologies are discussed in this section and presented in the table below.

Table 2.3-7. Methods of Ambient Air Sampling and Analysis

Parameter	Analysis
Total Suspended Particulates (TSP)	High Volume Sampler – Gravimetric Method
Particulate Matter <10 microns (PM_{10})	High Volume Sampler – Gravimetric Method
Sulfur Dioxide (SO_2)	Pararosaniline Method
Nitrogen Dioxide (NO_2)	Griess – Saltzman Reaction Method
Carbon Monoxide (CO)	Instrumental Analyzer Method

Source: USEPA 40 CFR, part 50 & 53

Methodology

- *Total Suspended Particulates (TSP) and Particulate Matter (PM_{10})*

  The filter paper sheet was carefully mounted on the filter holder. The holder was clamped properly to seal the filter paper sheet. The respirable dust sampler was then placed in an open space in each station and the sampler motor was operated. The date and time were recorded. The flow rate was fixed at 1.4 (L/m) and the reading with the corresponding flow rate from the calibration curve were recorded. Also, air temperature and barometric pressure of the location were noted. The sampler ran for 24 hours and/or 1 hour per station, then the final set of readings were taken at the end of the test period. Remove the filter from the mount very carefully so as not to lose any of the fiber material or collected particulate matter and add the collected particulate from the cyclone (for TSP only). Fold the filter in half upon itself with the collected material enclosed within. Place the folded filter in a clean tight envelope and mark it for identification, transport samples to the accredited laboratory for analysis.

- *Sulfur Dioxide (SO_2) and Nitrogen Dioxide (NO_2)*

  A sampling train, consisting an absorber, trap to protect flow devices, flow control and metering devices, temperature and vacuum gauge, and air pump, was set-up. Butt-to-butt connections were made with Tygon tubing. Exactly 10 millimeters of absorbing reagent was pipetted into the absorber (Midget Impinger), which was placed inside the cooler to avoid contaminations.

  The pump was started, and the air sample was aspirated through the absorber at a rate of 0.4-1.0 L/m (depending upon the concentration of SO2 in the atmosphere and the sampling time desired) and 1 liter per minute for NO2. The sampling time observed are 24-hour and 1-hour sampling. The temperature, barometric pressure, relative humidity, flow rate, time, date, and other observations on the sampling location were monitored. At the end of the sampling period, the final readings were recorded. The samples were recovered and stored in the collection device. The samples were then transported to a DENR accredited laboratory for analysis.

- *Carbon Monoxide (CO)*

  An air pump was utilized to collect air samples for carbon monoxide analysis of each station. The pump was operated and aspirated the air samples to the Tedlar bag. The collected samples were transported to a DENR accredited laboratory for analysis.

2.3.4.2.1.1 Background of Parameters

Total Suspended Particulates

Airborne particles that are less than 100 micrometers refer to Total Suspended Particulate matter (TSP). These particles enter the atmosphere from different sources. Some of these sources include motor vehicles, industrial processes, power generation, and combustion of products. There are also natural sources of these particles like soil, fungi, molds, yeast, pollen, bacteria, salt particles, etc. These particulate matters can be classified as inhalable particles or respirable particles. However, some of them have poisonous effects when inhaled, while others may take a long exposure for adverse health effects to manifest. These pollutants may even cause respiratory distress, heart straining, and other health problems (USEPA, 2016).

Particulate Matter (PM_{10})

Particulate matter are particles that come in various sizes and shapes, composed of hundreds of different chemicals. These particles are the sum of all solid and liquid particles suspended in the air. These particles can be directly emitted from various sources such as construction sites, unpaved roads, fields, smokestacks, and alike or it may be indirectly emitted and forms only in the atmosphere as a result of chemical reactions of pollutants emitted from power plants, industries, automobiles, etc. (USEPA, 2016).

Sulfur Dioxide (SO_2)

SO_2 is considered one of the most dangerous air pollutants because it is corrosive to organic materials, and it can cause irritation to the eyes, nose, and lungs. It has been estimated that anthropogenic sources of emissions produce around 76%, while the rest are natural sources. SO_2 is considered as a threat to everyone's health since it can trigger respiratory symptoms. When mixed and reacts with water and oxygen, it produces acid rain that is harmful to the environment (USEPA, 2016).

Nitrogen Dioxide (NO_2)

Road transport was identified as one of the largest contributors of nitrogen emissions. However, around 90% of the NO_X combustion products are in the form of nitrogen oxide, which are oxidized to nitrogen dioxide in the air. Therefore, most of the NO_2 molecules in the atmosphere are a result of chemical reactions. High concentrations of NO_2 may impose a harmful effect on human health and the environment (USEPA, 2016).

Carbon Monoxide (CO)

Carbon monoxide (CO) is a colorless and odorless gas that is released in the process of combustion. The notable sources of CO in the outdoor air are motorized vehicles and fueled machineries. CO is harmful to the health once inhaled in large quantities and high concentrations because it limits the oxygen that is transported in the blood steam especially to critical organs i.e., heart and brain (USEPA, 2016).

2.3.4.2.2 Ambient Noise Level Monitoring

A direct-reading sound level meter was used to collect noise level data at each sampling station. A-weighted (dBA) scale was selected as required by the 1978 NPCC and the 1980 NPCC standards were also based on the same weighting network. A-weighting network most closely approximates the response of human ear to various sound frequencies.

The procedure used followed that of Wilson (1989), in which at least a total of fifty (50) readings were recorded in order to increase the confidence limits of the data. Procedures outlined by Wilson (1989) were adopted in the monitoring as the time interval, duration of sampling, size of data needed, and methods of noise level analysis were not specified in the 1978 NPCC.

Field observations during the monitoring were also noted to identify the primary sources of noise in each area. Noise level of the area were recorded in a 24-hour and 1-hour duration to determine the noise level in the morning, evening, daytime, and nighttime. The time frame of each assessment period is presented in the table below.

Table 2.3-7. Noise Level Assessment Time Frame

Assessment Period	Time Frame
Morning	5:00 AM – 9:00 AM
Evening	6:00 PM – 10:00 PM
Daytime	9:00 AM – 6:00 PM
Nighttime	10:00 PM – 5:00 AM

Source: NPCC Memorandum Circular No. 022 of 1980

2.3.4.3 Other Meteorological Observations

Meteorological observation such as wind direction, wind speed, and cloud description were recorded during the duration of the activity to correlate the interpretation of the gathered concentrations.

Wind Direction

Wind direction is the direction to which the wind is heading. It is reported in the cardinal directions. The wind direction in a certain station is determined by observing the motion of the wind from field observation of objects such as trees, grasses, smoke, etc. using a compass as a reference.

Wind Speed

Wind speed describes how fast the air is moving past a certain point. Wind speeds were recorded during the sampling activity using the Beaufort Wind Scale as a guide. Devised by Britain's Admiral Francis Beaufort, this was one of the first scales used to estimate and report wind speeds via visual observations. Table 4 details a brief categorization of the Beaufort wind forces along with the corresponding equivalent speeds, wind descriptions, and land observations.

Table 2.3-8. Beaufort Wind Scale

Wind Description	Units in KpH	Units in KNOTS	Description as Observed
Light Winds	19 or less	10 or less	• The wind felt on face • Ordinary wind vanes moved by wind • Leaves rustle
Moderate Winds	20 – 29	11 – 16	• Wind raises dust and loses the paper • Small branches are moved
Moderate to Occasionally Strong			• Moderate winds mostly persist, but there are instances during the forecast period that it reaches strong wind force.
Fresh Winds	30 – 39	17 – 21	• Small trees in leaf begin to sway • Crested wavelets appear on inland waters
Strong Winds	40 – 50	22 – 27	• Large branches in motion • Whistling heard in telephone wires • Umbrellas used with difficulty
Gale: 1. Near Gale 2. Gale 3. Strong Gale	51 – 62 63 – 75 76 – 87	28 – 33 34 – 40 41 – 47	• Whole trees in motion • Inconvenience felt when walking against the wind • Twigs break off-road • Cars veer on road • Larger branches break off • Slight structural damage occurs-roofing dislodged
Stormy: 1. Storm 2. Violent Storm	88 – 102 103 – 117 118 or more	48 – 55 53 – 63 64 or more	• Trees uprooted • Considerable structural damage • Widespread damage

Wind Description	Units in KpH	Units in KNOTS	Description as Observed
3. Typhoon			

Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

Cloud Description

The system used to describe sky conditions during the sampling period is outlined below. The terminologies below were adopted and used by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Table 2.3.-9. Sky Conditions and its Descriptions

Sky Condition	Definition / Description
Clear or Sunny Skies	• State of the sky when it is cloudless, totally clear or with a few small light clouds visible • Has a total cloud cover of less than one okta
Partly Cloudy	• State of the sky is within 2 – 5 oktas total cloud cover or has between 30% to 70% cover of the celestial dome
Partly Cloudy to at Times Cloudy	• Mostly partly cloudy but there are times when more than 70% of the celestial dome us covered with clouds
Mostly or Mainly Cloudy	• The sky is mostly covered with clouds but with possible brief periods of sunshine • The sky is covered with clouds between 6 to 8 oktas
Cloudy	• The sky is covered with clouds between 6 to 8 oktas or has more than 70% cloud cover • Predominantly more clouds than clear sky • For a longer period during the day, the sun is obscured by clouds
Overcast	• The sky is totally or completely covered with thick and opaque clouds, 8 oktas, or around 100% cloud cover

2.3.4.4 Results and Discussions

2.3.4.4.1 Ambient Air Quality Assessment

Four (4) established sampling stations were assessed for TSP, PM_{10}, SO_2, NO_2, and CO concentrations on August 7-10, 2020. Samples were submitted to Elarsi, Inc. and Industramach Laboratories Inc., which are DENR-accredited laboratories, for analysis. The results of the analyses were released on August 24, 2020.

The results for each parameter are presented in **Table 2.3-10, Table 2.3-11**, and **Table 2.3-12**, together with the DENR National Ambient Air Quality Standard (NAAQS) value as reference for acceptable reading.

Table 2.3-10. Ambient Air Quality 24-Hour Assessment Result (µg/ Ncm)

Station	Location	Date and Time of Sampling	TSP	PM_{10}	SO_2	NO_2
A1	In front of Port Irene	August 8 – 9, 2020 10:56 PM – 10:56 PM	30.02	0.102	2.92	0.488
A2	Open area near shore	August 7 – 8, 2020 10:31 PM – 10:31 PM	10.62	0.081	2.54	0.295
DENR National Ambient Air Quality Standards based on 24-hour averaging time			**230**	**150**	**180**	**150**

Table 2.3-11. Ambient Air Quality 1-Hour Assessment Result (µg/ Ncm)

Station	Location	Date and Time of Sampling	TSP	PM_{10}	SO_2	NO_2
A3	Shore adjacent to the Port	August 10, 2020 9:30 AM – 10:30 AM	13.41	0.610	14.61	3.63
A4	Along Port Irene Access Road	August 10, 2020 8:06 AM – 9:06 AM	10.62	0.081	2.54	0.295
DENR National Ambient Air Quality Standards based on 60-minute averaging time			**300**	**200**	**340**	**260**

Table 2.3-12. Ambient Air CO Concentrations (mg/Ncm)

Station	Location	CO
1	In front of Port Irene	0.1
2	Open area near shore	0.1
3	Shore adjacent to the Port	0.1
4	Along Port Irene Access Road	0.1
DENR National Ambient Air Quality Standards		**35**

The 24-hour ambient air assessments were conducted in station A1 and station A2, which are in Port Irene and in an open area south of the port. The pollutant concentration for station A1 resulted to 30.02 µg/Ncm for TSP, 0.102 µg/Ncm for PM_{10}, 2.92 µg/Ncm for SO_2, and 0.488 for NO_2. The concentrations for station A2 have lower values compared to station A1 with values of 10.62 µg/Ncm for TSP, 0.081 µg/Ncm for PM10, 2.54 µg/Ncm for SO_2, and 0.295 µg/Ncm for NO_2. The differences may have been influence by the existing uses and activities in each station. Nevertheless, the two stations are within the DENR standard for ambient air quality.

Station A3 and station A4 are established sampling sites for 1-hour ambient air assessment. Station A3, located adjacent to the port, has pollutant concentrations of 13.41 µg/Ncm for TSP, 0.610 µg/Ncm for PM_{10}, 14.61 µg/Ncm for SO_2, and 3.63 µg/Ncm for NO_2. TSP, PM_{10}, and NO_2 concentrations for station A4 have higher values in comparison to station A3, given that it is in the access road going to the port. Despite the differences, the two station are both within the standard of DENR for 60 minutes ambient air averaging time.

The carbon monoxide concentration for all sites has a low value of 0.1 mg/Ncm and within the standard set by DENR for ambient air quality as shown in **Table 2.3-12**.

2.3.4.4.2 Noise Level Quality Assessment

Four (4) sampling stations were established for noise level quality monitoring. The sampling stations for noise level monitoring are the same with the stations identified for ambient air quality monitoring. The results are presented in **Table 2.3-13** with the standard set in NPCC Memorandum Circular 002 Series of 1980 for a specific category of area.

Table 2.3-13. Noise Level Assessment Results

Station	Location	Date and Time of Sampling	Category of Area	Assessment Period	Noise Level (dBA)	NPCC Standard
N1	In front of Port Irene	August 8 – 9, 2020 10:31 PM – 10:31 PM	C	Moring	61.6	65
				Daytime	63.1	70
				Evening	65.9	65
				Nighttime	61.9	60
N2	Open area near shore	August 7 – 8, 2020 10:45 PM – 10:57 PM	C	Moring	48.8	65
				Daytime	42.7	70
				Nighttime	47.9	60
N3	Shore adjacent to the Port	August 10, 2020 9:30 AM – 10:30 AM	C	Daytime	46.8	70
N4	Along Port Irene access road	August 10, 2020 8:06 AM – 9:06 AM	C	Morning	59.2	65

All stations are classified under Class C area category, described as a section primarily zoned as light industrial area. As shown in **Table 2.3-13**, all the stations under corresponding assessment periods are within the NPCC standard except for the evening and nighttime noise levels for Station N1. The results show that the noise level in station N1 during evening and nighttime were 65.9 dBA and 61.9 dBA, which are slightly elevated from the NPCC standard for the said assessment periods. Station N1 is within the vicinity of Port Irene and the noise level might have been influenced by the activities in the port. It was observed in the evening that the port has an ongoing activity of unloading of cargos from the ship and ended around 3 in the morning that caused the increase in noise level for the said periods.

The noise from the siphon vessel may be compared to channel dredging in near shore but because of deeper water depths, the noise will somehow be propagated for greater distances than in confined near shore areas (*Hildebrand 2004*). To minimize the noise attributed to the project, the generator set installed in the vessel will be equipped will be a low noise type with insulation materials to cover the unit and the vacuum pump will have a muffler installed. No inhabitants will be disturbed since the vessels will be situated offshore, 14 – 15 kilometers away from the inhabited coastal areas of Buguey, Gonzaga, and Aparri.

For safe working conditions and protection of employees on board the ship, the proponent will implement maximum allowable noise level limit in conformity with the guidelines set by the International Maritime Organization (IMO) Resolution A.468 (XII) Code on Noise Levels on Ship and the DOLE OSH Standards (Amended, 1989). **Table 2.3-14** shows the limits of noise levels (dBA) in various specified spaces inside a vessel. Personnel entering spaces with noise levels greater than 85 dBA should be required to wear hearing personal hearing protectors, no crew members shall be exposed to peak values of noise levels. If the noise levels within that area have exceeded the maximum limit set by the guideline, stay should be limited to very short periods of time or not allowed at all and continuous noise exposure should not exceed 80 dBA.

Table 2.3-14. Maximum Noise Level Based on Code on Noise Levels on Ship IMO Reso. A.468 (XII)

Designated Area	1,600 up to 10,000 GT Ship Size
Machinery Spaces	110
Machinery Control Rooms	75
Workshops other than those forming part of machinery spaces	85

Designated Area	1,600 up to 10,000 GT Ship Size
Non-specified work spaces (other work areas i.e. open deck)	85
Navigating bridge and chartrooms	65
Look-out posts, incl. navigation bridge wings and windows	70
Radio rooms (with radio equipment operating but not producing audio signals)	60
Radar rooms	65
Cabin and hospitals	60
Messrooms	65
Recreation rooms	65
Open recreation areas (external recreation areas)	75
Offices	65
Galleys, Serveries, and Pantries	75

2.3.4.4.3 Other Meteorological Observations

Meteorological observations in all sampling stations were also assessed. These observations were considered essential since these could affect the concentration of air pollutants in an area. On average, the sky condition is clear to partly cloudy with a range of 1-2 oktas for all stations, while the wind conditions were all calm or described as light winds having wind speeds of 19 kph or less. The mean barometric pressure for all sampling stations is 1011.7 hPa. Other meteorological observations were summarized in the table below.

Table 2.3-14. Meteorological Observations in Sampling Stations

Station	Average Temperature (°C)	Clouds (Okta)	Wind Direction	Wind Condition	Barometric Pressure
N1	32.0	2	NE	Calm/Light Wind	1011.7
N2	31.7	1	NE	Calm/Light Wind	1011.7
N3	31.0	1	NE	Calm/Light Wind	1011.7
N4	31.0	1	NE	Calm/Light Wind	1011.7

2.3.5 Impact Assessment and Mitigation

Potential Hazards/Impacts	Impact Analysis	Options for Prevention or Mitigation or Enhancement
Impacts on ambient air quality	Change in air quality due to pollutant emissions.	Regulations from the MARPOL (Maritime Pollution) 73/78 and those set-forth by the Marine Environmental Protection Rules and Regulations of the Philippine Coast Guard (PCG) will be adopted. Regular maintenance and monitoring of diesel-powered equipment and machineries will be implemented. The project operation will be located approximately 14-15 kilometers from the shore, thus will have minimal impact on the coastal communities.
Increase in noise level	Offshore mineral mining will somehow contribute to the increase in the level of noise in the sea, but little information exists regarding specific effects on marine organisms and their habitats. The noise from the siphon vessel may be compared to channel dredging in near shore but because of deeper water depths, the noise will somehow be propagated for greater distances than in confined near shore areas (*Hildebrand 2004*). Increase in ambient noise level which may result to noise nuisance that may affect the health and safety of onboard personnel.	To minimize the noise attributed to the proposed project, the generator set installed in the vacuum ship will be minimized by insulating the cover of the unit. The vacuum pump which is another potential source of noise will have a muffler installed to minimize the noise generated. Equipment including vessels will be operated at low speed and/or power whenever practical and switched off when not in use. Personal protective equipment (PPEs) will be provided as necessary.

2.4 PEOPLE

This section describes the baseline demographics, socio-economic conditions, public health data and sanitation, transportation, and maritime traffic in the coast of the host municipalities and affected barangays. Potential impacts related to people and its corresponding mitigation/enhancement measures are also provided in this section.

This module focuses in the 3 municipalities: Aparri, Buguey, and Gonzaga of Cagayan Province. The barangays includes for the Municipality of Aparri: Bulala Sur, Bulala Norte, Linao, Punta, Minanga, San Antonio, Maura, Dodan, Paddaya; for the Municipality of Buguey: Paddaya Weste, Paddaya Este, San Isidro, Cabaritan, Centro West, Centro, Santa Maria, Leron, Mala Weste, Mala Este, Villa Leonora, Minanga Weste and Minanga Estes; for the Municipality of Gonzaga: Caroan, Casitan, Callao, Minanga, Batangan, Tapel, Ipil, Amunitan, Santa Cruz, Baua and San Jose.

Several methods were employed in gathering information on the socio-economic conditions of the impact communities. These methods include the review of secondary data, conduct of perception survey, and data obtained from information, education and communication (IEC) activities. Secondary data were collated by the EIA preparer from the concerned Local Government Units and other related agencies and institutions. These include the following:

- Municipal Comprehensive Land Use Plan (CLUP);
  - Gonzaga CLUP 2013 – 2022;
  - Buguey CLUP 2016 – 2022
  - Aparri CLUP – 2014 - 2024
- Municipal Demographic Data;
- 2010 Census of Population and Household, Philippine Statistics Authority;
- 2012 Registry System on Basic Sector in Agriculture (RSBSA) Census;
- 2015 Census of Population and Household, Philippine Statistics Authority;
- Regional Social and Economic Trends (RSET) for Region II – Cagayan Valley, 2017.

2.4.1 Demographic Data

According to the 2015 Census of Population (POPCEN 2015), Region 2 (Cagayan Valley) has a total population of 3,451,210 with an average increase of 1.27% annually during the period of 2010 to 2015. Among the five (5) provinces in Cagayan Valley, Isabela Province had the biggest population in 2015 with 1.59 million, followed by Cagayan Province with 1.20 million, Nueva Vizcaya with 452,000, and Quirino Province with 189,000. Batanes, on the other hand, had the smallest population with 17,000.

Table 2.4-1: Population by Province: Region II - Cagayan Valley (Based on the 2000, 2010, and 2015 Censuses)

Province	Population (in thousands)		
	2000	2010	2015
Batanes	16	17	17
Cagayan	994	1,125	1,199
Isabela	1,288	1,490	1,594
Nueva Vizcaya	367	421	452
Quirino	149	177	189

Source: PSA, June 2016

Cagayan is a province in the Philippines situated in Cagayan Valley region occupying the northeastern section of Luzon. It has a total of 28 municipalities and 1. The total number of barangays in the province is 820. Tuguegarao is its capital city and the largest city in Region 2 among the population size followed

by the 3 cities in Isabela Province. The Province of Cagayan has a total land area of 9,295.75 square kilometers or roughly 3,589.11 square miles.

According to the 2015 Census Population, Cagayan had a total population of 1,199,320 with an annual growth rate of 1.23% and the population density is computed at 129 inhabitants per square kilometer or 334 inhabitants per square mile. This represented 34.75% of the total population of the Cagayan Valley region, 2.09% of the overall population of the Luzon Island group, or 1.19% of the entire population of the Philippines.

MUNICIPALITY OF APARRI

Municipality of Aparri is a first (1st) class municipality in the Province of Cagayan subdivided into forty (4) barangays with twenty (20) urban barangays and twenty-two (22) rural barangays. It has a total land area of 286.64 square kilometers or 110.67 square miles which constitutes 3.08% of Cagayan's total area. According to the POPCEN 2015, the municipality has a population of 65,649 with an annual growth rate of 1.35% or an increase of 4,450 people from the previous record of 61,199 in 2010. The total population density is computed at 229 inhabitants per square kilometer or 593 inhabitants per square mile. This represented 5.47% of the total population of Cagayan Province, or 1.90% of the overall population of the Cagayan Valley region. The available data gathered from the Municipality of Buguey was based on their Comprehensive Land Use Plan (CLUP) 2014 – 2024.

The municipality for the period of 107 years (1903 to 2010), only on census year 1948 experienced a negative (-0.62%) annual growth rate. The negative growth rate might be attributed by the second world war wherein population fled to other places away from any danger that possibly happen to them. It was census year 1960 that there was a tremendous increase of population with a growth rate 2.46. The rest of the census years manifested positive growth rates but of minimal increase. The minimal increase of annual growth rate is attributed by the geometric increase of population through birth and migration.

Table 2.4-2. Historical Population Growth Rate

Year	Population	Increase/Decrease	Municipal
1903	18,252		
1918	20,912	2,669	0.91
1939	26,409	5,497	1.12
1948	24,974	-1,435	-0.62
1960	33,424	8,450	2.46
1970	40,307	6,883	1.89
1975	42,419	2,112	1.03
1980	45,070	2,651	1.22
1990	51,501	6,431	1.34
1995	53,639	2,138	0.82
2000	59,046	5,407	0.01
2007	61,024	1,978	0.47
2010	61,199	175	0.1

Source: National Statistics Office

Projections made on population by barangay shows that rural barangays will have the most population over the urban barangays. It reveals that Binalan, Dodan, Paddaya, Tallungan and Toran are densest barangays and barangay Plaza will be the least dense among the rural barangays. In the urban area, Barangay Minanga, Maura, Macanaya, Punta, and San Antonio are expected the densest and barangay Centro 03 will be the least dense. These identified densest barangays both urban and rural must be significantly considered in programs and projects implementation within the planning period and in the future because it is where population influx and more demands on basic services be provided.

Table 2.4-3. Projected Population by Barangay Year 2015 – 2024 and Year Population Doubling Time

Barangay	Participation rate	2015	2016	2017	2018	2019	2024	2038
Centro 1	0.0106	663	665	667	668	670	682	1,252
Centro 2	0.0090	561	563	565	567	569	579	1,063
Centro 3	0.0014	85	86	86	88	89	90	165
Centro 4	0.0027	166	166	167	170	171	174	319
Centro 5	0.0047	294	295	294	296	297	303	555
Centro 6	0.0059	367	369	370	372	373	180	697
Centro 7	0.0054	335	336	337	140	341	148	638
Centro 8	0.0048	297	298	299	102	303	109	567
Centro 9	0.0167	1,038	1,042	1,046	1,052	1,056	1,075	1,972
Centro 10	0.0024	152	153	153	151	152	155	283
Centro 11	0.0029	183	183	184	183	183	187	343
Centro 12	0.0025	153	154	154	158	158	161	295
Centro 13	0.0030	190	191	191	189	190	193	354
Centro 14	0.0046	286	287	288	290	291	296	543
Centro 15	0.0017	106	106	106	107	108	109	201
Macanaya	0.0759	4,732	4,749	4,766	4,781	4,798	4,884	8,963
Maura	0.1166	7,265	7,292	7,318	7,344	7,370	7,504	13,770
Minanga	0.0258	1,605	1,611	1,617	1,625	1,631	1,660	3,047
Punta	0.0691	4,308	4,323	4,339	4,352	4,368	4,447	8,160
San Antonio	0.0676	4,209	4,225	4,240	4,258	4,273	4,350	7,983
Total Urban		**26,994**	**27,092**	**27,189**	**27,293**	**27,391**	**27,886**	**51,170**
Backiling	0.0191	1,192	1,197	1,201	1,203	1,207	1,229	2,256
Bangag	0.0239	1,488	1,493	1,499	1,505	1,511	1,538	2,822
Binalan	0.0355	2,211	2,219	2,227	2,236	2,244	2,285	4,192
Bisagu	0.0225	1,400	1,405	1,410	1,417	1,422	1,448	2,657
Bukig	0.0152	947	950	953	957	961	979	1,795
Bulala Norte	0.0151	941	945	953	951	955	973	1,783
Bulala Sur	0.0113	706	709	711	712	714	727	1,334
Caagaman	0.0238	1,481	1,486	1,491	1,499	1,504	1,532	2,811
Dodan	0.0357	2,224	2,232	2,241	2,249	2,257	2,297	4,216
Fuga Island	0.0357	1,829	1,835	1,842	1,845	1,852	1,886	3,460
Gaddang	0.0316	1,969	1,976	1,983	1,990	1,997	2,034	3,732
Linao	0.0316	1,821	1,828	1,835	1,839	1,846	1,879	3,448
Mabanguc	0.0316	1,024	1,027	1,031	1,033	1,037	1,055	1,937
Navagan	0.0316	858	861	864	869	872	889	1,630
Paddaya	0.0316	3,135	861	3,158	3,168	3,180	3,237	5,940
Paruddun Norte	0.0316	1,483	1,488	3,158	1,499	1,504	1,532	2,811
Parrudun Sur	0.0316	1,222	1,226	1,231	1,235	1,239	1,261	2,315
Plaza	0.0316	718	720	723	724	727	740	1,358
Tallungan	0.0316	3,103	3,115	3,126	3,137	3,148	3,205	5,881
Toran	0.0316	3,162	3,173	3,184	3,193	3,205	3,263	5,987
Sanja	0.0316	1,395	1,400	1,405	1,411	1,416	1,442	2,645
Zinarag	0.0316	1,006	1,009	1,013	1,014	1,018	1,036	1,901
Total Rural		**35,314**	**35,441**	**35,569**	**35,686**	**35,819**	**36,464**	**66,922**

Source: National Statistics Office

In consideration with the physical land area of 28,664 hectares and the 2010 population of 61,199; the municipality has a gross density of 2 persons per hectare. This shows that the municipality is not so urbanized and still have wide land area for its growing population to search and occupy. The rural density is 1 person per hectare and the densest are Tallungan and Linao followed by Zanja and Toran. Barangay Fuga Island is the least dense of 0.17 person per hectare. The urban density is 36 persons per hectare. This means that there is more population count in every hectare of land area in the urban core. The high density of the urban as compared to the rural despite the wider land area of the rural area is the tendency of population to prefer their stay at the urban for their daily economic activities especially those whose inclination are doing business and services. Among the barangays in the urban, Maura is the densest and Macanaya is the least dense.

Presented in **Table 2.4-4** is the comparison between the result of NSO census for census years 2000 and 2010 on Household population urban and rural and average household size. It is observed that an increase of 2,154 population from the overall total of census year 2000 is attributed by the geometric increase on population by migration and natural birth. It is further noted that urban population also manifest a very minimal increase of 109 while rural population had the most increase of 2,045. This trend of increase is also through to the number of households for both census years- the urban had increased by 25 households while the rural had 366 households. The increase of both population and households is tantamount to provision of additional major basic facilities and services on the part of the local government to sustain socio-economic development of the municipality.

Table 2.4-4. Household Population by Urban and Rural Barangay and Average Household Size, Year 2000 and 2010

Barangays	2000 Population	2000 Household	Average HH Size	2010 Population	2010 Household
TOTAL	**59,045**	**11,019**	**5**	**61,199**	**12,782**
Urban					
Centro 1	626	112	6	981	174
Centro 2	532	104	5	388	84
Centro 3	81	13	6	56	26
Centro 4	157	25	6	131	37
Centro 5	279	47	6	183	42
Centro 6	348	55	6	260	65
Centro 7	317	60	5	296	69
Centro 8	281	68	4	172	48
Centro 9	984	196	5	1,044	173
Centro 10	144	31	5	132	25
Centro 11	173	40	4	217	50
Centro 12	145	32	5	137	47
Centro 13	180	31	6	134	29
Centro 14	271	55	5	280	51
Centro 15	100	27	4	8	45
Macanaya	4,484	877	5	5,121	904
Maura	6,885	1,226	6	6,256	1339
Minanga	1,521	271	6	1,631	318
Punta	4,082	852	5	4,437	936
San Antonio	3,989	847	5	3,824	764
Urban Total	**25,579**	**4,969**	**5**	**25,688**	**5226**
Backiling	1,130	238	5	1,194	250
Bangag	1,410	259	5	1,612	372
Binalan	2,095	401	5	2,104	481
Bisagu	1,327	243	5	1,517	319

Barangays	2000 Population	2000 Household	Average HH Size	2010 Population	2010 Household
Bukig	897	157	6	797	169
Bulala Norte	892	183	5	808	182
Bulala Sur	669	134	5	808	181
Caagaman	1,403	240	6	1,447	305
Dodan	2,108	327	6	2,182	432
Fuga Island	1,733	312	6	1,884	471
Gaddang	1,866	278	7	1,976	435
Linao	1,726	305	6	1,533	392
Mabanguc	970	186	5	1,010	220
Navagan	813	144	6	962	191
Paddaya	2,971	526	6	3,374	687
Paruddun Norte	1,406	243	6	1,469	315
Parrudun Sur	1,158	215	5	1,075	248
Plaza	680	131	5	786	176
Tallungan	2,941	531	6	3,285	613
Toran	2,996	577	5	3,131	613
Sanja	1,322	213	6	1,553	266
Zinarag	953	207	5	1,004	238
Rural Total	**33,466**	**6,050**	**6**	**35,511**	**7,556**

Source: National Statistics Office, CBMS 2010

From the year 2000 results of census, the municipality recorded a population of 59,045 and 11,019 households. With a computed 1.010% annual growth rate, projected population from year 2010 to 2019, 2024 will sustain increase and it is expected the population will double on year 2038. With this trend, it is foreseen that socio-economic activities will also increase, and more development must be initiated to cope up with the increasing demands of population later. Local planners must develop a responsive plan to the ever-changing environmental situations brought about by the increasing population, climate change and turbulent advancement of science and technology **(Table 2.4-5)**.

Table 2.4-5. Census Population and Number of Households Year 2000 and Projected Population and Households, Year 2010 - 2019, 2024 and 2038

Year	Population	Household
2000	59,045	11,019
2010	61,199	12,782
2013	61,862	13,471
2014	62,085	13,519
2015	62,308	13,568
2016	62,533	13,617
2017	62,984	13,666
2018	62,758	13,714
2019	63,210	13,764
2024	64,353	14,014
2038	118,092	21,471

Source: National Statistics Office and Projected through standard geometric formula

The municipal population for year 2010 was 61,199 which is composed of 35,334 labor force and 25,864 dependent population. In the labor force, 50.87 percent are male and 49.13 are female. These percentages of working age population are the independent wherein socio-economic activities of the municipality are determined. However, some of these are un-employed seeking or waiting for jobs to be offered by the government and investors within and outside the municipality. Others are either

employed in the government, private sectors or self-employed. For the dependent population, 51.03 percent are male, and 48.97 percent are female. These are the young whose age ranges from 0-14 and the old's 65 and over and known to be helpless without the independents to support their needs in life. The young dominate the dependent population over the old's. The overall dependency ratio is 1:73; the young dependency ratio and old dependency ratio are 1:65 and 1:12 respectively. The sex composition of the population is also observed that from under 1 year old to 49 years old, the male is more than the female. For the succeeding group age, female is already more than the male that is commonly attributed to the exposure of men to the pressure of earning a living for the family **(Table 2.4-6)**.

Table 2.4-6. Population by Age Group, Gender, and Labor Force

Age group	Male		Female		Total
	Number	%	Number	%	
Under 1	1,152	55.66	917	44.34	2,069
1 – 4	3,006	52.77	2,690	47.23	5,695
5 – 9	3,940	51.27	3,745	48.73	7,684
10 – 14	3,823	51.54	3,596	48.46	7,419
15 – 19	3,263	51.34	3,093	48.66	6,356
20 – 24	2,678	50.96	2,578	49.04	5,256
25 – 29	2,254	50.94	2,171	49.06	4,426
30 – 34	1,995	51.43	1,884	48.57	3,879
35 – 39	1,958	51.39	1,852	48.61	3,810
40 – 44	1,768	49.26	1,821	50.74	3,589
45 – 49	1,523	52.24	1,392	47.76	2,915
50 – 54	1,055	49.30	1,085	50.70	2,140
55 – 59	719	49.18	743	50.82	1,462
60 – 64	720	48.00	780	52.00	1,501
65 – 69	489	44.91	600	55.09	1,089
70 – 74	352	41.41	499	58.59	851
75 – 79	232	43.75	299	56.25	531
80 & Over	205	38.98	321	61.02	527
TOTAL	**31,133**	**50.87**	**30,066**	**49.13**	**61,199**
Total Labor Force (15-64)	**17,934**	**51.00**	**17,400**	**49.00**	**35,334**
Total Young Population (0-14)	**11,920**	**52.00**	**10,947**	**48.00**	**22,867**
Total Old Population (65 & above)	**1,279**	**43.00**	**1,718**	**57.00**	**2,997**
Total Dependents	**13,199**	**51.03**	**12,666**	**48.97**	**25,86**
Age Dependency Ratio			**1:73**		
Young Dependency Ratio			**1:65**		
Old Dependency Ratio			**1:12**		

Source: National Statistics Office

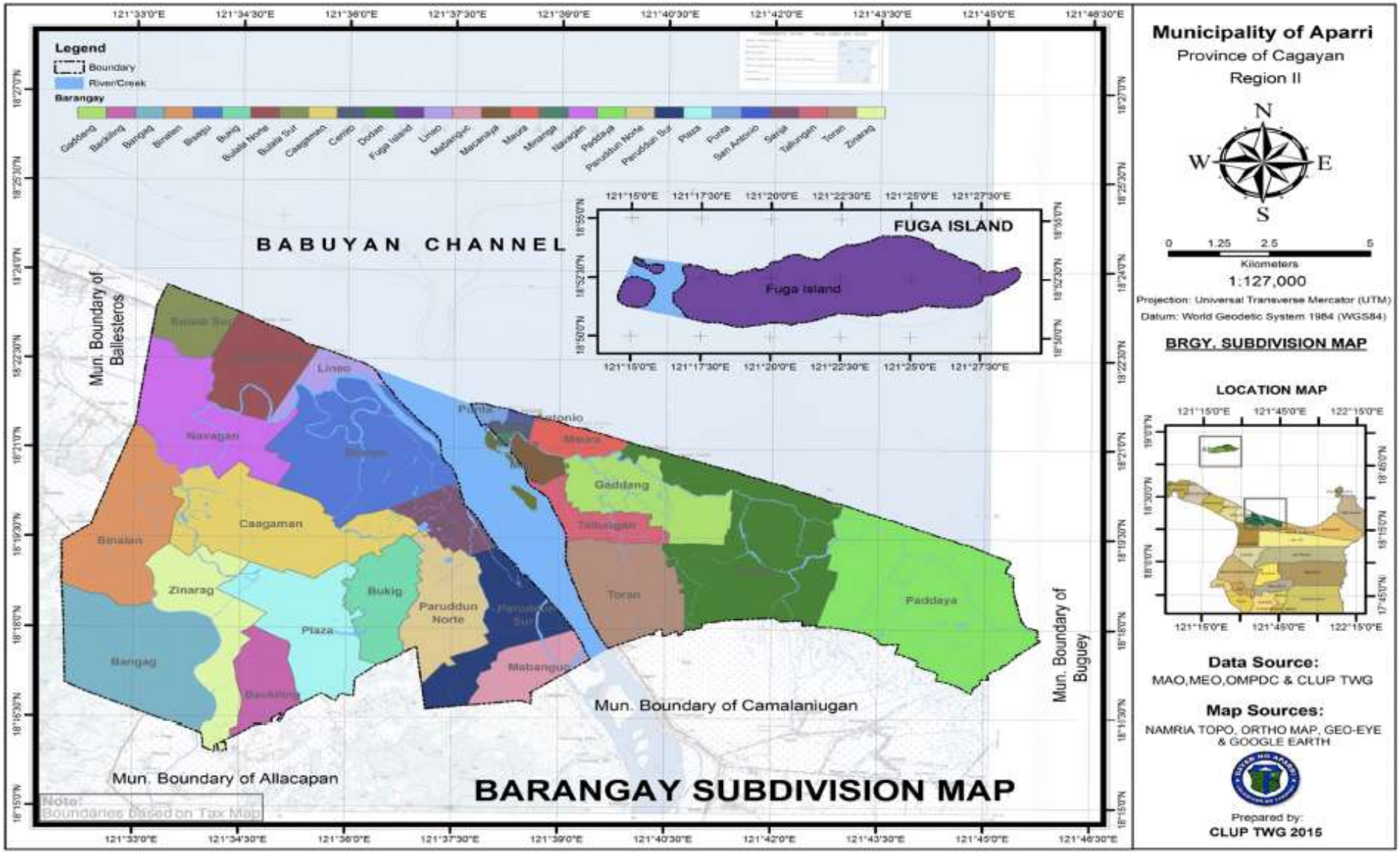


Figure 2.4-1. Barangay Boundery Map of Aparri *Source: Aparri CLUP 2014-2024*

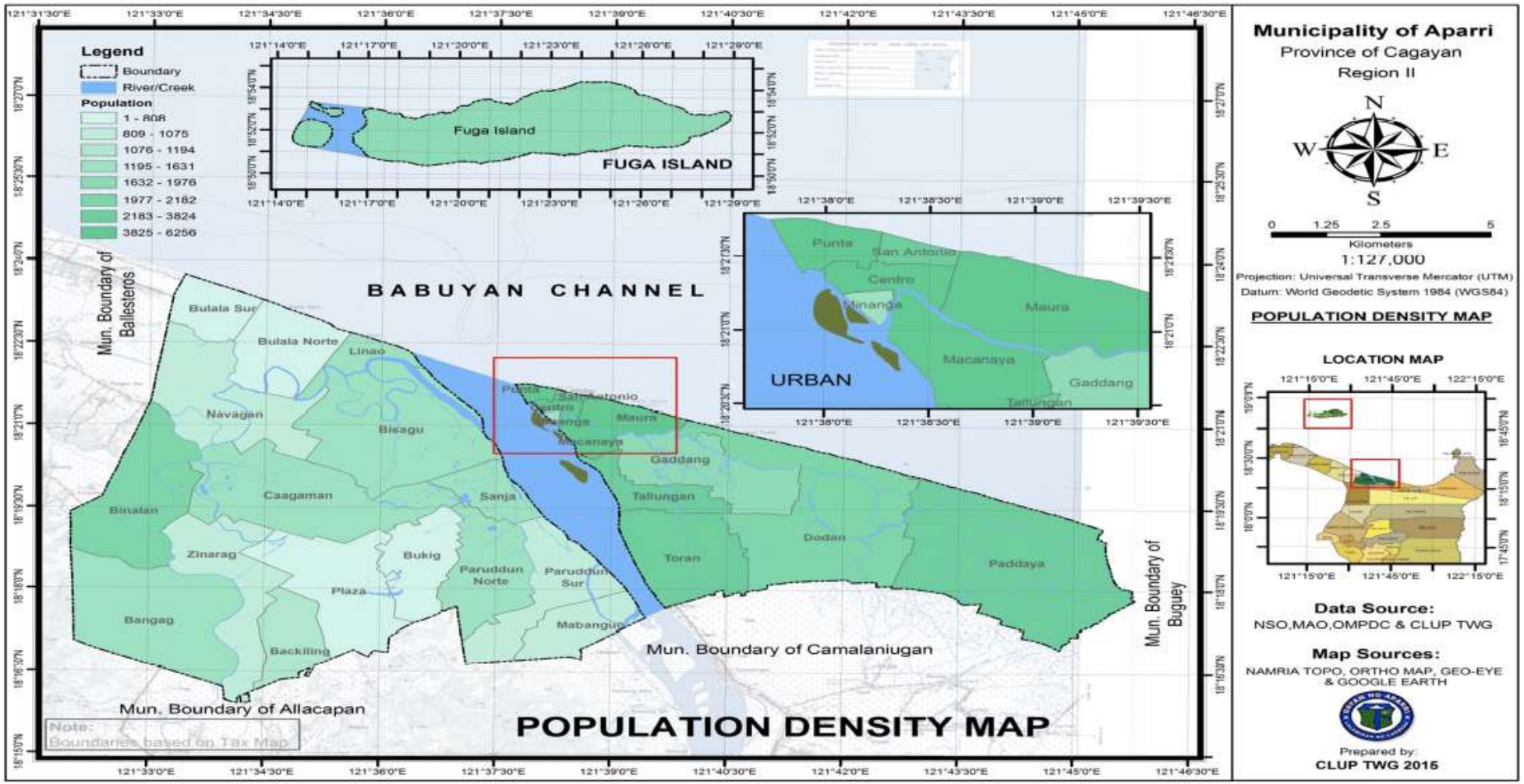


Figure 2.4-2. Population Density Map of Aparri *Source: CLUP 2014-2024*

MUNICIPALITY OF BUGUEY

Municipality of Buguey is a third (3rd) class municipality in the Province of Cagayan politically subdivided into 30 barangays comprising of thirteen (13) coastal barangays and seventeen (17) non-coastal barangays with a total land area of 16,450.05 hectares. According to the 2015 Census of Population (POPCEN), the municipality has a total population of 30, 175 people with an annual growth rate of 1.12% and the population density is computed at 180 inhabitants per square kilometer or 470 inhabitants per square mile. This represented 2.52% of the total population of Cagayan Province or 0.87% of the Cagayan Valley region. The available data gathered from the Municipality of Buguey was based on their Comprehensive Land Use Plan (CLUP) 2016 – 2025.

In addition to the population size, growth rate, and density, according to the 2012 Registry System on Basic Sector in Agriculture (RSBSA) census, Buguey, in 2012, has population size of 29,578 with an average population growth rate of 1.95% between 2010 – 2012. It has a population density of 1.79 person per hectare. The municipality will double its population by 2048 given the population growth rate mentioned above.

The figure below (**Figure 2.4-3**) showed the historical growth of population from 1903-2012, while **Table 2.4-7** showed the projected population from 2016-2025. The computed population growth rate of 1.95% used in projecting population, was derived based on 2010 NSO Census on Population and the 2012 RSBSA census on population. **Table 2.4-8** showed the population density of Buguey per barangay as of 2012 while **Figure 2.4-5** shows the population density map of Buguey. This map indicates that the coastal municipality of Buguey shaded in dark red are the most densely populated areas in Buguey having more than 1,000 persons per square kilometer.

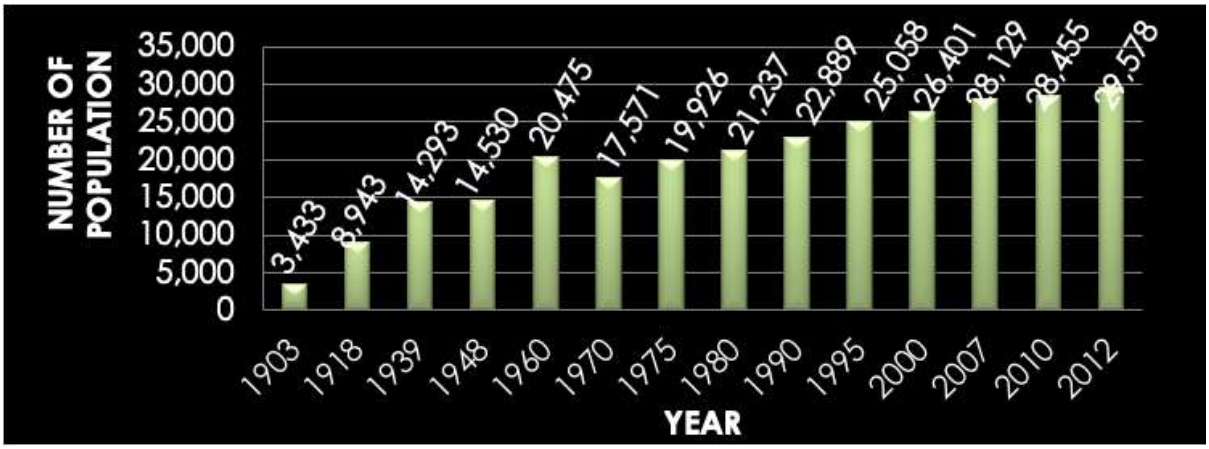


Figure 2.4-.3 Historical Population Growth of Buguey, 1903-2012
Source: National Statistics Office (NSO) RSBSA Census / Buguey CLUP 2016-2025

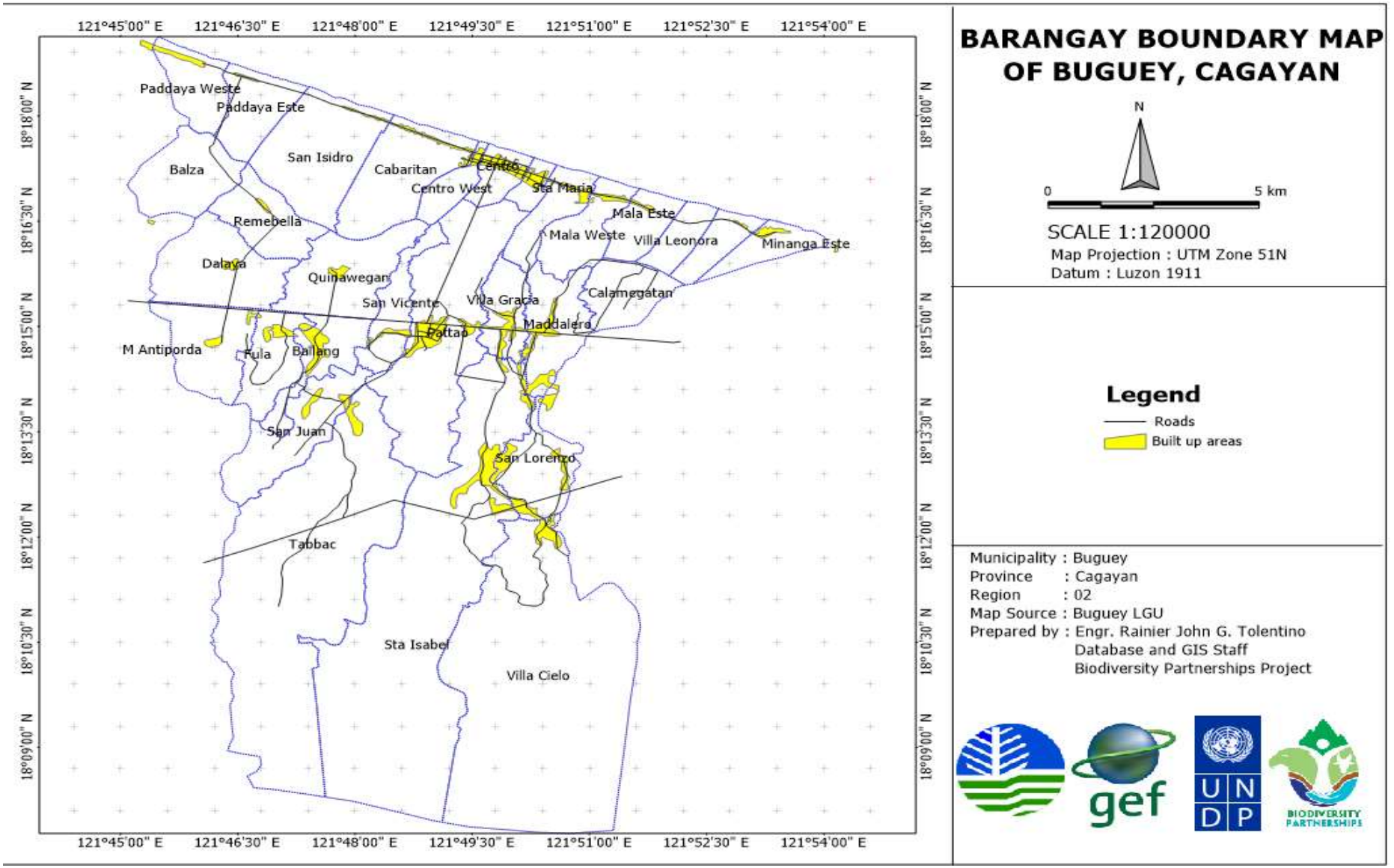


Figure 2.4-4. Barangay Boundery Map of Buguey *Source: Buguey CLUP 2016-202*

Table 2.4-7: Projected Population of Buguey, 2016-2025

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Urban Barangays										
1. Centro	2,253	2,297	2,341	2,387	2,434	2,481	2,529	2,578	2,629	2,680
2. Centro West	719	733	747	762	777	792	807	823	839	855
3. Leron	1,863	1,899	1,936	1,974	2,013	2,052	2,092	2,133	2,174	2,217
4. Pattao	3,288	3,352	3,418	3,484	3,552	3,621	3,692	3,764	3,837	3,912
5. Sta. Isabel	1,038	1,059	1,079	1,100	1,122	1,144	1,166	1,189	1,212	1,236
6. San Lorenzo	901	919	937	955	973	992	1,012	1032	1,052	1,072
7. Sta. Maria	757	772	787	802	818	834	850	867	883	901
8. Tabbac	834	850	867	884	901	919	936	954	973	992
Sub-total	**11,653**	**11,881**	**12,112**	**12,348**	**12,590**	**12,835**	**13,084**	**13,340**	**13,599**	**13,865**
Rural Barangays										
1. Ballang	553	564	575	586	597	609	621	633	646	658
2. Balza	323	329	335	342	349	355	362	369	376	383
3. Cabaritan	818	834	850	867	884	901	919	937	955	974
4. Calamegatan	764	779	794	809	825	841	858	875	892	909
5. Dalaya	907	925	943	962	980	999	1,019	1,039	1,059	1,080
6. Fula	1,182	1,205	1,229	1,253	1,277	1,302	1,328	1,354	1,380	1,407
7. M. Antiporda	706	720	734	748	763	778	793	808	824	840
8. Maddalero	1,719	1,753	1,787	1,822	1,857	1,893	1,930	1,968	2,006	2,045
9. Mala Este	438	446	455	464	473	482	492	501	511	521
10. Mala Weste	1,035	1,055	1,076	1,097	1,118	1,040	1,162	1,185	1,208	1,232
11. Minanga Este	1,329	1,355	1,382	1,409	1,436	1,464	1,493	1,522	1,552	1,582
12. Minanga Weste	1,751	1,785	1,820	1,855	1,892	1,929	1,966	2,004	2,044	2,083
13. Padddaya Este	754	769	784	799	815	831	847	864	881	898
14. Paddaya Weste	1,013	1,033	1,053	1,073	1,094	1,116	1,137	1,159	1,182	1,205
15. Quinawegan	978	997	1,016	1,036	1,056	1,077	1,098	1,119	1,141	1,163
16. Remebella	729	743	757	772	787	802	818	834	850	867
17. San Isidro	991	1,010	1,030	1,050	1,070	1,091	1,112	1,134	1,156	1,178
18. San Juan	498	508	518	528	539	549	560	571	582	593
19. San Vicente	1,339	1,365	1,392	1,419	1,446	1,475	1,503	1,532	1,562	1,593
20. Villa Cielo	959	977	996	1,016	1,036	1,056	1,076	1,097	1,118	1,140
21. Villa Leonora	789	805	820	836	853	869	886	903	921	939
22. Villa Gracia	725	739	754	769	784	799	814	830	846	863
Sub-total	**20,300**	**20,696**	**21,100**	**21,512**	**21,931**	**22,358**	**22,794**	**23,238**	**23,692**	**24,153**
GRANDTOTAL	**31,953**	**32,577**	**33,212**	**33,860**	**34,519**	**35,192**	**35,879**	**36,578**	**37,291**	**38,018**

Source: RSBSA Census, 2012 / Buguey CLUP 2016-2025

Table 2.4-8: Total Population, Land Area and Population Density per Barangay, 2012

Barangays	Total Population	Total Land Area (Has)	Population Density
Urban Barangays			
Centro	2,085	98.525	21.16 person/ha
Centro West	666	122.767	5.42 person/ha
Leron	1,723	82.562	20.87 person/ha
Sta. Maria	701	22.805	30.74 person/ha
Pattao	3, 044	871.284	3.49 person/ha
Sta. Isabel	961	1,691.399	0.57 person/ha
San Lorenzo	834	205.971	4.05 person/ha
Tabbac	772	2,224.275	0.35 person/ha
Rural Barangays			
Ballang	511	192.823	2.65 person/ha
Balza	300	387.774	0.77 person/ha
Cabaritan	757	453.920	1.67 person/ha
Calamegatan	706	458.556	1.54 person/ha
Dalaya	841	541.754	1.55 person/ha
Fula	1,095	324.635	3.37 person/ha
Maddalero	654	363.063	1.80person/ha
M. Antiporda	1,592	286.223	5.56person/ha
Mala Este	406	78.580	51.7 person/ha
Mala Weste	959	466.131	2.06 person/ha
Minanga Este	1,229	123.752	9.93 person/ha
Minanga Weste	1,681	88.054	18.41 person/ha
Paddaya Este	697	356.187	1.96 person/ha
Paddaya Weste	938	257.926	3.64 person/ha
Quinawegan	904	506.260	1.78 person/ha
Remebella	674	229.082	2.94 person/ha
San Isidro	917	819.013	1.12 person/ha
San Juan	461	650.810	0.71 person/ha
San Vicente	1,240	369.459	3.36 person/ha
Villa Cielo	887	1, 841.535	0.48 person/ha
Villa Gracia	731	213.860	3.42 person/ha
Villa Leonora	678	160.196	4.23 person/ha
Total Population (a.o. 2012)	**29,578**		
Water Bodies/Inland Water		**1,960.872**	
Total Land Area		**16,450.053/has**	
Gross Density			**1.79 person /ha**

Source: RSBSA Census, 2012 / Buguey CLUP 2016-2025

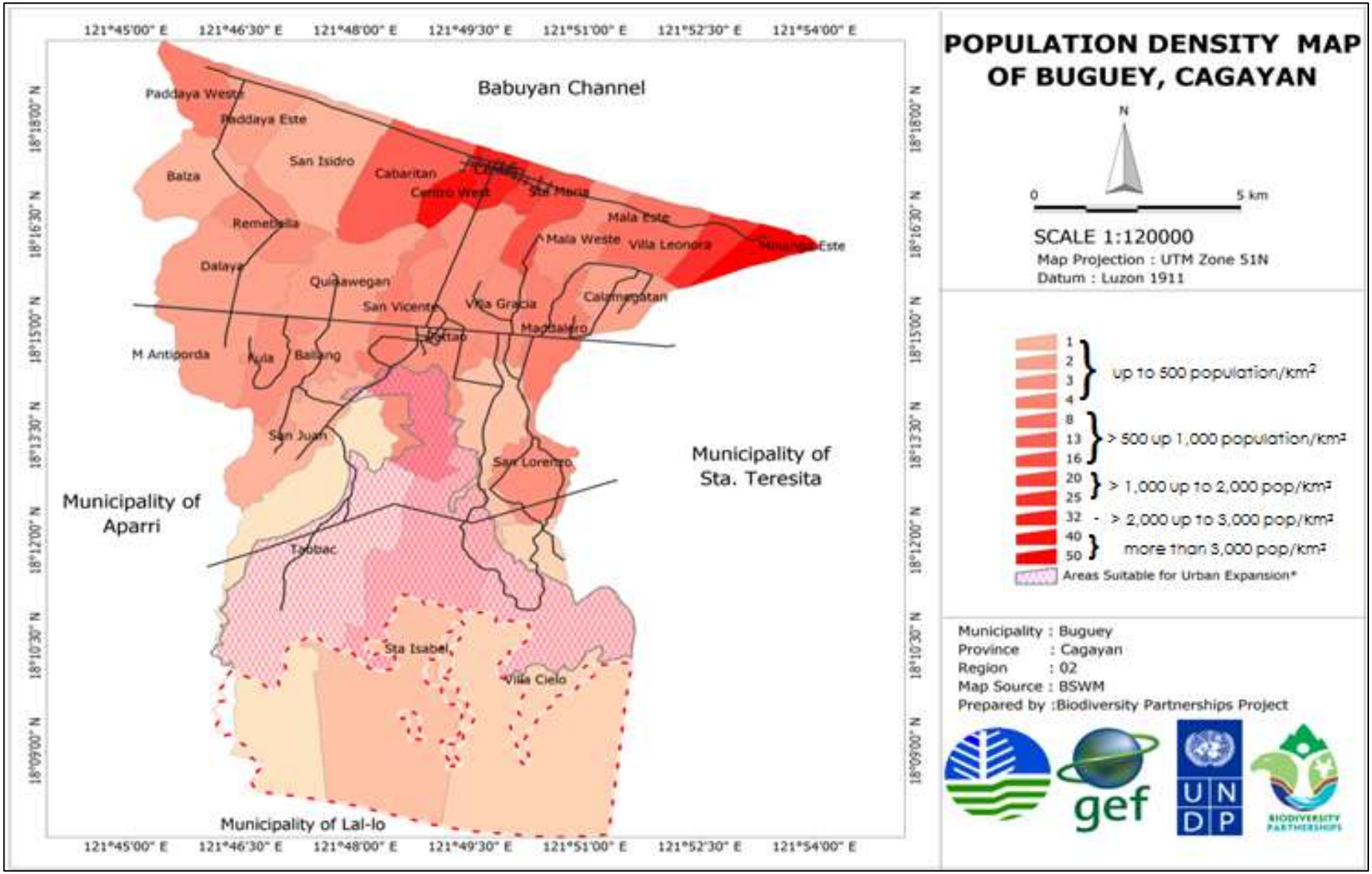


Figure 2.4-5. Population Density Map of Buguey *Source: Buguey CLUP 2016-2025*

With regards to the population distribution in the Municipality of Buguey, Barangay Pattao, an urbanizing area, is the most populated barangays with 3,044 population. The large population is attributed to the strategic location of the barangay and its role as the gateway to the municipality. Barangay Centro, the seat of the municipal government, is the second most populated area with 2,085 population followed by barangay Leron, an urban core area, with 1,723 population. On the other hand, Balza is the least populated with 300 population. The small population is attributed to its physical attribute as flood prone area. Mala Este is the second least populated area with 406 population followed by Barangay San Juan with 461 population. These barangays are typically rural, and households are dispersed. **Table 2.4-9** showed the population distribution per barangay in Buguey.

Table 2.4-9. Population Distribution by Barangay, 2012

Barangays	Total Population
Urban Barangays	
1. Centro	2,085
2. Centro West	666
3. Leron	1,723
4. Pattao	3,044
5. Sta. Isabel	961
6. Sta. Maria	701
7. Tabbac	772
8. San Lorenzo	834
Sub Total	**10,786**
Rural Barangays	
1. Ballang	511
2. Balza	300
3. Cabaritan	757
4. Calamegatan	706
5. Dalaya	841
6. Fula	1,095
7. M. Antiporda	1,592
8. Maddalero	1,654
9. Mala Este	406
10. Mala Weste	959
11. Minanga Este	1,229
12. Minanga Weste	1,621
13. Padday Este	697
14. Paddaya Weste	938
15. Quinawegan	904
16. Remebella	674
17. San Isidro	917
18. San Juan	461
19. San Vicente	1,240
20. Villa Leonora	672
21. Villa Gracia	731
22. Villa Cielo	887
Subtotal	**18,792**
TOTAL	**29,578**

Source: RSBSA Census, 2012 / Buguey CLUP 2016-2025

Population by sex composition in the Municipality of Buguey based on RSBSA 2012 census indicated a male to female ratio of 0.98:1 or 49.53% of the population is male and 50.47% of the population is female. The municipality has young population as indicated in the broad base of the population pyramid **(Figure 2.4-6)**. The young population aged 0-19 years old constitute about 42.68% of the total population.

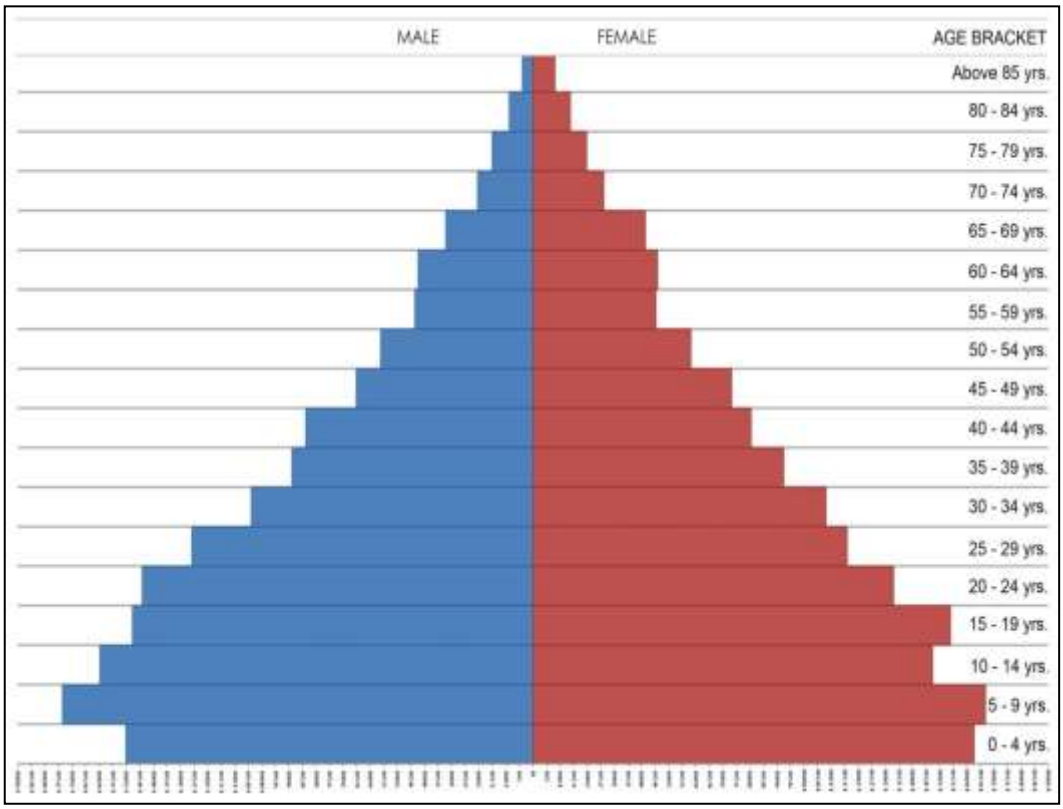


Figure 2.4-6. Distribution of Population by Age Group and by Gender, 2012
Source: RSBSA Census, 2012 / Buguey CLUP 2016-2025

The dependent young population (0-14 years old) constitute about 30.73% or 9,089 of the total population while the dependent old population (65 years old and over) constitute about 6.39% or 1,890 of the total population. Dependent women population constitute about 21.54% or 6,372 of the total population.

Of the total population of 29,578, about 61.65% or 18,235 is in the labor force. The age group that has the most number in the labor force is 35-44 years old constituting about 28.24% or 5,150 of the labor force while the least is age group 15-24 accounting for 10.60% or 1,933 of the labor force. Women constitute about 46% or 8,389 of the labor force. The agriculture sector employed about 61.35% or 8,798 of the working population, the service sector absorbed about 25.58% or 3,669 of the working population and the industry sector employed about 13.07% or 1,875 of the working population. Women constituting about 43.88% or 6,293 of the working population.

The Municipality of Buguey has a conglomeration of ethnic groups that speaks several dialects. However, majority of the population speak Ilocano. The 2010 NSO records show that about 77.74% of the population speak Ilocano, 12.14% speak Tagalog, 6.3% speak *Ibanag*, and the remaining 3.82% speak either Pampanga, *Pangasinense*, *Waray*, Bicol or *Isneg*. In terms of religious affiliation, majority of the residents are Roman Catholics accounting to about 91.60%, Iglesia Ni Cristo of about 3% and the remaining 5.4% are either, Jehova's Witnessess, United Methodist Church, Seventh Day Adventist, Born Again Christian, Protestant, Baptist, Aglipay, and Islam.

MUNICIPALITY OF GONZAGA

The Municipality of Gonzaga is one of the coastal municipalities in the Province of Cagayan with a total of 25 barangays. It is also of the first (1st) class municipality in Cagayan Province with a total land area of 567.43 square kilometers or 219.09 square miles which constitutes 6.10% of Cagayan's total land area. In the 2015 Census of Population, Gonzaga has a total population of 38,892 people with an annual growth rate of 1.32%. Population density computed at 69 inhabitants per square kilometer or 178 inhabitants per square mile, representing 3.24% of the total population of Cagayan Province and 1.13% of the overall population of the Cagayan Valley region. The available data gathered from the Municipality of Gonzaga was based on their Comprehensive Land Use Plan 2013 – 2022.

In addition to their demographic data, based on the 2010 official census of the National Statistics Office (NSO), the municipality of Gonzaga has a population of 36.303 with a computed annual growth rate of 1.24%. it is projected that the municipal population will be at 40,037. **Table 2.4-10** showed the historical growth of population in the Municipality of Gonzaga. It also has a total household of 8,075 with an average size of 4.71 or 5 members per household.

The population distribution of the municipality is unevenly distributed to the 25 barangays. The four (4) urban barangays composed of Flourishing (Poblacion), Paradise (Poblacion), Progressive (Poblacion), and Smart (Poblacion) have an aggregate population of 7,098 or 19.55% of the total municipal population; the rest, all the rural barangays have an aggregate population of 29,205 or 80.44% equivalent of the total population.

Table 2.4-10. Gonzaga Historical Growth of Population

Year	Population	Increase or Decrease	Growth rate for the locality	Growth rate		
				Provincial	Regional	National
1918	3,339			1.73	1.1	2.02
1939	8,682	5,343	4.65	2.03	2.62	2.11
1948	10,811	2,129	2.47	0.69	1.21	2.06
1960	12,519	1,708	1.23	3.03	3.7	2.87
1970	17,688	5,169	3.52	2.7	3.51	3.03
1975	19,316	1,628	1.79	2.07	2.62	2.75
1980	22,469	3,153	3.07	2.01	2.75	2.66
1990	26,498	4,029	1.66	1.55	2.01	2.33
1995	27,997	1,499	1.11	1.52	1.51	2.32
2000	32,079	4,082	2.76	2.26	2.25	2.36
2007	35,424	3,345	1.4	1.10	1.16	2.21
2010	36,303	879	.82	1.67	1.92	1.41

Source: Buguey CLUP 2013-2022

In terms of population by gender, the male has more number than the female with a total number and percentage of 18,101 (51%) and 17,323 (49%), respectively giving a sex ratio of 1:1.045. As presented in their CLUP 2013-2022, Gonzaga has a school going population with ages ranging from 3 to 21 with 14,818; working-age group with ages 15-64 numbering to 21,090; labor force with ages 15 and over numbering to 23,193; dependent population-young (0-14) with 12,301 and old (65 and above) with 2,033. From the school going population group, 3,319 or 22% belongs to day care and pre-school ages (3-5 years old); 4,874 or 33% are elementary school ages (6-11 years old); 3,030 or 20.6% belongs to the Junior High School ages (12-15 years old); 1,896 or 12.9 % belongs to Senior High School and 2,171 or 14.8 % are tertiary-school ages (18-21 years old). Of the population 5 years old and over, 88 % or 31,187 are literate or able to read and write.

Dependent population is 14,334 with 12,301 young population and 2,033 old population. Meanwhile, 21,090 composed the working age population. Labor Force of the municipality is composed of 11,687 males and 11,436 females, total of 23,123.

The municipality is a conglomerate of various dialects that originate from diverse ethnic groups within the country. Hence, Ilocano dominates the mother's tongue with 82% of the 2010 population. This is followed by Tagalog and Ibanag with 3% and 1%, respectively. Other ethnic groups are evident however these are of minimal number. In terms of religion, Roman Catholic has dominance over other sectors representing 73% followed by Iglesia ni Cristo and Church of Christ with 4.9% and 3.3, respectively. Other religious affiliation has insignificant numbers.

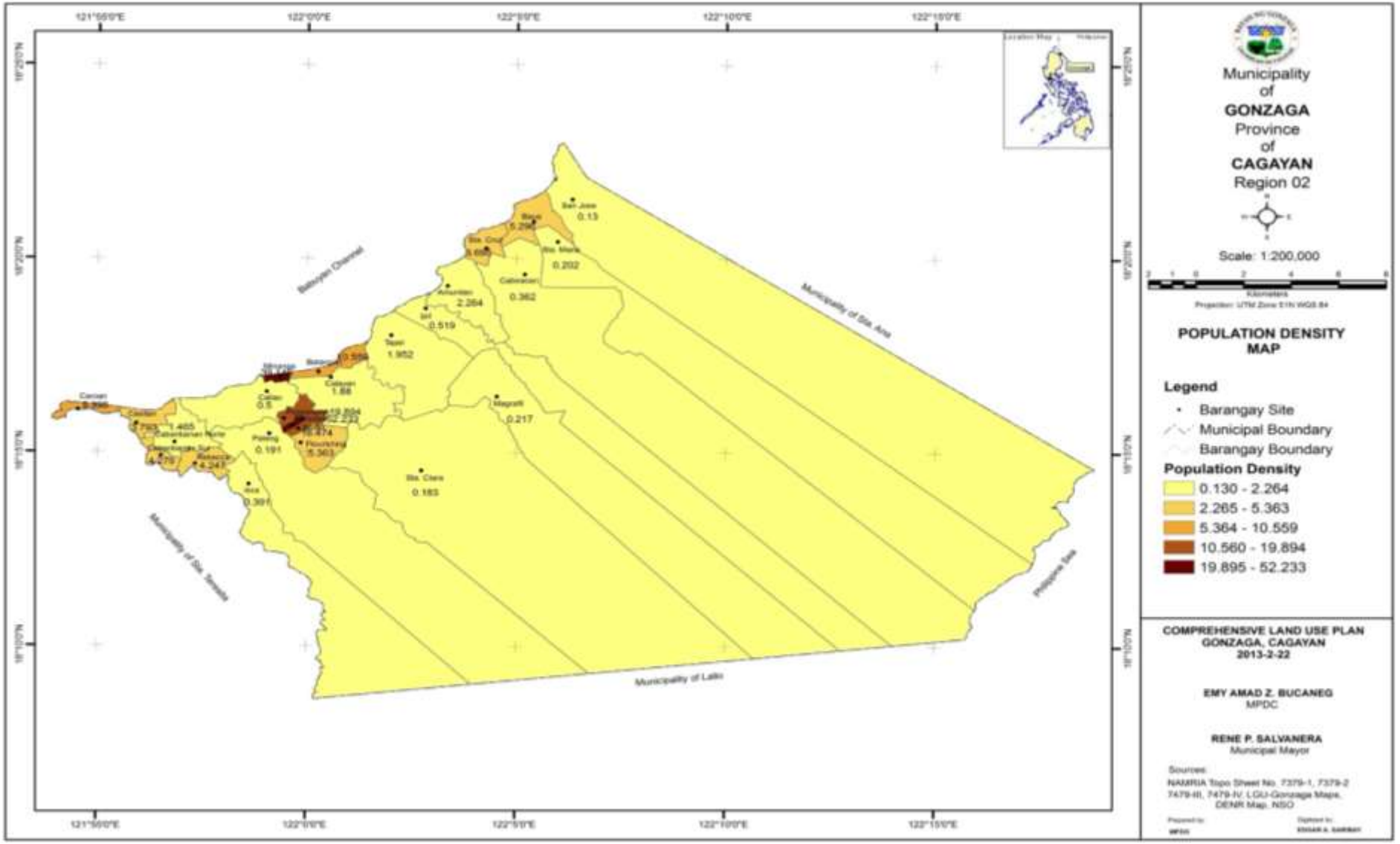


Figure 2.4-7. Population Density Map of Gonzaga *Source: Gonzaga CLUP 2013-2022*

2.4.2 In-migration

One possible impact of development in an area is in-migration. Presence of opportunities for jobs and livelihood brought by the project activity will invite workers from other areas to migrate in the impact communities. Influx of workers from other areas is expected during the commercial operation phase with the introduction of other economic activities related to the operations.

In-migrants will add to the continuously increasing population of the Barangays and Municipalities. The natural increase in population in the areas will already cause competition in accessing the basic services and available economic opportunities in the areas. With the entry of in-migrants, further competition in terms of local employment, public utilities, and access to basic services will be experienced.

To mitigate potential impacts due to in-migration, the following management measures shall be implemented:

- Implement priority local hiring policy for qualified local workers.
- Coordinate with barangay or/and municipal LGU as to relevant ordinance on providing opportunities for local employment.
- Conduct consultation with barangay LGUs on requirements and process of hiring to maximize employment of residents.
- Require and monitor contractor commitments on providing local employment.
- Coordination with the municipal and barangay peace and order councils to ensure peace and order; and,
- Coordination meetings shall also be undertaken regularly with the LGUs to identify threats and vulnerabilities in the society as well as to develop programs to prevent foreseen social problems.

2.4.3 Cultural / Lifestyle Change (esp. Indigenous People, if any)

There were no identified Indigenous People groups within the host communities or its immediate vicinity during the conduct of the study. Also, the project is not expected to create a big impact in terms of changing or altering the lifestyle of the people in the affected communities.

The project and proponent aim to enhance the standard of living of those people especially the coastal barangays who will benefit from the project and those that will be hired by the company as they are provided with a stable livelihood and employment. The talents and skills of the existing residents may not be suitable or limited to supply to the needed manpower of the operations. Further, with the social development programs of the proponent, the host communities will also benefit from skills development and capacity building programs. This will ensure the employability of the impact barangay residents in the proposed project.

2.4.4 Impacts of Physical Cultural Resources

The project site is not within any tourism or recognized physical cultural resources and will not pose any direct effects on such sites, hence, it intends to partner with the local tourism office as well as other tourism agencies in programs that will enhance the host municipalities cultural resources.

Similarly, the proponent through responsible mining practices, it aims to set an example to the host communities/municipalities and encourage other stakeholders to support their programs on responsible mining and environmental protection.

The company will put up a Community Relations Office that will facilitate the community extension program of the company to the community. This will be responsible in seeing that no major detrimental alterations in any cultural values and practices will occur in the area.

2.4.5 Threat to Delivery of basic Services / Resource Competition

MUNICIPALITY OF APARRI

Power Utilities

Forty-one (41) barangays of Aparri is served by CAGELCO II while Fuga Island depend on electric generators. In 2013, CAGELCO II distributed power supply to 83% households while 17.25% unserved households were considered for potential future connections.

Households are the major consumers of electricity in the municipality. For year 2005 there were 11,179 households, 10,575 of which are with power connections ceding 2,520 households unserved with electricity. For year 2010 after 5 years there was a growth of household formation of 1,593 and the number of connections served with electricity as per CAGELCO II records was 11,320 this includes commercial, institutional, and industrial consumers. However, for households' connection shown in Community Based Management System (CBMS) survey, there were 10,016 which was lesser than the recorded connections for year 2005. This means that there were households that were disconnected by the Electric Cooperative. Likewise for year 2013 the municipality has households of 13,780 of which 12,629 were served with electricity while the remaining 2,198 were not yet accorded the power services. The noted consumers without electric connections are those that cannot afford to avail due to high cost of materials and those that are pending due to some concerns that impede tapping. Nonetheless, generally the municipality is said to be fully energized both the primary, tertiary, and secondary power lines that are available for immediate tapping.

Power supply for the municipality is expected to increase yearly as it goes along with the power consumption of consumers considering the increase of household formations and the foreseen growth of socio-economic activities of the population attributed by the expected increase of commercial, industrial and institutional establishments within the plan period.

Water Utilities

The municipality has various water system to supply demand for domestic, commercial, industrial, and institutional consumers. There are One Thousand Five Hundred Eighty (1,580) sources of domestic water supply of Aparrianos that are categorized as level – 1, level – II, level – III and other sources such as the purified mineral water and water bodies that are present in the locality. The urban area is served by Aparri Water District and some Level – I installed by the barangays and private individuals. The level – I water system is the most commonly available in the municipality wherein 704 units were established to various locations both urban and rural areas serving 24,406 population; there were 857 units that are established individually by households catering a 6,242 population. The rural area uses shallow wells and water stations except barangay Gaddang that use level – II water source distributed in fifty faucets located at various strategic places that benefit 202 households. The level – III water system caters water demands in the urban core and its neighboring barangays of which there are 4 pumping stations serving 6,944 population. Other source such as the presence of water purification processes- a commercial supply of drinking water in which 17processing plants are in the municipality providing safe drinking water for 23,170 population. As to potability of water for domestic use it can be assured considering the chlorination activities introduced by the Rural Health Units and the Aparri Water District (AWD), likewise, the various purification processes done by the processing plants.

Aside from level-1 to level-III water sources, an open dug well is a traditional way of water sourcing for residents is still practiced. Records shows that the whole municipality has 118 open dug wells used by the public of 7,337 population benefited and 48 are privately owned open dug wells serving 446 population. This type of water sourcing for domestic use is said to be doubtful considering its open exposure to environment and other foreign materials that may pollute or contaminate the water. Nonetheless, to make it safe, periodic chlorination is being undertaken by the municipal sanitation personnel.

There are several sources of irrigation water to twenty (20) barangays of the municipality. A total of 6,288.85 has. is served by various sources that benefit 3,293 farmers, as follows: The National Irrigation Administration extends water to 4,125.12 has; Open-Source Pump -1,102.45 has., Communal Irrigation System – 725.18 has., Small Water Impounding Project- 102 has., Small Farm Reservoir – 10 has, and Shallow Tube Wells – 223.60 has. The communal irrigation system located at sitio Caroronan, Binalan is managed by farmers' organization.

Educational Facilities

The education of the people of Aparri is provided by both government and private institutions. Public Elementary Schools compose of three (3) Zonal Districts specifically: Aparri East, Aparri West and Aparri South; these constitute thirty (30) complete elementary grade schools and five (5) primary level schools. There are three (3) private elementary schools. There are four (4) public high schools and four (4) private high schools in the secondary level. For the tertiary level, Aparri has one (1) state university, one (1) private college, one (1) government vocational/technical school and one (1) privately operated school that offers Religious Ministry course.

Public Schools in Aparri are strategically established in almost all the barangays. However, there are still instances wherein pupils and teachers use any available room to conduct classes and activities for Home Economics and Shop subjects. This is due to lack of resource funds by the government in putting up H.E. and Shop buildings separately.

It is observed too that some public schools have built-in classroom's comfort rooms while others maintain communal toilets located outside the building accessible to pupils. Although minimum standards for basic education were provided, there still a need for complete and upgraded existing educational facilities among elementary and primary levels considering the fast-changing technology for our generations to come up and at par with the education provided by other developed countries. These educational facilities be strategically installed in safe locations to avoid loss and destruction in times of disaster occurrence knowing that the municipality is disaster prone area. School buildings must be built sturdy enough to withstand any type of disaster.

Housing Facilities

The housing situation of the municipality for the last three census years (1990, 2000 and 2010) increases with the geometric growth of population through natural birth, migration, and new household formations through marriage. As of census year 1990, the occupied housing units was 9,476; this rose by 1,394 housing units for census year 2000. Again, there was an increase of 574 housing units for census year 2010 but lesser than year 2000. As to its ratio to households, it is said to be within the standards of 1:1 because it was on census year 1990 and 2000 that there was a slight increase. Likewise on ratio to population, data reveal that an average of less than six persons are staying in each occupied housing unit.

Most of these housing units are highly vulnerable to disaster specially the urban area wherein majority of settlements are along the coastal areas of the municipality. These are high risks to storm surge, tidal

wave, tsunami and most specially to typhoon. Hence, pre-disaster preparedness should always be in placed through construction of protective structures, buffer zones be developed along the coasts and residential houses and other housing units must be built to withstand the impact of climate change. Likewise housing units that are situated in a geo-hazard area should be resettled to safer places.

The municipality being urbanize and a coastal town of the province, there observed presence and increasing number of informal settlers along coastal barangays and most of it in the urban. The good ambiance of investment and economic activities such as business and trade, fishery that create employment to be economically active and survive are reasons of the rapid growth of these informal settlers in which population from other places flock in the municipality. The average number of years of their presence on the said private and public lands ranges from 15 to 30 years; this mean that within those years no one of them has the courage to take the initial step to own the residential land despite of the government's comprehensive housing program. Their long stay is a valid cause for the government to adapt measures for the resolution of informal settlers in order for them to own the residential lands presently occupied. The above table shows that 7.958 hectares are presently occupied by 679 household's informal settlers with approximate area of 0.012-hectare residential land per household. These areas occupied are now provided by major basic infrastructure facilities for them to live normal life though they do not own the land.

The current housing needs for the municipality is 641, this is expected to increase within the plan period (2015 to 2019 and 2024). The said increase is attributed by the growth of population, housing units that are made up of salvage and improvised construction materials and of those that are dilapidated and loss due to their obsolescence. A municipal shelter plan be formulated to address the housing demands of the population within the plan period.

Sports and Recreational Activities

Sports activities in the town are held most of the time at the public park and Municipal Gymnasium. The area of the Public Park comprises about 7,200 square meters which is far less than the existing standard requirement of 500 square meters for every 1000 population or equivalent to 30,599.5 square meters. The park is with sports and recreational amenities like children paraphernalia, tennis court, leisure walking and strolling lane, shades, bridge trellis, fountain, and canteens. Additional improvements are to be introduced in order to attract more sport and recreation enthusiasts to avail the park facilities thereby promoting local tourism destination.

Likewise, the Municipal Gymnasium has an area of about 1,686 square meters which also serve the venue of basketball tournaments, meetings, and other social and cultural activities. Its present physical condition needs improvement and get-up to provide more comfortable and presentable atmosphere. Furthermore, most barangays have no gymnasium, others have but are constructed within the school campus in which the barangays find it more practical to share their resources to provide places for school children to hold their social activities which the Department of Education (DepEd) cannot give.

These sports facilities be strategically established in a safe location to avoid loss and destroy in times of disaster occurrence knowing the municipality is disaster prone area. Areas vulnerable to disaster destroy and loss of any type must be provided with safety net structures, projects and programs that mitigate disaster impact to sustain sports and recreation development flow.

Internet café located at Centro 02, 11, 13, 14 and one (1) in Maura are to be monitored by proper authority to prevent preschoolers, elementary pupils, high school and college students during school days to indulge in recreation and playing games or worst with cybersex and social media pornography. Moreover, these internet cafés must be regulated mainly for school's projects and research purposes using the internet. This is considered a type of recreation facility and be strategically located in a safe

location to avoid loss and destroy and to protect owners, customers, pupils and students from any type of disaster and other geo-hazard calamities.

Communication Network

Information and communication facilities available in the municipality are postal services, internet providers, telephone services, cell sites networks and the broadcast and television relay networks. These are established at the urban core and its immediate vicinity. The postal services cater the municipality in the delivery of mails and packages. It includes money transfers, postal identification, philately, and other related services. Internet providers grew like mushroom due to the availability of communication cellular site networks wherein private individuals can avail, operate and own through an internet gadget with monthly rental to the cell site companies. A telephone service provider through landline services is catered by PLDT company that provides telephone services to institutions, commercial and industrial establishments, and residential consumers. There are 6 cell site networks that are within the municipality to provide communication services to mobile phones which most of the population has. These revolutionized the modern communication technology making information and communication faster in seconds and introduce drastic change of character and attitude to every individual as he is exposed to the outside world from its limited environment. A radio station and a television relay station are also evident in the municipality providing broadcast media information and communication for residents through radio area coverage and cable system respectively.

Roads and Transportation Network

Roads in the municipality are classified according to its maintenance and implementer. It has a total length of 159.685 kilometers of which 25.491 kilometers are National roads, 25.58 kilometers are Provincial Roads, 7.665 are Municipal Roads, and 100.672 kilometers are Barangay and Farm to Market Roads and 0.27-kilometer alleys. Out of its total length, 51.405 kilometers are concrete, 1.06 kilometers asphalt, 13.767 kilometers graveled, and 98.453 kilometers earth filled pavement. All these roads are in good and passable condition all through the year.

The creeks and river tributaries are traversed by bridges. There are four (4) bridges at the national roads, three (3) bridges at provincial roads, five (5) bridges at barangay roads, eight (8) bridges within the barangays and three (3) bridges at Japanese Friendship Highway.

There are one thousand two hundred (1,200) registered tricycles operating in the urban and rural barangays. Being a commercial and institutional center, they are always busy transporting passengers going to and from the different service centers.

Pedestrian crossing is located mostly in school zones and main roads in the business district. A number of streetlights are appreciated during nighttime because of well lighted streets, not only in the urban area but also in the rural area. These also help in the maintenance of peace and public order during nighttime. There is a need to increase the installation of street signages and directional signs in the urban and rural area to guide visitors coming in the municipality to easily locate places where they want to go.

There is no public terminal but there are roads designated for parking of jeepneys and other public transport. Buses and multi cabs are renting private lots for parking purposes. There are five bus companies that established their lines for regular daily trips to and from Manila and Baguio. There are six (6) landing wharfs to service travelers via the Cagayan River and its tributaries plus one (1) national port of entry for commercial ships and vessels. An average of two (2) trips daily plying to and from these landing wharfs except Toran wharf with an average of five (5) trips daily.

Protective and Safety Services

The municipality is home of national government public safety offices as follows: the Armed Forces of the Philippines, Philippine Coast Guard, Philippine Navy, Criminal Investigation and Detection Group, Maritime Command and Bureau of Jail Management and Penology. These agencies provide support to the Philippine National Police and Bureau of Fire Protection in terms of maintenance of peace and order and security in the municipality and its neighboring municipality as well. The total land area occupied by these public safety offices is approximately 52,160 sq. meters. It accommodates 227 personnel non-uniformed and uniformed personnel and equipped with 10 various serviceable vehicles for exigency of public safety services.

The PNP headquarter and municipal jail are temporarily housed at the hall of the *Liga ng mga Barangay* having a floor area of less than 200 square meters. It is provided with the basic office equipment and tools. Latest inventory of its vehicles shows six (6) units of patrol car but, two (2) are unserviceable. The
present police force is 30, revealing a police-population ratio of 1:2,055 which is higher than the standard of 1:1,000 ratio. In addition to, the district jail is a newly constructed building located at barangay Minanga, an LGU donated lot. It is managed by a jail warden and twelve (12) jail guards. The present jail guard to inmates' ratio is 1:14 against the standard ratio of 1:7. On the other hand, the inmate in the municipal jail is lesser than in the district jail having a jail guard to inmate ratio of 1:5 against the standard ratio of 1:7. Complementing the effort of peace officers in thirty three (3) barangays are two hundred fifty nine (259) barangay Tanods who provides traffic and security jobs for the barangays.

Moreover, the municipal urban geographical location, having only one-entrance and one-exit through land transportation is an advantage to the PNP considering the lesser number policeman in a population of more than 60,000. To further ensure the security of the people especially in the eastern part were business center is located an outpost was established at strategic locations like barangay Macanaya, Tallungan and to possible escape routes at Gaddang-Macanaya barangay road and Tallungan barangay road leading to the north- eastern municipalities of Cagayan particularly Buguey, Sta. Teresita, Gonzaga, and Sta. Ana.

The Bureau of Fire Protection Office is adjacent to the town hall. It has two (2) fire trucks and a fire protection force of 15. The present fireman-population ratio is 1:4,109 again higher than the standard ratio of 1:2,000.

Securing the bodies of water in terms of illegal fishing and implementation of marine and fisheries laws, the Philippine Coast Guard and Maritime Command are available, having ten (10) deployed forces and thirty-three (33) deployed forces respectively. Their headquarters are both located at barangay Minanga. The Maritime Command also put up its sub-station at barangay Macanaya to check passenger and fishing boats coming from neighboring islands and towns. A military company is also camped at barangay Punta. They serve the whole northern part of the province consisting of one hundred eleven (111) soldiers. The Criminal Investigation and Detection Group is at the LGU owned building at barangay Centro 3 manned by four (4) investigators.

These public safety facilities are strategically installed in locations accessible to the DRRM command center. The personnel of these offices are the ones who are called to recue in times of disaster occurrence or any incidence that are beyond human control. They are trained to conduct rescue operations as member of the Municipal Disaster Risk Reduction Management Council.

MUNICIPALITY OF BUGUEY

Power Utilities

The thirty (30) barangays of Buguey are fully energized with sustainable power and electricity supplied by the Cagayan Electric Cooperative II. However, remote, and far-flung sitios of Pannao (Bgry. Tabbac), Birao (Brgy. Villa Cielo), and Maub-ubong (Brgy. San Juan), all at the southern part of the municipality are yet to be energized. Power service provision is 24 hours, but occasional power interruptions are experienced on account of regular repairs and maintenance.

Water Utilities

Sources of water supply in the municipality are shallow wells, open dug wells, undeveloped spring, rainwater, and water peddlers. The most common sources are shallow wells and dug wells. There are 953 shallow wells and 1,030 dug wells throughout the municipality benefiting 13,629 household population and 15,949 household population, respectively. About 15.18% or 4,491 household population depend on waters peddlers for drinking water.

Alternative sources of water for household use are undeveloped spring benefitting about 347 household population, and rainwater benefitting about 563 household population. Households from the upland barangays of Tabbac, Sta. Isabel, and Villa Cielo benefit most from water source supplied by the undeveloped spring while use of rainwater is common in barangays where water is relatively scarce such as barangays Quinawegan, Balza, Remebella, Dalaya, and Calamegatan.

Existing surface water resources are ideally for fishing, agriculture, and irrigation. The irrigation needs of the municipality are supplied by the National Irrigation Administration (NIA), communal irrigation system, and the gravity type of irrigation system. Of the 4,785 hectares irrigated agricultural lands, about 60.15% or 2, 878 hectares is being served by NIA and the other areas rely on communal irrigation system and the gravity type of irrigation system.

Most recent development is the construction/rehabilitation of a potable water supply system at M. Antiporda with the primary objective of providing safe, adequate, and reliable water supply services and improved health, hygiene, and sanitation practices of residents in waterless barangays of M. Antiporda, Dalaya, Remebella, and Balza. The facility shall benefit 789 households.

Educational Facilities

Basic education is accessible in twenty-six (26) complete elementary schools in almost every barangay, six (6) secondary schools established in growth node barangays in the municipality, and day care centers for preschoolers in every barangay.

Housing Facilities

In terms of housing facilities and services, about 1.65 hectares is being negotiated to various lot owners. The site is located at the Poblacion and has passed the assessment required by the Environmental Management Bureau (EMB). About 150-200 housing units shall be constructed in the area. Another housing site is a 2-hectare lot at Villa Leonora. Negotiation with lot owner is underway. The project shall benefit about 200 families in the barangay.

Other areas potential for housing projects are located in barangays Pattao, Sta. Isabel, San Lorenzo, and Tabbac. These are grasslands and idle agricultural lands of about 32 hectares more than enough

to cover fifteen or more hectares required for 2,465 households. Existing housing projects are the Poblacion Housing project at Centro and the Villa Leonora Housing project at Villa Leonora.

Communication Network

Communication services and facilities available in the municipality are postal services, internet, cell sites, and TV cable station. These facilities and services are provided by the private sector and accessible at the town proper and at Barangay Pattao.

Transportation Network

The municipality has a total road length of 169.240 kilometers, of which 19.100 kilometers are national road,27.350 kilometers are provincial road, 9.275 kilometers are municipal road, and 113.515 kilometers are barangay road. The national road (Maharlika Highway) is concrete paved and the only circulation network linking Buguey to nearby municipalities, cities and other suburbs.

Most of the provincial, municipal and barangay roads are gravel surfaced and serve as the internal circulation network in the municipality. There are fifteen (15) bridges in the municipality of which seven (7) are national type of administration, three (3) are provincial, and five (5) are municipal/barangay. The municipality has no terminal facility but there are pick up and parking designated areas at the Poblacion and at Barangay Pattao by virtue of local ordinances.

Public utility vehicle servicing the population includes bus, multicabs, jeepneys, vans, and tricycles. Tricycles are available 24/7 at the Pattao Junction and at the Poblacion to bring passengers to different barangays of the municipality. Multicabs and jeepneys ply the Buguey-Aparri route while vans ply the Buguey-Tuguegarao route daily. Florida Bus offers a daily trip from Buguey to Manila and vice-versa. The municipality has no terminal facility but there are pick-up designated areas at the Poblacion and at barangay Pattao.

Protective and Safety Services

In sustaining peace and order in the municipality, the organized Barangay Tanod municipal wide of about 360 volunteers augment the police force in providing protective services to the people. These volunteer service providers are somehow trained to provide quick response during crime, fire, vehicular accidents, and another incidence. Existing protective facilities and equipment are Police Station at Centro, Sub-Police Station at Barangay Pattao and three (3) patrol cars. These facilities and equipment are in good physical condition and perceived adequate in relation to current needs of the station.

For fire protection services, the Barangay Tanod likewise provide augmentation to local firemen to respond to fire incidence in the municipality. However, considering the limitations of volunteer service providers, services of nearby fire station of Camalaniugan and Gonzaga are often sought whenever a fire incident happen. As to the services of the Jail Management and Penology, fugitive from justice is brought to the nearest jail facility which is about 18 kilometers away from the town proper.

MUNICIPALITY OF GONZAGA

Power and Water Utilities

The electricity supplied for the municipality is from the TRANSCO through its hydroelectric plant at Magat Dam, Ramon, Isabela with its franchise, the CAGELCO II. All the 25 barangays are already energized except some of the interior sitios like Bagsang, Laoc, Matara, and Namuyucan considering their accessibility.

The municipality has a water system, the Gonzaga Water District, that caters the demands of the urban barangays. It has 3 pumping stations. The number of households served by the system is 1,719. There are 1,835 water connections served by the system within its service area. Households not served by the system have their own alternative sources of potable waters like shallow wells, pump wells, artesian wells and other systems.

Educational Facilities

The municipality has a complete educational system. It has 3 primary schools, 25 elementary schools, 6 secondary schools and one state university. These educational institutions are established in strategic locations to provide immediate access of population to education which is believed to be one of the major basic needs. Aside from the 2 private elementary and one private secondary school, all the other schools are government owned. Area occupied educational institutions is enough to provide adequate space for convenience and sufficient to accommodate future expansion in each school within the span of 5 years.

The Cagayan State University has the widest area of approximately 30.890 hectares for instructional and research purposes. For the school year 2012-2013 the primary level has a total enrollment of 232 with 10 teachers. Also in the elementary level, there are 6,266 pupils enrolled being taken cared by 218 teachers. On the other hand, there are 2,860 students enrolled in all secondary schools taught by 46 teachers. Lastly, the Cagayan State University has 1533 enrollees in tertiary level with 46 instructors and professors.

Housing Facilities

Based on the 2007 NSO survey, the municipality has a total of 7,274 housing units. Majority of these are made of mixed materials like concrete, wood, and galvanized iron. The household number consist of 7,522. The housing units has 7,274 indicating a housing backlog of 278 units. So far, Barangay Cabiraoan has the highest number of households and dwelling units, and barangay Callao has the least.

There are some informal settlers identified in the municipality but there is no housing project undertaken by the government or the private sector. However, there is a site allocated at Barangay Callao with an area of 25.11 hectares, but it was not yet developed.

During the past years, the municipality established 9 units core shelter for the Agtas at sitio Bagsang, Barangay Sta. Clara spearheaded by the DSWD. This project is presently using by the Agtas. As of this time, a 50-unit core shelter project is being undertaken at Barangay Caroan, a joint project of the LGU and DSWD.

Sports and Recreation Facilities

Sports have been institutionalized in the municipality of Gonzaga. The major and popular sports and recreation of the population aged group from pre-schools, elementary, secondary to professionals is basketball, as manifested by the presence of 39 basketball courts in the 25 barangays, 2 of which are located in a covered court. A municipal gymnasium, the Gonzaga People's Gymnasium, which is found inside the municipal hall compound is being utilized also as venue for volleyball, table tennis, badminton, Socio-Cultural presentations, meetings, film showing and other cultural activities.

The CSU sports oval accommodates big athletic competitions like schools' division and district meets, where athletics, baseball, softball, archery, football and running events were being conducted. A gun shooting range has been temporarily staged at a little area of the CSU Campus.

Communication Network

Gonzaga has one post office located within the municipal compound manned with 3 personnel. The DIGITEL communication is one of the franchise holders in the locality. Its coverage area is within the urban core with 55 active subscribers. The BUTEL is the only telegraphic facility in the municipality; it is located at municipal compound. Transactions are seldom because of the presence of mobile phones.

Globe, Smart, and Sun Telecommunications are other franchisees in the municipality. Their cell sites are located at barangays Pateng and Progressive, respectively. It serves all the mobile phone owners in the municipality. There are 6 internet cafés' available through these communications. The advance communication facilities present in the locality played a significant role in socio-development of the municipality-barangays it provides recent news/entertainment. Likewise, a community radio (DWTG) has been established at the Municipal Gymnasium.

Road and Transportation Network

Generally, all barangay centers in the municipality can be reached and accessible through land transportation. This is due to the presence of a total length road network in the whole area of 299.293 kilometers. This comprised 25,473 kilometers national road; 23.056 kilometers provincial roads; 8.621 kilometers municipal road and 242.143 kilometers barangay and farm-to-market roads. These road circulations define the existing socio-economic development of the municipality as it interacts with its neighboring towns and the turbulent advancement of science and technology.

The presence of more roads in rural areas depicts level of rural development in terms of agricultural production and agro-industrial growth as it affects the increment of business and trade in the urban core. Some constraints in rural development are the presence of earth filled type of roads, unmaintained and insufficient funds for road maintenance thereby roads are not passable during the wet season of the year.

Land transportation is the major means of transportation in the municipality. There are 6 buses; 47 jeepneys; 80 multi cabs and 19 vans. Among the 6 buses, 3 air con buses ply to and from the Manila and the 3 ordinary buses ply to from Ilocos Region. Jeepneys, multi cabs and vans cater the needs of the people in going around the produce and nearby municipalities, Private vehicles like bicycles, kuligligs, peddy cabs, carts, motorcycles, tricycles, and other service vehicles are more popular means of transportation within the urban core and nearby barangays. Freight trucks, elf/forward, trailers and tractors are used by businessmen and farmers to transport farm products. Dump trucks and other government vehicles are also used in government operations. Furthermore, there are four fish ports in the municipality that are located at Barangays Minanga, Batangan, Tapel and Amunitan. These facilities are being used as terminal area for the fish catch of fishermen.

There is no permanent terminal structure established by the local government in the municipality. Open areas at the helm of the central business district (CBD) are used for temporary space for loading and unloading of vehicles of all type. Due to the limited space in the central business district and other areas, road shoulders are also used as parking space, which may cause risky traffic congestion both pedestrians and vehicles. Florida Buses have their own terminal center.

Protective and Safety Services

The Philippine National Police, Gonzaga Police Station has a total force of 22, led by two (2) Police Commissioned Officers, the Chief of Police (COP) and a Deputy Chief of Police with twenty (20) Police

Non-Commission Officers. They are quartered in the Gonzaga Municipal Police/Station with a detention cell located inside the Municipal Public Market Compound.

The PNP is being complemented by 250 Barangay Police (Tanod), and a Civilian Volunteer Officers (CVO's) being supervised by a Non-Commissioned Officer of the Philippine Army's 17th Infantry Battalion of the 5th ID. The CVOs has two (2) military camps at Sta. Clara and Cabiraoan. The presence of these instrumentalities plays a vital role in the maintenance of peace and order in the community.

Gonzaga has a Fire Protection Bureau stationed in the Municipal Hall Compound and manned by eight (8) personnel including the head who is a Non-Commissioned Officer, showing a fireman-population ratio of 1:4,537 surpassing the prescribed standard ratio of a fireman to 1,000 population. The fire station has two (2) units of fire trucks.

Irrigation and Other Agricultural Facilities

The National Irrigation Administration (NIA) has improved, maintained, and extended irrigation services of various barangays of the municipality. Rainfed and some corn lands areas are being converted into rice paddies as a result of the irrigation expansion serviced by the NIA thus, increasing rice production area of the municipality. Along with the NIA, there are 39 Communal Irrigation System Strategically located in various barangays and are being managed by Farmers Irrigators Association (FIA) Also, there are 23 Small Farm Reservoirs (SFR) and 86 units of water pumps implemented and funded by the Department of Agriculture. The presence of Baua and Wangag watershed where some of these facilities are installed and found to be very vital in the provision of adequate irrigation water for the municipality.

Post-harvest facilities like Multi-Purpose Drying Pavement (MPDP), mechanical dryers and palay sheds are also distributed to various barangays in the municipality for their agricultural production. As usually observed, drying is still the common issue and concern of farmers especially when harvest falls at the month of September to November. Despite the presence of some mechanical dryers, these could not accommodate the volume of harvest during the dry season.

Currently, the residents of the 3 host municipalities have abundant supply of water for domestic and agricultural use. All three (3) host municipalities are supplied by CAGELCO II for their electricity with minimal power interruptions due to repairs and maintenance. It was also concluded that there would be an increase in power and water demand due to the increasing number of households every year. Housing facilities for the three (3) municipalities have also increased due to growth of population from natural birth, migration, new number of household and increasing number of informal settlers. In terms of transportation, the municipalities have limited drop point and/ no permanent terminal facilities for its commuters. When it comes to educational facilities, each municipalities have the capacity to provide quality education having a complete educational system. While it is expected that the project will require manpower to support its development, resulting in possible resource competition, the current resources of the municipalities will be sufficient to support its utility requirements.

The existence of the project will somehow provide opportunities for the improvement of services on education and health. Enhancement the education, health, as well as the social welfare services and public infrastructures will be enhanced due to the additional income opportunities of the LGUs from the taxes and fees to be collected from the proposed projects as well as the mandatory assistance of the proponent through the Social Development and Management Program.

2.4.6 Threat to Public Health and Safety

Since there were no data available regarding the health statistics of the host municipalities, an update report published by the Philippine Statistics Authority (PSA) last 2017 on Regional Social and Economic Trends (RSET) for Region II – Cagayan Valley is a compilation of various statistical information at the regional and/or subnational level deemed useful for informing was used in this section. This features the results of the 2015 Census of Population count of Cagayan Valley. One chapter in this report presents the for the region and its provinces/city on the registration of vital events occurring in these areas. The data include the number of births, deaths, and marriages, including infant deaths, and the leading causes of mortality. Likewise, it also contains data on fertility, projected life expectancies and the number of health personnel and facilities. Meanwhile, the data on health presented include the leading causes of morbidity, and notifiable diseases.

Highlights:

- In 2014, the number of births registered in Cagayan Valley had a total of 62,611, a decrease of about 2.6 percent compared to 63,690 births in 2013. On the average, 168 babies are born daily in the region or 7 births per hour. Cagayan province recorded the highest number of registered live births in Cagayan Valley at 29,804 babies **(Table 2.4-11).**
- In 2016, there were more births attended by medical professionals (Physician, Nurse, and Midwife) with 58,823 or 95.9 percent. Hilot (Trained and Untrained) or traditional birth attendants aided in the delivery of 1,782 or 2.9 percent of the total births in Cagayan Valley **(Table 2.4-12)**.
- Infant mortality rate (per 1,000 live births) in Cagayan Valley was reported at 4.8 in 2016. The highest mortality rate in the region was recorded in Tuguegarao City which reported 12 deaths in 1,000 live births (**Table 2.4-13)**.
- The top three diseases reported in Cagayan Valley in 2016 were Dengue, STDs, and Influenza-like illness with a prevalence of 3,714, 2,394, and 1,027, respectively (**Table 2.4-16)**.
- A total of 1,289 barangay health stations were recorded in Cagayan Valley in 2016. Moreover, government and private hospitals reported a total bed capacity of 3,761 **(Table 2.4-18)**.
- A total of 12,033 professional health workers served in the local government units (LGUs) of Cagayan Valley in 2016 (**Table 2.4-19)**.

Table 2.4-11. Live Births in Cagayan Province by Place of Occurrence and Sex Year 2010 – 2014 (By Municipality/City)

PLACE OF OCCURRENCE / YEAR / SEX	NUMBER OF LIVE BIRTHS														
	2010			2011			2012			2013			2014		
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female
Cagayan	**23,538**	**12,267**	**11,271**	**23,093**	**12,124**	**10,969**	**23,232**	**12,071**	**11,161**	**21,983**	**11,467**	**10,516**	**21,077**	**11,009**	**10,068**
Abulug	420	206	214	291	151	140	267	147	120	195	104	91	115	57	58
Alcala	708	350	358	689	362	327	753	391	362	608	330	278	665	349	316
Allacapan	430	226	204	398	211	187	332	163	169	285	145	140	274	139	135
Amulung	787	404	383	789	395	394	729	376	353	653	340	313	492	243	249
Aparri	2,162	1,141	1,021	2,010	1,089	921	1,732	842	890	1,564	817	747	1,402	723	679
Baggao	1,010	521	489	1,017	539	478	1,038	530	508	827	426	401	652	331	321
Ballesteros	795	418	377	891	464	427	1,042	556	486	894	486	408	847	465	382
Buguey	472	247	225	435	230	205	444	244	200	375	190	185	273	132	141
Calayan	244	134	110	313	151	162	325	169	156	291	157	134	280	143	137
Camalaniugan	795	423	372	929	479	450	1,344	707	637	1,661	882	779	1,957	1,038	919
Claveria	253	133	120	210	102	108	154	80	74	82	38	44	185	90	95
Enrile	461	234	227	450	233	217	353	174	179	224	121	103	174	89	85
Gattaran	662	335	327	568	308	260	629	335	294	526	268	258	444	241	203
Gonzaga	745	386	359	775	405	370	762	386	376	606	314	292	605	285	320
Iguig	391	218	173	333	179	154	316	172	144	324	165	159	247	133	114
Lal-lo	498	277	221	388	206	182	409	200	209	323	174	149	256	124	132
Lasam	552	295	257	492	259	233	558	299	259	488	266	222	469	236	233
Pamplona	275	157	118	248	127	121	208	108	100	222	124	98	210	111	99
Peñablanca	713	345	368	700	346	354	700	355	345	623	311	312	478	223	255
Piat	489	256	233	552	304	248	468	240	228	453	223	230	485	254	231
Rizal	198	91	107	210	105	105	187	93	94	167	87	80	168	77	91
Sanchez-mira	771	401	370	785	413	372	828	438	390	786	411	375	590	312	278
Santa Ana	558	290	268	525	284	241	488	261	227	474	229	245	445	229	216
Santa Praxedes	34	18	16	28	18	10	34	17	17	37	16	21	26	11	15
Santa Teresita	250	128	122	252	122	130	220	109	111	211	112	99	188	98	90
Santo Niño	361	180	181	361	168	193	369	196	173	326	163	163	255	130	125
Solana	1,024	527	497	938	468	470	982	508	474	736	374	362	652	340	312
Tuao	1,063	522	541	1,112	567	545	1,192	637	555	993	512	481	891	465	426
Tuguegarao City	6,417	3,404	3,013	6,404	3,439	2,965	6,369	3,338	3,031	7,029	3,682	3,347	7,352	3,941	3,411

Source: RSET Cagayan Valley, 2017

Table 2.4-12. Registered Live Births in Cagayan Valley by Attendant at Birth (2012 – 2016)

ATTENDANT AT BIRTH / YEAR	NUMBER OF REGISTERED LIVE BIRTHS				
	2012	2013	2014	2015	2016
CAGAYAN VALLEY	**69,199**	**65,583**	**55,044**	**63,618**	**61,352**
Physician	32,474	34,329	29,494	42,836	43,655
Nurse	578	597	1,004	452	406
Midwife	28,732	25,019	19,274	16,873	14,762
Trained Hilot	6,447	4,784	4,340	2,682	1,782
Untrained Hilot	0	0	0	0	0
Others/Unknown	968	854	932	775	747

Table 2.4-13. Infant Deaths/Mortality in Cagayan Valley by Province/City (2012 – 2016)

PROVINCE/CITY / YEAR	2012		2013		2014		2015		2016	
	Number	Rate [1]	Number	Rate [1]	Number	Rate [1]	Number	Rate [1]	Number	Rate [1]
CAGAYAN VALLEY	**447**	**6.5**	**344**	**5.2**	**397**	**7.2**	**287**	**4.5**	**297**	**4.8**
Batanes	2	7.1	4	13.5	3	11.6	3	11.5	2	8.0
Cagayan	170	8.3	80	4.5	56	3.8	53	3.2	36	2.3
Tuguegarao City	33	13.0	47	19.2	42	19.1	47	21.7	25	12.0
Isabela	139	5.6	121	5.1	156	10.9	54	2.7	66	3.2
City of Cauayan	11	5.1	3	1.5	29	8.8	22	10.7	18	8.7
City of Ilagan [2]	-	-	-	-	-	-	3	0.6	3	0.9
City of Santiago	23	6.6	10	2.9	23	4.7	26	6.8	14	3.7
Nueva Vizcaya	53	4.6	67	5.7	42	3.7	49	4.9	88	9.2
Quirino	16	3.9	12	3.0	46	12.0	30	7.3	45	11.1

Source: RSET Cagayan Valley, 2017

Table 2.4-14. Leading Causes of Maternal Mortality in Cagayan Valley (2012 – 2016)

CAUSE / YEAR	2012		2013		2014		2015		2016	
	Number	Rate [1]	Number	Rate [1]	Number	Rate [1]	Number	Rate [1]	Number	Rate [1]
Abortion	-	-	-	-	-	-	-	-	-	-
Abruptio Placenta	-	-	3	9.4	-	-	1	2.8	1	4.6
Amniotic Fluid Embolism	2	8.7	-	-	-	-	1	2.8	-	-
Childbirth and Puerperium	-	-	-	-	-	-	-	-	-	-
Dystocia of Pregnancy	-	-	-	-	-	-	-	-	-	-
Eclampsia	6	26.1	12	37.2	7	23.0	7	19.4	14	63.6
Hemorrhage of Pregnancy and Puerperium	-	-	-	-	-	-	-	-	-	-
Hydatidiform Mole	-	-	-	-	-	-	-	-	-	-
Hypertension in Pregnancy	-	-	-	-	-	-	-	-	-	-
Hypovolemic Shock	-	-	-	-	-	-	-	-	6	27.3
Placenta Previa	-	-	-	-	-	-	-	-	-	-
Placental Retention	-	-	1	3.1	2	6.5	6	16.7	-	-
Postpartum Hemorrhage	-	-	-	-	-	-	-	-	-	-
Postpartum Infection	-	-	-	-	-	-	-	-	-	-
Pre Eclampsia	-	-	-	-	-	-	4	11.1	-	-
Puerperal Sepsis	-	-	-	-	-	-	-	-	-	-
Ruptured Ectopic Pregnancy	-	-	-	-	-	-	-	-	-	-
Ruptured Uterus	-	-	-	-	2	6.5				
Septicemia	-	-	-	-	-	-	-	-	-	-
Sudden Cardiac Death	-	-	-	-	-	-	-	-	1	4.6
Toxemias of Pregnancy	-	-	-	-	-	-	-	-	-	-
Uterine Atony	-	-	-	-	5	17.0	1	2.8		
Other Complications of Pregnancy	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	5	17.0	-	-	-	-

Source: RSET Cagayan Valley, 2017

Table 2.4-15. Deaths in Cagayan Province by Place of Occurrence and Sex (By City/Municipality) 2010 – 2014

PLACE OF OCCURRENCE / YEAR / SEX	NUMBER OF DEATHS														
	2010			2011			2012			2013			2014		
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female
Cagayan	7,031	4,031	3,000	7,054	4,037	3,017	7,372	4,294	3,078	7,543	4,404	3,139	7,616	4,396	3,220
Abulug	174	91	83	149	88	61	149	87	62	141	86	55	170	94	76
Alcala	235	120	115	226	126	100	200	101	99	201	118	83	191	109	82
Allacapan	119	68	51	118	69	49	143	87	56	147	99	48	153	85	68
Amulung	163	86	77	175	91	84	231	128	103	188	99	89	174	100	74
Aparri	534	318	216	530	288	242	502	282	220	494	286	208	518	301	217
Baggao	244	128	116	268	151	117	285	162	123	307	193	114	271	147	124
Ballesteros	212	113	99	251	133	118	267	144	123	285	165	120	246	135	111
Buguey	141	79	62	178	101	77	170	90	80	173	93	80	189	112	77
Calayan	27	18	9	21	11	10	24	15	9	27	22	5	31	22	9
Camalaniugan	178	105	73	147	72	75	193	119	74	202	114	88	206	111	95
Claveria	231	135	96	168	101	67	186	101	85	157	89	68	171	99	72
Enrile	179	109	70	155	82	73	162	85	77	181	102	79	152	87	65
Gattaran	254	147	107	252	145	107	294	166	128	282	162	120	297	171	126
Gonzaga	209	124	85	217	123	94	229	138	91	220	128	92	221	118	103
Iguig	131	81	50	134	80	54	159	82	77	184	94	90	122	65	57
Lal-lo	193	107	86	218	132	86	199	112	87	212	115	97	196	108	88
Lasam	206	110	96	174	105	69	220	129	91	217	126	91	209	126	83
Pamplona	138	70	68	106	57	49	124	74	50	119	73	46	136	77	59
Peñablanca	163	94	69	158	92	66	157	92	65	169	100	69	148	80	68
Piat	153	95	58	146	95	51	145	85	60	149	74	75	132	79	53
Rizal	41	31	10	56	31	25	68	37	31	77	34	43	62	27	35
Sanchez-mira	218	145	73	246	140	106	213	130	83	244	138	106	214	129	85
Santa Ana	96	59	37	111	74	37	131	87	44	106	64	42	138	84	54
Santa Praxedes	20	12	8	16	6	10	11	4	7	10	6	4	6	3	3
Santa Teresita	83	46	37	77	45	32	85	49	36	93	59	34	106	54	52
Santo Niño	132	70	62	134	72	62	143	83	60	146	78	68	157	82	75
Solana	346	193	153	345	192	153	389	244	145	344	208	136	380	226	154
Tuao	268	144	124	323	172	151	328	186	142	346	225	121	340	194	146
Tuguegarao City	1,943	1,133	810	1,955	1,163	792	1,965	1,195	770	2,122	1,254	868	2,280	1,371	909

Source: RSET Cagayan Valley, 2017

Table 2.4-16. Notifiable Diseases/Causes of Morbidity in Cagayan Valley (2012 – 2016)

PROVINCE / DISEASE / YEAR	NUMBER OF OCCURRENCE				
	2012	2013	2014	2015	2016
CAGAYAN VALLEY					
Tonsilitis/Tonsillopharyngitis	-	-	-	-	-
Typhoid & Paratyphoid Fever [a]	-	2,178	1,222	1,035	609
STDs[b]	3,104	-	2,051	1,837	2,394
Poisoning/Food Poisoning	-	-	-	-	7
Diarrhea (All Forms)	1,671	1,132	1,776	1,441	-
T.B. (All Forms)	-	-	-	-	-
Leprosy	-	-	-	-	-
Chicken Pox	-	-	-	-	-
Whooping Cough	-	5	1	-	12
Tetanus	62	39	74	24	26
Hypertension	-	-	-	-	-
Urinary Tract Infection	-	-	-	-	-
Measles	60	184	1,896	118	53
Viral Hepatitis	144	53	133	68	42
Acute Febrille Illness	-	-	-	-	3
Rabies/Dog bite	18	18	18	10	5
Malaria	28	58	22	5	-
Dental Problems	-	-	-	-	-
Acute Hemorrhagic Fever (eg. Dengue)	7,929	12,144	3,695	13,468	-
Iron Deficiency Anemia	-	-	-	-	-
Asthma	-	-	-	-	-
Goiter	-	-	-	-	-
Diseases of the Heart	-	-	-	-	-
Bronchitis	-	-	-	-	-
Pneumonia	-	-	-	-	-
Influenza-like illlness	1,800	2,458	1,823	1,532	1,027
Parasitism	-	-	-	-	-
Gastritis	-	-	-	-	-
Neonatal Tetanus	10	8	2	6	4
Dengue	-	-	-	-	3,714

Source: RSET Cagayan Valley, 2017

Table 2.4-17. Number of Barangay Health Stations (BHS) in Cagayan Valley By Province

PROVINCE / YEAR	2012		2013		2014		2015		2016	
	Number of Brgys.	Number of BHS	Number of Brgys.	Number of BHS	Number of Brgys.	Number of BHS	Number of Brgys.	Number of BHS	Number of Brgys.	Number of BHS
CAGAYAN VALLEY	**2,311**	**1,131**	**2,311**	**1,135**	**2,311**	**1,128**	**2,311**	**1,240**	**2,311**	**1,289**
Batanes	29	6	29	6	29	5	29	5	29	7
Cagayan	820	283	820	273	820	273	820	328	820	341
Isabela	1055	572	1055	562	1055	592	1055	608	1055	634
Nueva Vizcaya	275	188	275	201	275	177	275	198	275	214
Quirino	132	82	132	93	132	81	132	101	132	93

Source: RSET Cagayan Valley, 2017

Table 2.4-18. Bed Capacity of Government and Private Hospitals in Cagayan Valley By Province (2012 – 2016)

PROVINCE / YEAR	NUMBER OF AUTHORIZED BEDS				
	2012	2013	2014	2015	2016
CAGAYAN VALLEY	**3,261**	**3,369**	**3,438**	**3,655**	**3,761**
Batanes	90	90	90	90	90
Cagayan	1,497	1,413	1,478	1,480	1,555
Isabela	1,067	1,242	1,236	1,411	1,442
Nueva Vizcaya	467	484	484	524	534
Quirino	140	140	150	150	140

Source: RSET Cagayan Valley, 2017

Table 2.4-19. Health Workers in Local Government Units (LGUs) in Cagayan Valley (2012 - 2016)

PROVINCE / PROFESSION / YEAR	NUMBER OF HEALTH WORKERS IN LGUs				
	2012	2013	2014	2015	2016
CAGAYAN VALLEY	**11,921**	**11,292**	**11,784**	**11,603**	**12,033**
Doctors	113	111	109	101	105
Dentists	77	74	71	62	61
Nurses	261	233	239	204	230
Midwives	875	867	839	795	813
Nutritionists	11	9	13	9	13
Engrs/Sanitary Inspectors	121	122	114	104	109
Med Techs	90	82	88	90	87
Active BHWs	10,373	9,794	10,311	10,238	10,615

Source: RSET Cagayan Valley, 2017

MUNICIPALITY OF APARRI

Health and Social Services

Four (4) public health service facilities; two (2) Rural Health Units located at Centro 03, Aparri - I and at Bukig, Aparri - II; two (2) government hospitals: one (1) Provincial Hospital located at Toran, and one (1) Community Hospital located at Bangag; two (2) private hospitals namely: Selby Hospital (formerly Aparri Christian Hospital) located at Punta and Lyceum of Aparri Hospital located at Macanaya, both offer Secondary and Tertiary Level of health services.

Several private medical practitioners established the following: ten (10) Private Medical Clinics, five (5) Private Dental Clinics, two (2) Private Diagnostic Laboratory Centers, two (2) Mercury Drug Stores and eighteen other Drugstores and Pharmacies. Complementary thereto, said medical health facilities are compliant with all the requirements laid down by proper authorities in accordance with the standards of the Department of Health. Also, medical establishment buildings are strategically located in safe areas and sturdy enough to withstand any type of disaster considering Aparri is a disaster-prone area.

The Main Health Center is a Phil-Health - Primary Care Benefit (PCB) Provider which also renders various laboratory services such as: Routine Urinalysis and Fecalysis, Hemoglobin determination and Blood Typing to pregnant mothers, Gram Stain for hospitality girls (GRO), Platelet count and Sputum Examination. It is also an accredited anti-rabies service provider.
The two (2) health centers have fourteen (14) health personnel: two (2) Medical Doctors, two (2) Nurses, ten (10) Rural Health Midwives, one (1) Dentist, one (1) Medical Technologist and two (2) Rural Sanitary

Inspectors. Aparri has a total of 135 Barangay Health Workers (BHWs) and 47 Barangay Nutrition Scholars (BNS) who are responsible in giving help and assistance to the staff of the health centers in rendering basic health services (ie: Prenatal and Post-natal Check-ups, Micronutrients supplemental feeding and Immunization) to the people in the community. As a prescribed role of these BHWs and BNS to safeguard the health of their respective community, there are designated Barangay Health Stations (BHS) for them to maintain and look after.

The Local Government Unit allotted office space at the municipal town hall for the use of Senior Citizens in providing administrative services to the members like planning of social activities, registration of members, preparation and distribution of ID's/booklets and facilitation of other documents that will benefit the well-being of the members. Their social activities are either conducted at the Function Hall of the building or at the Municipal Public Park. The Office of the Senior Citizens Association (OSCA) is managed by well-trained senior citizens and assisted by the staff of the MSWDO. However, there's a need to rehabilitate the existing Municipal Social Welfare Office and possible construction of OSCA building during the conduct of seminars, meeting and other relevant activities.

There are thirty-nine (39) Day Care Centers in the municipality manned by Day Care Workers; these are supervised by the MSWDO Personnel and Staff. Maintenance and Other Operating Expenses (MOOE) of various Day Care Centers are jointly sourced out from the LGU and its respective barangays. It is observed, Macanaya Day Care Centre have the greatest number of day care children of 44 and Bangag-Nanappatan Day Care Centre have the least of only 13 in year 2011.

In collaboration with the Department of Education and coordination with the three (3) schools zonal districts, these Day Care Workers are given privilege to undergo trainings in the aspect of teaching and preparation of lesson plans and other activities. In addition to, these Day Care Workers are being oriented to go back with the basic approach in parting good values to these day care children in which 60 percent consist of good practices, respect to elders and peers, recognition of rules at home, simple self-hygiene and dressing up, safe crossing on the streets and other learnings fitted with their age.

Complementary thereto, said medical health facilities are compliant with all the requirements laid down by proper authorities in accordance with the standards of the Department of Health (DOH). Also, medical establishment buildings are strategically located in a safe area and sturdy enough to withstand any type of disaster considering Aparri is a disaster prone and other calamity.

Crude Birth Rate (CBR), Mortality Rate and Morbidity Rate

Crude Birth Rate (CBR) in Aparri shows an irregular pattern of increase and decrease trend for the last five (5) years with a CBR of 15 births per 1,000 population in 2007 and a slight decrease of 14 births per 1,000 population in 2011. However, a significant increased were noted in 2008 and 2010 with a rate as high as 21. This is attributed with the irregular usage and patriotism of family planning contraceptives and methods that lead to fluctuating increase and decrease of Crude Birth Rate health indicator.

Patients' consultations are mainly captured in the Main Health Center, Aparri - I, observed to be increasing throughout the years except for a noticeable decrease in 2010. The significant change of weather and disaster occurrence are factors that determine individual's vulnerability to sickness which usually affects productivity, attendance to work and schools. Population most vulnerable to this are the young and old age and those that are in below poverty level of our society. Crude Death Rate (CDR) sustains several 7 deaths per 1,000 population for the years 2008, 2009, 2010, and 2011.

Infant Mortality Rate decreases for the years 2008, 2009, 2010, and 2011 and maintains 7 infant deaths per 1,000 live births for the years 2010 and 2011. On the other hand, Maternal Mortality Rate maintains one (1) maternal death per 1,000 live births for the period 2008 - 2010 and an abrupt increase of 4

maternal deaths in 2011. Records show that these maternal deaths are hospital deaths; however, the need to advocate more on the strict implementation of pre-natal and post-natal checkup by the Rural Health Midwives among pregnant mothers and the immediate referral for hospital deliveries among risk pregnancies are both essential in the effective delivery of basic health services to come up with a very low Infant Mortality and Maternal Mortality Rate.

Table 2.4-20. General Health Situation from 2007 – 2011

Health Indicator	2007		2008		2009		2010		2011	
	Tot. Pop. = 61.024		Tot. Pop. = 61,082		Tot. Pop. = 61,140		Tot. Pop. = 61,199		Tot. Pop. = 61,420	
	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*
Fertility (Rate per 1,000 Population)										
Crude Birth Rates (CBR)	934	15	1,258	21	1,053	17	1,276	21	854	14
Morbidity (Rate per 1,000 Population)	5,750	9,423	9,806	16,054	11,836	19,359	9,706	15,860	19,067	31,044
Mortality (Rate per 1,000 Population)										
Crude Birth Rate (CDR) *Rate per 1,000 Population	377	6	435	7	432	7	440	7	436	7
Proportioned Mortality Rate (PMR)										
Infant Mortality Rate (PMR) *Rate per 1,000 Population	12	13	21	17	9	9	9	7	6	7
Young Child Mortality Rate (YCMR)										
Maternal Mortality Rate (MMR) *Rate per 1,000 Population	2	2	1	1	1	1	1	1	3	4

Source: Municipal Health Office, Local Civil Registry / Hospital Records

Record of the Rural Health Units shows that respiratory diseases is consistently the top leading cause of morbidity. It contributes about 80 percent of the total morbid cases from 2009 to 2011 **(Table 2.4-21)**. This is brought about by the sudden change of weather and the relative climate change throughout the season making the community susceptible to cough and colds.

Acute Gastro-enteritis, being the next leading cause of morbidity is attributed also with the prolonged drought brought by El Nino and the heavy rains causing flood (La Nina) as a result of the associated climate change making drinking water source contaminated and infected with coliform bacteria.

With this scenario, the Local Government Unit must have to prioritize the purchase of medicines for Acute and Chronic Respiratory Diseases as well as for Acute Gastro-enteritis. Also, the Rural Sanitary Inspectors assigned in the municipality must be vigilant in disinfecting the drinking water source of the community in times of drought and during the start of rainy season through the use of water disinfectant solution (chlorine).

Aparri is known for having night-life establishments wherein people of adjacent and nearby municipalities visit the area for recreation. Despite of this, it was noted in the year 2011 there was no referred case of Sexually Transmitted Diseases. This shows the dedication of the Municipal Health Office concerned personnel in the strict implementation of a regular visits and check-up for a weekly Gram Stain procedure for detection of gonococcal infection among the hospitality girls (GRO) working in red light districts and karaoke bars prior to issuance of Pink Card Health Certificate as a requirement before they can go back again for work. Also, effective advocacy by MHO personnel on the use of contraceptive (condom) during sexual activity and the awareness of the clientele on the consequences of getting the disease attribute to the low incidence and absence of STD cases.

Table 2.4-21a. Ten (10) Leading Causes of Morbidity from 2009 to 2011

Causes	2009		2010		2011	
	Tot. Pop = 61,140		Tot. Pop. = 61,199		Tot. Pop. = 61,420	
	No. of Cases	Rate per 100,000 population	No. of Cases	Rate per 100,000 population	No. of Cases	Rate per 100,000 population
1. Respiratory Diseases	8,592	14,053	7,325	11,969	13,802	22,472
2. Acute Gastroenteritis	963	1,575	451	737	764	1,244
3. Dermatitis	603	986	-	-	-	-
4. Musculoskeletal	300	491	-	-	670	1,091
5. Cardiovascular Diseases	278	455	159	260	777	1,265
6. Rheumatism	243	397	-	-	-	-
7. Sexually Transmitted Diseases	238	389	208	340	-	-
8. Peptic Ulcer	223	365	-	-	-	-
9. Influenza	216	353	204	333	-	-
10. Urinary Tract Infection	210	343	213	348	399	650
TOTAL :	**11,866**	**19,408**	**8,560**	**13,987**	**16,412**	**26,721**

Source: Municipal Health Office, Local Civil Registrar

Cardio-vascular diseases was recorded to be the highest cause of Mortality. It contributes about 39 percent of the total number of deaths for the last three (3) years (2009 - 2011). It also ranks 4 in the Top 10 Leading Cause of Morbidity. The high incidence of cardio-vascular related diseases is brought by poor eating habit and poor healthy lifestyle of most of Filipinos. More often, the fun of eating oily and salty foods and not being choosy of the food intake resulted of having high blood cholesterol and triglycerides level. Lack of exercise, excessive drinking of alcohol and smoking promote the risk of developing cardio-vascular related diseases. Respiratory diseases on the other hand, ranks no. 2 in the Leading Cause of Mortality after being number 1 in the Top 10 Leading Cause of Morbidity. These two (2) diseases should be taken into consideration especially on the proper management and treatment of patients to avoid high Mortality Rate. Pulmonary tuberculosis, one of the priority programs of the Department of Health continuous to be decreasing from 38 deaths in 2009 down to 9 in 2010 and dropped to zero (0) death in 2011. This attributes to the good case holding of TB patients of RHU Personnel and Barangay Health Workers (BHWs) as treatment partners and the sustainable provision of FREE anti-TB drugs by the Department of Health.

Table 2.4-21b. Ten (10) Leading Causes of Morbidity from 2009 to 2011

Causes	2009		2010		2011	
	Tot. Pop = 61,140		Tot. Pop. = 61,199		Tot. Pop. = 61,420	
	No. of Cases	Rate per 100,000 population	No. of Cases	Rate per 100,000 population	No. of Cases	Rate per 100,000 population
1. Cardiovascular Diseases	153	250	120	196	131	213
2. Respiratory Diseases	59	96	111	181	100	163
3. Multi-organ Failure	-	-	64	105	68	111
4. Pulmonary Tuberculosis	38	62	9	15	-	-
5. Cancer (All forms)	31	51	40	65	37	60
6. Violent Death	10	16	-	-	-	-
7. Acute Gastroenteritis	8	13	-	-	-	-
8. Diabetes Mellitus	7	11	13	21	10	16
9. Liver Diseases	6	10		-	8	13
10. Renal Failure	4	7	5	8	7	11
TOTAL :	316	517	362	592	361	588

Source: Municipal Health Office, Local Civil Registrar

Waste Management

The existing solid waste management system of Aparri particularly in the disposal of solid wastes is already under the scrutiny of EMB and several sectors due to its present dump site location. The failure of the LGU to have sanitary land fill is because of its land feature where compatible land area to be developed is located 68 kilometers from the urban area. To comply with the order of EMB for the total closure of said dump site, LGU Aparri has clustered with LGU Lallo in the use of its sanitary landfill until September 2016.

At present, an area of 5.38 has. Located at the boundary of barangays Bangag and Binalan is already identified for development into sanitary land fill. While waiting for the issuance of SPECIAL LAND USE PERMIT by EMB, the following are undertaken to prepare the series of development in the area.

Education of the people through radio, barangay assemblies, search for the cleanest barangay, regular monitoring and above all the construction of MRF in every barangay are the few activities to enhance the awareness of the people on solid waste management system. Barangays have already adopted their own solid waste management plan and instituted strategies in the reduction of solid waste at source and regular collection of wastes in their respective area of responsibility. Solid waste management is a shared responsibility between the government and the people. The municipal government collects all non-recycable wastes or residual wastes while the barangays collect recyclable wastes and placed in MRF's. Likewise, the households will dispose their own compostable wastes.

LGU has constructed MRF located at barangay Maura. Residuals are collected at barangay MRF's at certain scheduled date and the policy "NO SEGREGATION, NO COLLECTION" is strictly enforced. Vermi composting technology was introduced by the Office of the Municipal Agriculturist and adopted by Toran MPCI. LGU Aparri also put-up vermin composting facility at the MRF. Organic fertilizers produced are distributed to the different model and pilot farms. Likewise, Toran MPCI distribute their produced to the member farmers.

In compliance to RA 9003, the Municipal Mayor is designated as the MENRO to oversee the implementation of Solid Waste Management system in the municipality. He directly supervises thirty-seven (37) employees who are on temporary and permanent status appointments. There are three (3) garbage trucks at his disposal that are used in the collection of residuals and other wastes. An average of twenty (20) cubic meters of solid wastes is disposed daily at Lal-lo landfill facility.

MUNICIPALITY OF BUGUEY

Health and Social Services

The Main Health Center offers a 24/7 maternal and child health services. It is located at the heart of the Poblacion and about 8 kilometers away from the farthest barangay. The facility, however, is not capable for the care and management of prevalent diseases in the locality. Other health facilities are lying-in clinic/birthing center at Maddalero, Tabbac and Paddaya Weste. These facilities are augmented by barangay health stations serving coastal and non-coastal barangays.

Waste Management

The municipality is utilizing a private lot, under a Memorandum of Agreement, for its disposal facility employing a controlled dumpsite disposal method under the supervision of a dumpsite caretaker that does the segregation with the help of scavengers. The facility is accessible through a 3-6-meter-wide dirt road and about 6 kms away from the town proper. The Centro public market and Pattao public market are the collection areas which collection is undertaken every other day utilizing a 6 cubic meter

load capacity dump truck. About 71% of wastes generated are biodegradable and about 74% of the waste generated come from residential sources or household.

The disposal facility is about 720 square meters. The municipality identified two (2) sites for its sanitary landfill, one at the barangay Pattao and the other at barangay Sta. Isabel. The Mines and Geosciences Bureau (MGB) conducted geological assessment of the identified sites and the one at sitio Malababoy in Barangay Pattao passed the MGB assessment.

MUNICIPALITY OF GONZAGA

Health and Social Services

The delivery of primary health services to the 36,303 residents is being provided by the Municipal Health Office, a Philhealth accredited institution which is located within the municipal hall compound. It also provides laboratory services. The MHO is being manned by a municipal health officer, a couple of nurses, midwives, a medical technologist, a rural sanitary inspector, a dental aide and ambulance drivers. It regularly opens and serves on weekdays from 8:00 to 5:00 pm although all health personnel are always ready on-call, and all set to render overtime services if the need arises, especially for pregnant women who are giving birth. Nutrition health care services are also provided by six (6) barangay health stations administered by midwives and assisted by Barangay Nutrition Scholars (BNS) and Barangay Health Workers (BHW). There are two (2) ambulances ready to serve in case of emergency and critical health cases.

Complementing the MHO is the Alfonso Ponce Enrile Memorial District Hospital, a 25-bed capacity hospital; the Gonzaga Community Clinic, a 10-bed clinic; the R.C Nicolas Clinic; a 9-bed clinic and three (3) consultation medical clinics, the Salvanera, Siazon and Triffany Clinics. There are two (2) dental clinics also to provide dental services to the community.

The delivery of social welfare services in the municipality is being provided by the Municipal Social Welfare Development Office (MSWDO). Headed by the Municipal Social Welfare Development Officer and supported by the Social Welfare Officer I, a Social Welfare Assistant, two (2) Day Care Workers and a job order employee.

The MSWDO supervises 32 Day Care Centers of the 25 barangays, the Office of Senior Citizens Association (OSCA) and the Gonzaga Federation of Senior Citizens Association (GOFESCA) of the elderly including their monthly social pension fund. The GOFESCA has a separate office and building with an annual fund allocation from the municipal government. Further, the Social Welfare office is spearheading financial assistance to indigent families, the self-employment assistance program, 50-core and shelter projects and burial and health assistance program of LGU employees of Gonzaga.

Waste Management

Upon completion of the 10-year Municipal Ecological Solid Waste Management Plan 2009-2018, the program was immediately implemented by the municipal government in the whole community through massive information, education, and communication (IEC) seminars which were conducted initially for almost three (3) months. Simultaneously, the LGU established/constructed the Sanitary Land Fill (SLF) and Municipal Eco-Center and prepared the open dumpsite for closure, practically, all household heads, institutions, establishments, barangay leaders, schools and students had undergone seminar on R.A 9003.

The Sanitary Landfill is located in a 6-hectare area located at Sitio Sta. Maria, Barangay Pateng, 4.12 kilometers away southwest of the urban center of the Poblacion. The utility place is considered as Eco-

Park due to presence of thick vegetations and only one (1) hectare is allocated for landfill. Other areas will serve as agro-forestry and buffer area. To this date, the local government is utilizing the 4th chamber of the SLF, together with the septic vault used to accommodate hazardous wastes collected in the whole community.

Barangay governments had constructed their own Materials Recovery Facility (MRF), and households are mandated to have compost pits or compost piles for their own biodegradable wastes. The municipal government collects all non-recyclable wastes which is the residual and special wastes. Barangay governments also collect all recyclable waste and being placed in their MRF's. Households will dispense their own compostable wastes.

In the urban core, a house-to-house collection is being done and centralized collection in rural barangays where barangay MRF served as the collection points. No Segregation, No Collection policy is being strictly enforced. The residual wastes are being dumped in the SLF and special wastes are placed in a sanitary septic vault. Recyclable wastes are being sold to itinerants or junk shops.

The Municipal Government has an Eco-Center which caters all biodegradable waste generated from the Municipal Public Market. The eco-center has two (2) units of composting machines with a shredder and a squeezing machine. It is manned by two Eco-Boys and being supervised by the Municipal Environment and Natural Resources Officer.

The Municipal Agriculturist Office has a static composting area and a vermi-composting facility. All organic fertilizers produced from these projects are being utilized in a model and pilot farms. Although burning is prohibited under R.A 9003, there are still indolent farmers and household members who are used to burn their wastes.

IEC Advocacy to all barangays, schools and institutions is continuously being done. As part of it, an incentives and awards programs, all barangays and schools are mandated to participate in this LGU-sponsored competition. A model barangay and model elementary and secondary school will be awarded with cash and plaques during the conduct of the Foundation Day of the municipality. Evaluation and Monitoring are being conducted anytime and quarterly.

For couples-to-be who wishes to secure marriage license and household or institutional head who wishes to secure locational clearances, they will undergo IEC seminar regarding the Ecological Solid Waste Management.

Disaster/Calamity Response Capability

The municipality, with her geographical location, is vulnerable to natural disasters and also to man-made disasters. In order to increase the level of disaster preparedness and responsiveness of the people, the municipal government had enhanced the institutional mechanisms arrangements as well as the human and material resources to cope with. A disaster and contingency plans have been formulated in order to develop self-reliance by promoting and encouraging the spirit of self-help and mutual assistance among the local officials and citizenry. To date, the municipality has 65 trained rescuers to assist the Municipal Disaster Risk Reduction and Management Council (MDRRMC) in the search, evacuation, and rescue operations.

As part of mitigation, the municipal government, together with the farmers group had planted Narra and fruit bearing trees in denuded forest areas, in Barangays Sta. Clara and Pateng. This is consonance with the Upland Development Program and National Greening Program of the national government. Drainage canals in the urban core were improved and desilted and farm-to-market roads were maintained and rehabilitated.

Barangay Disaster Risk Reduction and Management Councils (BDRRMC) were capacitated establishing their Disaster Information and Operations Centers including their evacuation centers. The Municipal Disaster Risk Reduction and Management Councils (MDRRMC) has its own Disaster Operations Center (DOC) which houses office of the Municipal Disaster Risk Reduction and Management Officer (MDRRMO) and his staff, logistics room; personnel quarters and community kitchen. The main evacuation center is the Gonzaga People's Gymnasium. The evacuation centers in all rural barangays are the elementary and secondary schools.

Disaster equipment and logistics of the MDRRMC include four (4) dump trucks, a loader, two (2) graders, a bulldozer, two shuttle buses, a backhoe, a tractor with low-bed, ambulances, three (3) vans, stretchers and spine boards, scuba diving gears, a rubber boat, flashlights, dust masks, rechargeable lamps, a genset, a collapsible tents, raincoats, rain boots, hard hats, bolos, rescue ropes and chain saws, fire extinguishers, first aid kits, life vests, cadaver bags, a bolt cutter, emergency lights and adjustable ladder.

2.4.7 Generation of Local Benefits from the Project

MUNICIPALITY OF APARRI

It is undeniable that the municipality is a conglomerate of agriculture, fishery, business/trade and some small-scale industries in its economy. The vast track of agricultural lands devoted to crop and livestock production and the wide fresh and marine waters as source of fishery and mineral resources had contributed to the source of income for families because they can have dual income sources doing farming activities during cropping season and fishing activities all throughout the year. Other members of the family can have jobs or employment on the business and trade sectors. In year 2011 to 2013 foreign investors had some of the mineral resources of the municipality which augmented family income.

Farming and fishing are the two main activities in the municipality. Rice and soft-shelled shrimps or locally known as "aramang" are the two products that command the movement of economic activities in the locality. Rice harvest in 2011 was tremendously affected due to El Niño. It was only 19.33% of the total area planted with 3,693.12 MT rice production but in 2012 the farmers were able to plant 83.1% hectares and produced 35,644.5 MT.

There are two (2) fishing grounds in Aparri, marine and inland. Fishermen utilized these grounds one after the other that depending on the weather condition. Records show that marine ground has contributed more to the livelihood of the fishermen due to the commercial and exportable quality of soft-shelled shrimps.

Business and services are established to support the primary economic activities in the municipality. These are privately operated. The municipality is known to venture on economic enterprise like the market and slaughterhouse and cemeteries. In 2013, Aparri recorded a total of P53,617,861.70 income from local sources and P99,247,939.00 from Internal Revenue allotment.

Local Employment

Agriculture and fishery are the largest employer of the municipal labor force. It employs about 65% through self-employment while others are hired as fishermen and farm workers. The business/trade and small-scale industries also consist 20% of the labor force who are hired as regular employees and others as skilled workers and helpers. About 10% are employed by the government institutions that are

established in the municipality while the remaining 5% are OFW's who seek greener pasture and higher compensation.

MUNICIPALITY OF BUGUEY

Income Sources

The primary income sources of the people in the municipality are agriculture, fishery, and forestry and remains the major contributor of the local economy. Data for 2012 indicated that the primary sector accounted for about 60.58% or P 212.203 M of the local economy. Of the total income generated by the basic sector, crops and livestock contributed P182.586M while fisheries and aqua-culture accounted for P29.617M.

Secondary income sources are local industries basically traditional such as furniture making, hollow blocks making, rice milling, nipa wine making, bagoong making, and miki processing. For 2012, the secondary sector contributed about 13.07% or P45.782 M to the local economy. Tertiary income sources are wholesale/retail trade; hotels, restaurants, and allied services; transport utility, construction, and real estate/renting, etc.

Local Employment

Agriculture remains the major employment generator in the municipality. The sector accounted for about 61.35% of the total employment of 14,342 followed by the services sector accounting about 25.58% of the total employment in the municipality. The industry sector remains the least prominent employment generator accounting to about 13.07% of the total employment. Employment in the furniture industry is perceived to decline due to limited supply of wood materials while employment in local tourism particularly in tour guiding and health and wellness is expected to increase moderately.

Poverty Level

The municipality has a relatively high incidence of poverty at 22.40% based on 2010 NSO data. Family Income and Expenditure Survey (FIES) data in 2009 indicated that the average annual income of families was P47,377.50 with about 52% of the member of families derive their income from agriculture, 18% from entrepreneurial activities, 20% depend on wages and salaries and 10% on other sources of income. The foregoing situation is associated to the very insignificant investments inflow for commercial and industrial activities resulting to the perpetuation of traditional levels of economic activities and the dearth of alternative employment opportunities.

MUNICIPALITY OF GONZAGA

Income Sources

Generally, Gonzaga is an agricultural community and the major sources of livelihood of the people are farming and fishing. Rice, corn, commercial crop, livestock, and poultry production are the main sources of income of the people. Fishing is also another main economic activity in the town especially in the coastal barangays. The municipality has fish ports located at barangays Minanga, Batangan, Tapel and Amunitan. Aside from being used as fish ports, the facilities are also utilized as net mending area and small fishing boats are carried and placed during typhoons.

Rice and corn are the major crop grown in the municipality, it is of commercial scale considering the area devoted to are 6,648.78 hectares, respectively. It is in here that most of the farmers defend to in terms of livelihood and income. These can also be considered as high value commercial crops because it serves as raw materials in the manufacture of animal feeds and at the same time is the stable food of

the people in the municipality. The existing volume of harvest of rice and corn for year 2012 is approximately 32,180.06 & 19,934 metric tons respectively. The value of production are P547,019,880 and P239,446,650 respectively.

There are two fishing grounds in the municipality, these are the inlands and marine water bodies. Inland fishing encompasses brackish water bodies, fish caging and fishpond development. So far, the municipality has 15-hectare brackish water bodies, 10 units of fish cages, 103 developed fish ponds. It recorded an average volume of catch of 1,380 kgs/year with a value of P2,640,000.00. Marine fishing is within 15km municipal waters as provided by the law, RA 8550. The volume of catch in these waters is almost 944,780 kgs valuing to P132,262,200.00.

Business activities in Gonzaga are mostly retailed enterprise such as sari-sari store. It is privately managed or single proprietorship. The municipal government is known to venture only on its economic enterprise particularly the public market, the heavy equipment rented, and a tourism facility which is the Gonzaga Riverview Hotel and Resort, Baua Beach Resort, Danashs Beach Resort, Kangaroo Beach Resort, Carmela Beach Resort, Tallag Rocks and Beach Resort, Surbida Beach Resort and Matara Reef and White Sand Beach Resort.

There is no available data on income generated from the industry sector, which is composed of rice mills, welding shop, automotive repair shops and CHB making, pinipig crunch, longganisa and dried fish making. Commerce, trade, services, and industries have contributed P12,277,470 revenue of the municipality.

Local Employment

As an agricultural community, about 55% of the active population of the municipality is engaged in farming and fishing. The rest are laborers or unskilled workers, some are engaged in vehicles/ appliances repairs, machine operators, drivers, domestic services government and private services, manufacturing, trade and industry and construction. Some are working in foreign countries as domestic helpers, nurses, engineers, doctors, teachers, agriculturists, and consultants and others.

The wholesale and retail trading has the most number of employment of 540 individuals working in the 480 establishments. This is followed by the hotel and restaurants, transport, and storage with 45 employees in 15 establishments. The least number of employments is in real estate, renting business with 10 employments.

Poverty Level

Based on the 2012 Municipal Social Welfare and Development Office (MSWDO) data, the average family income level in the municipality is P 8,000.00 monthly. Expenditures of the family from their income are mostly for food and some are being use for clothing and shelter. There are 1,118 families belongs to the family threshold level.

2.4.8 Marine Traffic Assessment

I. Introduction

JDVC Resources Corporation (hereinafter referred to as the "Company") holds a Mineral Production Sharing Agreement (MPSA No. OMR 338-2010-II) with the Republic of the Philippines for a 14,240-hectare mining area. The Company has a Partial DMPF mining concession and commercial extraction of minerals like magnetite iron sand, titanium, vanadium and other valuable minerals with a life of 25 years and renewable for another 25 years. MPSA-338-2010-II-OMR was approved on June 2010 as a contract between the Republic of the Philippines and Bo GO Resources Mining Corporation (Bo Go). It was transferred to JDVC Resources Corporation by Bo Go on November 25, 2011, by virtue of a Deed of Assignment. The Deed of Assignment was duly registered with MGB Region II, Tuguegarao City, Cagayan on January 27, 2012, and was duly approved by Department of Environment and Natural Resources (DENR) Secretary.

The Environmental Compliance Certificate (ECC-CO-1409-0021) was issued to JDVC for its proposed "Cagayan Offshore Magnetite Mining Project" covering the 4,999.2358-hectare area of MPSA No. 338-2010-II-OMR-Amended A located in Gonzaga, Buguey and Aparri, Cagayan, allowing a maximum production rate of 1.3 million dry metric tons of magnetite iron sand concentrate per annum last May 20, 2016.

The Mines and Geosciences Bureau (MGB) approved the Declaration of Mining Project Feasibility (DMPF) for the said 4,999.2350-hectare area of MPSA No. 338-2010-II-OMR-Amended A, thereby, authorizing JDVC to proceed to the Development and Operating Periods, including extraction and commercial disposition of magnetite sand and other associated minerals, subject to compliance with certain conditions.

The Proponent, then applied for the expansion of Extraction Volume of the Cagayan Offshore Magnetite Mining Project from 1.3 to 30 million dry metric tons of magnetite iron sand concentrate per annum. There will be a change of vessel composition for the proposed extraction compared to the current vessel complement, and it might affect the marine traffic in the area.

a. Project Location and Area

MPSA Number 338-2010-II-OMR containing an area of 14,240 hectares is located 14-15 kilometers offshore of the municipalities of Sanchez Mira, Pamplona, Abulug, Ballesteros, Aparri, Buguey and Gonzaga in the Province of Cagayan (as shown in Figure 1). The proponent considered the extraction of magnetite starting only within mine operational area from a distance of 15 km away from Cagayan shoreline. This is to prevent the negative impact of disturbed sand on the quality of water that was traditionally used by the people for fishing and beyond the 10 km-limit for municipal waters.

Figure 2.4-8. Satellite Image of the partial DMPF area (in yellow) and the whole MPSA area (in red)

b. Marine Environment

The project site is within the Babuyan Channel. It is a part of Luzon Strait (see Figure 2).

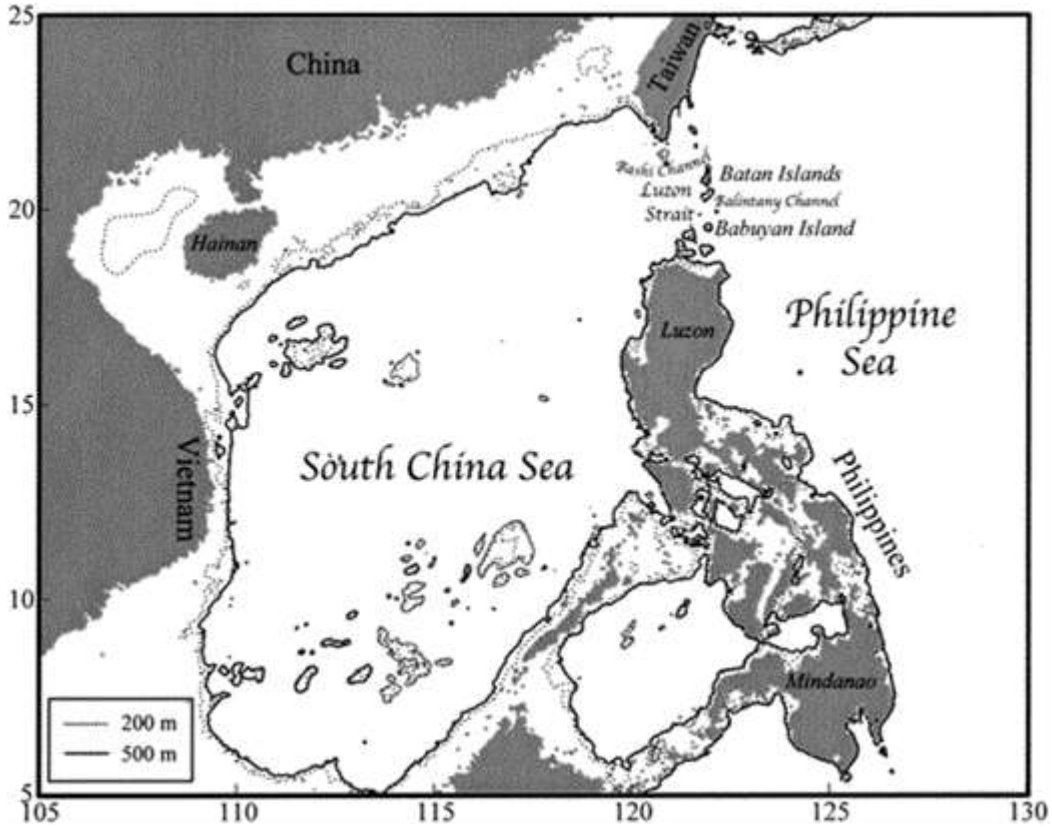


Figure 2.4-9. Luzon Strait and Babuyan Channel

The Luzon Strait (Filipino: *Kipot ng Luzon*) is the strait between Taiwan and Luzon Island of the Philippine (see **Figure 2.4-9**). The strait thereby connects the Philippine Sea to the South China Sea in the western Pacific Ocean.

This body of water is an important strait for shipping and communications. Many ships from the Americas use this route to go to important East Asian ports. Many submarine communications cables pass through the Luzon Strait. These cables provide important data and telephone services to China, Hong Kong, Taiwan, Japan and South Korea.

The Luzon Strait is approximately 250 kilometers (160 mi) wide containing several islands belonging to the Philippines that are grouped into two: the islands comprising the province of Batanes and the Babuyan Islands, which are part of the province of Cagayan. The strait is divided into several smaller channels. The Babuyan Channel, where the Project is located, separates Luzon from the Babuyan Islands, which is separated from Batanes by the Balintang Channel. Batanes is separated from Taiwan by the Bashi Channel. Babuyan Channel is about 32 kilometers (20 miles) wide (see **Figure 2.4-10)**. The depth of water was measured to be below 30 – 45 meters from maximum 23 km to minimum of 11 km offshore, followed by a sudden slope of more than 90 m thereafter (*Source: EIS of JDVC Resources Corporation)*. In the areas subject of the DMPF has a depth of 50 to 75 meters for Parcel A and 55 to 200 meters for Parcel B.

Figure 2.4-10. Balintang and Babuyan Channel from an old Japanese Map.

c. Need for Assessment

The exploration and operation of the Project would entail marine traffic risks, hence the need for this assessment.

II. Objective

The objective of the assessment, addressing the requirements of the EIA, may be summarized as follows:

- To evaluate the existing and future planned/proposed marine traffic environment.
- To assess the impact on marine traffic arising from Project activity associated with the exploration and operation of the proposed magnetite mining extraction Project.
- To ascertain the associated risk levels at all stages of the Project, and
- To recommend mitigation measures to reduce the marine risks (e.g., collision, grounding, mechanical failure, man overboard, typhoon, fire, oil pollution, etc.) to acceptable levels.

For the scope of the assessment, the area of interest has covered the immediate vicinity of the proposed site and the adjoining fairways.

III. Existing Condition

Maritime trade and commerce (interisland and international) are present in the area. The Project site is gird by the coastal municipalities of Sanchez Mira, Pamplona, Abulug, Ballesteros, Aparri, Buguey, Gonzaga and Sta. Ana.

There are seaports in the area – two National Ports of Entry in Aparri (Punta) and Claveria Taggat), which are under the jurisdiction of the Philippine Ports Authority (PPA) and Port Irene in Casambalangan, Santa Ana which is being managed by the Cagayan Economic Zone Authority CEZA) plus two Municipal Ports - Port of Abulug and Port of San Vicente in Sta. Ana.

The Port of Aparri is a very small port in Philippines. However, Port of Aparri was a container port – and was one of the top 7 provincial performers on revenue – Bureau of Customs. PETRON operates its own port facilities in Aparri. Calayan of the Babuyan Islands is the largest town and only port with regular interisland shipping service from Aparri, but this link is frequently broken from September to February during the typhoon season. Cattle, hogs, goats, and lumber are exported. From Aparri port via a lampitaw (cargo boat), boat ride (motorized pump boat) to Calayan. In the Port of Aparri, vessels presently anchored at the anchorage area are waiting for instructions of the owners for their operations.

Aparri was the main area for trade of Japan owing to its location at the northern tip of Luzon at the mouth of the Cagayan River. As far back as 1680, Aparri was made one of the major Spanish ports of the Galleon Trade. In the years before the outbreak of World War II, it became a transshipment point for smuggled goods from China, Taiwan and other neighboring Southeast Asian nations.

Inter-island pump boats are operating via Aparri to Cagayan group of islands and from Claveria to Calayan islands and vice versa.

Port Irene **(Figure 2.4-11)** is a busy free port due to the activities of the Cagayan Special Economic Zone or CEZA, particularly on imported used cars, vans, buses and trucks and other goods similar to the Subic Bay Freeport. CEZA's main thrust is to develop the CSEZFP as an interactive gaming, shipping, and ecotourism hub in Southeast Asia. The free port occupies all of 441,000 hectares of Sta. Ana, or an area almost three times the size of Quezon City. It also includes the far-off islands of Fuga, Barit and Mabbag, which are under the jurisdiction of Aparri town. The 238.48-hectare projects include the Marina Yacht Club, beach club and commercial areas, casino and entertainment, and residential resort villas.

Figure 2.4-11. Port Irene in Sta. Ana

The whole complex extends to the village of San Vicente and shares the use of the airstrip of the Philippine Navy's Camilo Osias Operating Base here.

San Vicente Port – Gateway to Cagayan Exploration

The San Vicente fish port **(Figure 2.4-12a & 2.4-12b)**, which also serves as a docking facility for passenger ferries bound for the eastern coastal towns of Isabela, as well as for boats that bring tourists to nearby Palaui Island, one of the town's main tourist attractions. The M/V Eagle Ferry is one vessel to ride from San Vicente Port to Camiguin Norte and Calayan in Babuyan Islands. Tourist boats are mostly present in Sta. Ana going to Palaui island. The largest marine vessel present in Aparri is the M/V Eagle Ferry. Travels twice a week between Santa Ana (San Vicente Port) and Calayan; via Camiguin Island.

Figure 2.4-12a. M/V Eagle Ferry at San Vicente Port in Santa Ana, Cagayan

Figure 2.4-12b. Port of San Vicente in Sta. Ana

Located at Sta. Ana, Province of Cagayan, the 642-kilometer marker lies at the San Vicente Port, the jump-off point to discover the rich marine and protected areas of the Philippines situated in the province of Cagayan.

Figure 2.4-13. The other side of San Vicente Port.

For the entire Cagayan Province exploration which covers Tuguegarao City, Sta. Ana, Aparri, Palaui and Crocodile Islands, Angib Beach and Penablanca, Cagayan are started from San Vicente Port. The San Vicente Port is the take-off point to tourism destinations in the Cagayan Freeport, such as Palaui Island. Small boats (see **Figure 2.4-13**) are currently being utilized to ferry tourists from the said port to Palaui Island and other tourist areas in the zone. This aims to accommodate leisure fishing boats, sail boats and luxury yachts, and further advance the status of the Cagayan Freeport as a premier game fishing destination.

Santa Ana is the Game Fishing hub of the Philippines. It has hosted international decathlons, where athletes run through the rugged terrain of Punta Verde to Cape Engaño, then dipped in the crystal-clear water of the Philippine Sea.

Santa Ana is also known as one of the sites for Kiteboarding and Windsurfing. In 2015, the Philippine Windsurfing Association and the Philippine Kiteboarding Association organized a Kiteboarding and Windsurfing competition in Anguib Beach, known as the paradise for kiteboarders and windsurfers.

IV. Babuyan Channel

Babuyan Channel is generally too rough for crossings from December to March and during peak typhoon season from August to October. April to June is calm with April as the calmest month.

Babuyan Channel **(Figure 2.4-14 and 15)** is one of the major fishing grounds in the country providing livelihood, income, and employment particularly to fisherfolk living in the coastal areas of the Northern Philippines thus, there is a need to assess the status of the area to determine strategies and policies to sustain its production and livelihood of the fisherfolk.

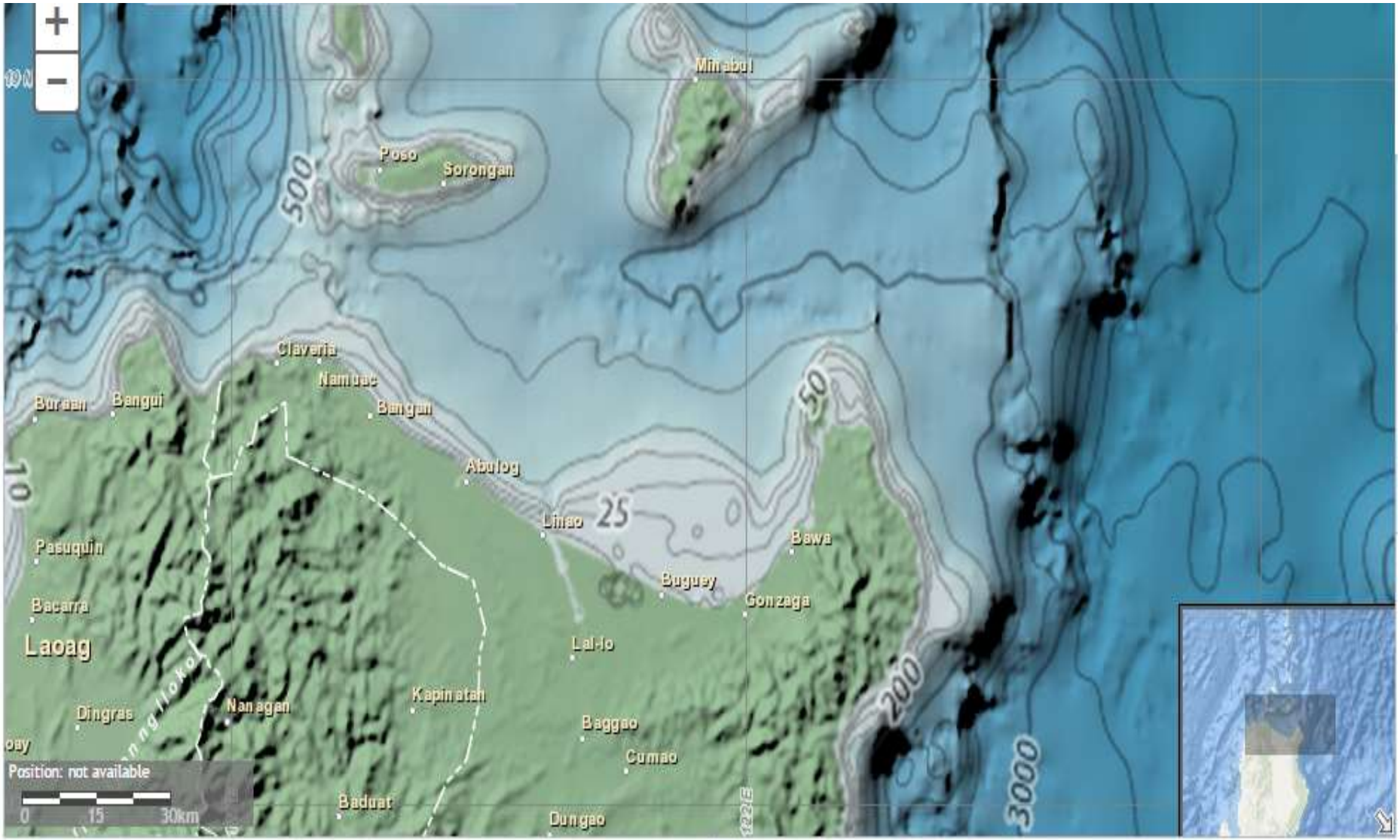


Figure 2.4-14. Babuyan Channel, showing the contours

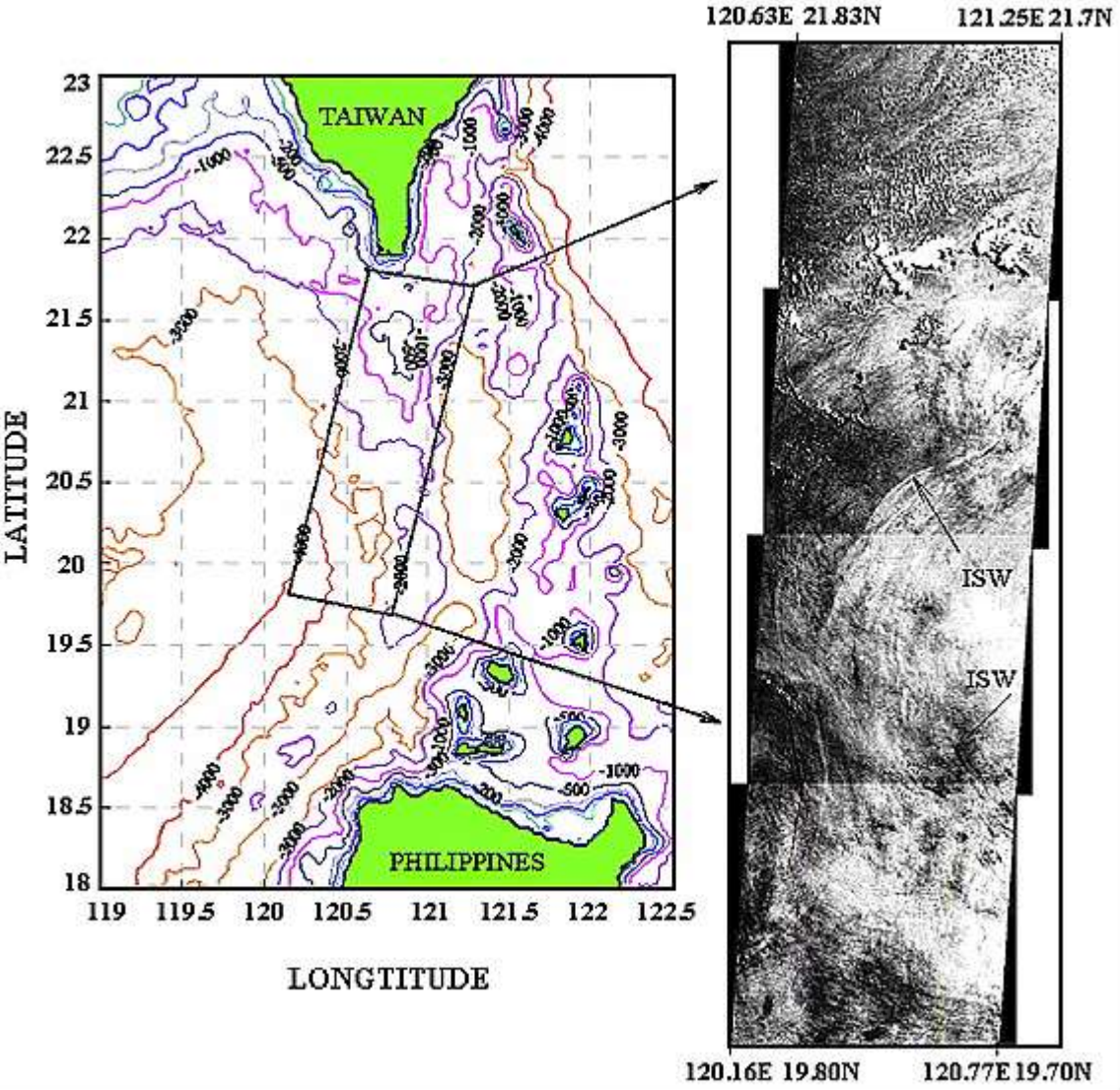


Figure 2.4-15. Relative geographical location of Babuyan Channel

a. Babuyan Channel Characteristics

Tidal Levels and Currents

Tides in Babuyan Channel vary between semi-diurnal – two daily (high and low tide) and mixed, with the latter occurring in Aparri and Abulug..The tidal range **(Table 2.4-22)** is comparatively small, averaging just over a meter, but a couples of times a year the range may be almost two meters. The tide within the channel flows in a constant direction without turbulence and the velocity of the current is relatively high in the 2 to 2.5-knot range which would not affect the mining activities.

Table 2.4-22. Tide levels in Babuyan Channel

Location	Maximum height	Minimum height
Abulug	1.0 m	- 0.2 m
Aparri	1.3 m	- 0.4 m
Calayan	1.3 m	- 0.4 m
Sta. Ana	1.4 m	- 0.4 m

Table 2.4-23. Occurrence of tides

Location	1st low tide	1st high tide	2nd low tide	2nd high tide
Sta. Ana	1:04 h	7:00 h	13:38 h	20:14 h
Calayan	1:10 h	7:08 h	13:44 h	20:22 h
Aparri	5:54 h	11:27 h	18:09 h	
Abulug		8:15 h	17:08 h.	20:21 h

Apparently, the tide starts from the Philippine Sea to Sta. Ana and reaches Calayan Island in 8 minutes. On the other hand, the tide from South China Sea most probably affects tide levels in Abulug and Aparri (see **Table 2.4-23**).

Current Distribution Near Site

- *Impacts of tidal currents and Kuroshio intrusion on the generation of nonlinear internal waves in Luzon Strait*

Some of the largest ocean waves in the world, at times over 170 meters in height and stemming from tides and ocean currents, are found in the north of Luzon strait. These waves or currents are underwater and rarely break the surface, thus posing no danger to shipping but are sometimes visible to satellites. The oscillation is largely prompted by a long north – south ridge which covers almost all of the strait, then amplified in the northern section by a second parallel ridge. The depth of the strait reaches the 3,500 m and 4,000 contours in north–south trenches in the middle and south-western edge.

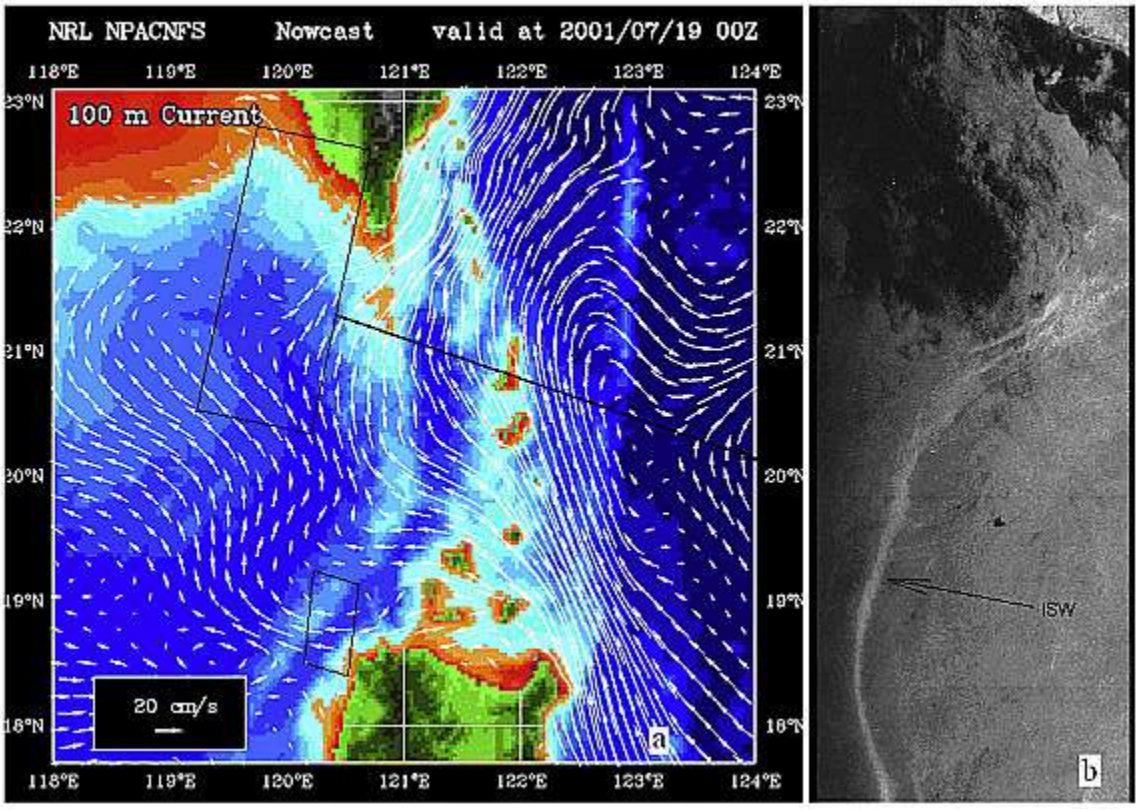


Figure 2.4-16. Current observations in one season.

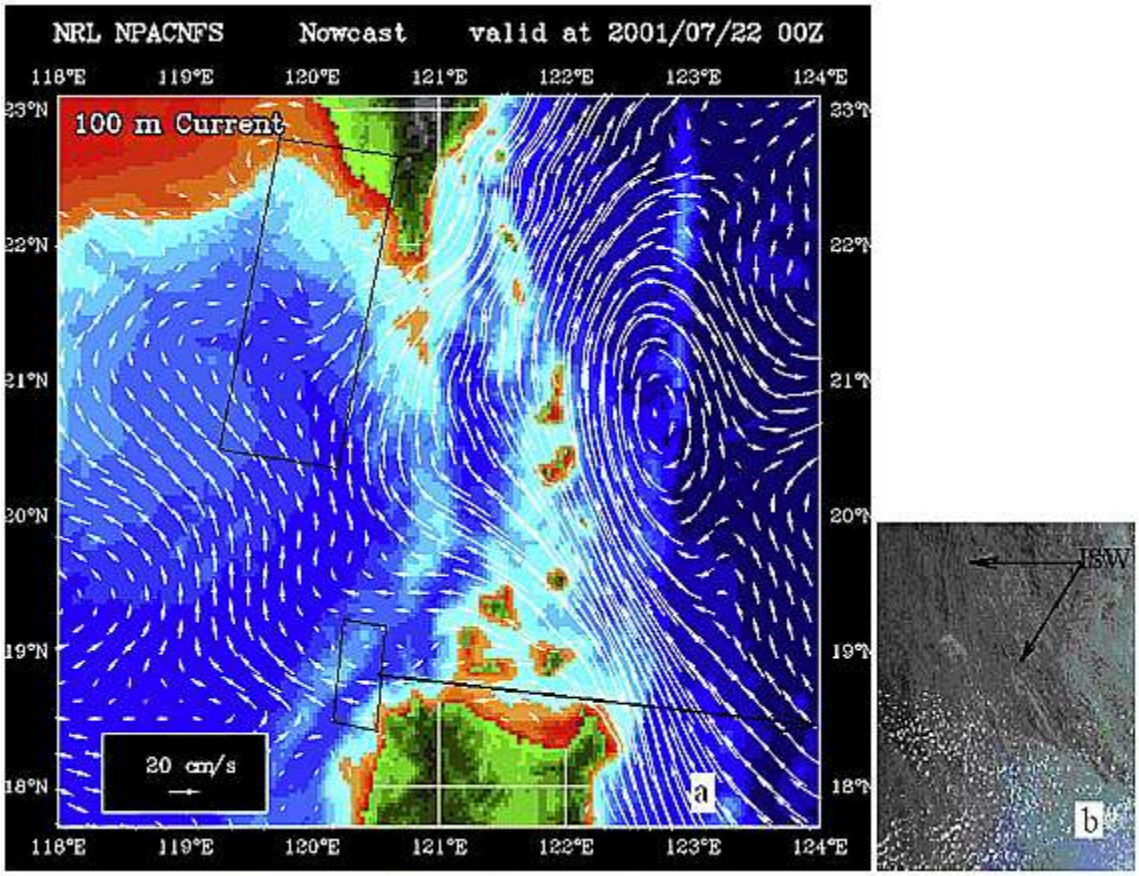


Figure 2.4-17. Current observations in other seasons.

Velocity observations near the surface made with Argos satellite-tracked drifters between 1989 and 2002 provide evidence of seasonal currents entering the South China Sea from the Philippine Sea through the Luzon Strait. The drifters cross the strait and reach the interior of the South China Sea only between October and January, with ensemble mean speeds of 0.7 ± 0.4 m s−1 and daily mean westward speeds that can exceed 1.65 m s−1. Many of the drifters that continued to reside in the South China Sea made the entry within a westward current system located at ~20°N that crossed the prevailing northward Kuroshio path (Figure 9). In other seasons, the drifters looped across the strait within the Kuroshio and exited along the south coast of Taiwan. During one intrusion event, satellite altimeters indicated that, directly west of the strait, anticyclonic and cyclonic eddies resided, respectively, north and south of the entering drifter track (Figure 10). The surface currents measured by the crossing drifters were much larger than the Ekman currents that would be produced by an 8–10 m s−1 northeast monsoon, suggesting that a deeper westward current system, as seen in historical water mass analyses, was present.

- *Dominant Current Patterns*

The surface circulation south and east of the Luzon strait is dominated by strong and persistent subtropical current systems based on previous studies. At the surface, the yearly mean Pacific North Equatorial Current bifurcates at approximately 130°N near the east coast of Luzon is called the Kuroshio Current (see **Figure 2.4-18**). Studies have shown that Kuroshio penetrates the northern South China Sea through the Balintang Channel and the passage south of Babuyan Island in Luzon Strait, (Centurioni et al., 2004) to form the northward flowing Kuroshio and the southward flowing Mindanao current. The near-surface bifurcation latitude moves between 11°N in May and 14.5°N in November and at depth, it is even farther north of its surface expression. At 18oN, the Kuroshio is a well-formed, northward flowing western boundary current concentrated entirely west of 124oE; its high-speed core

is positioned at 123oE, and its baroclinic structure is evident in the upper 600m. Before reaching Taiwan, the Kuroshio takes a westward set and makes a detour into the South China Sea through the deepest channels of the Luzon Strait: The Balintang Channel and south of Babuyan Island. West and north of Batan Island, the Kuroshio flows within the Bashi Chanel until it reaches the southeast coast of Taiwan (Centurioni, 2004).

The largest westward component of the Kuroshio intrusion is through the deepest channels of the Luzon Strait (the Balintang Channel, the south of Babuyan Island) and the largest eastward component (outflow back toward the Philippine Sea) is through the Bashi Channel between Taiwan and Batan Island. However, the westward component of the intrusion through the Balintang Channel in August was much smaller than in December. A branch of Kuroshio penetrates the Babuyan Channel which the MPSA area is located. This seasonal variability is consistent with the previous findings that the Kuroshio intrusion into the interior of South China Sea is mainly between October to January (Wu, 2007).

Shown in **Figure 2.4-19** are lines representing the different paths of Kuroshio Current across the strait. The purple represents the direct path of the current, the blue represents the intrusion of Kuroshio in the northern South China Sea, and the orange color represents the branch of Kuroshio penetrating the Babuyan Channel which the MPSA area is located.

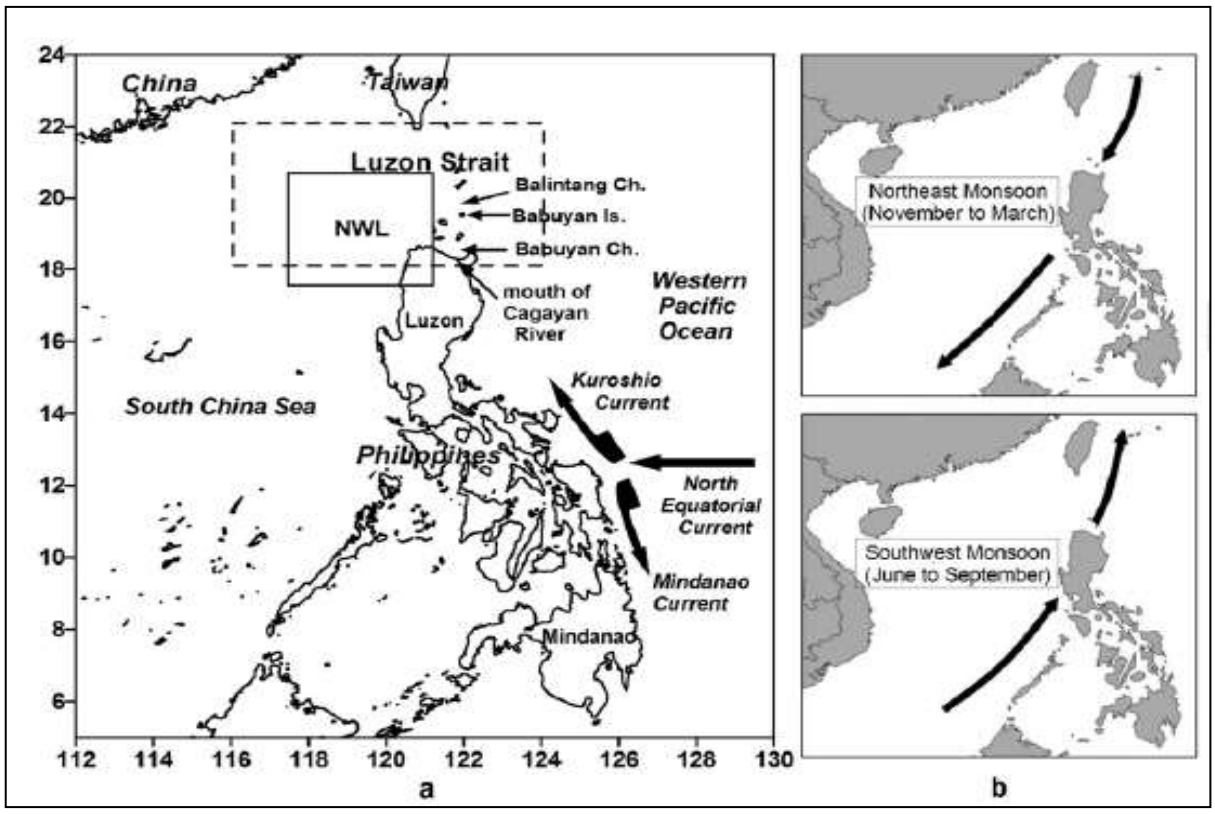


Figure 2.4-18. Map of the Philippines and its surrounding areas showing the Kuroshio Current. (a) The Philippines and its surrounding areas (b) Monsoon seasons showing the arrows of wind direction

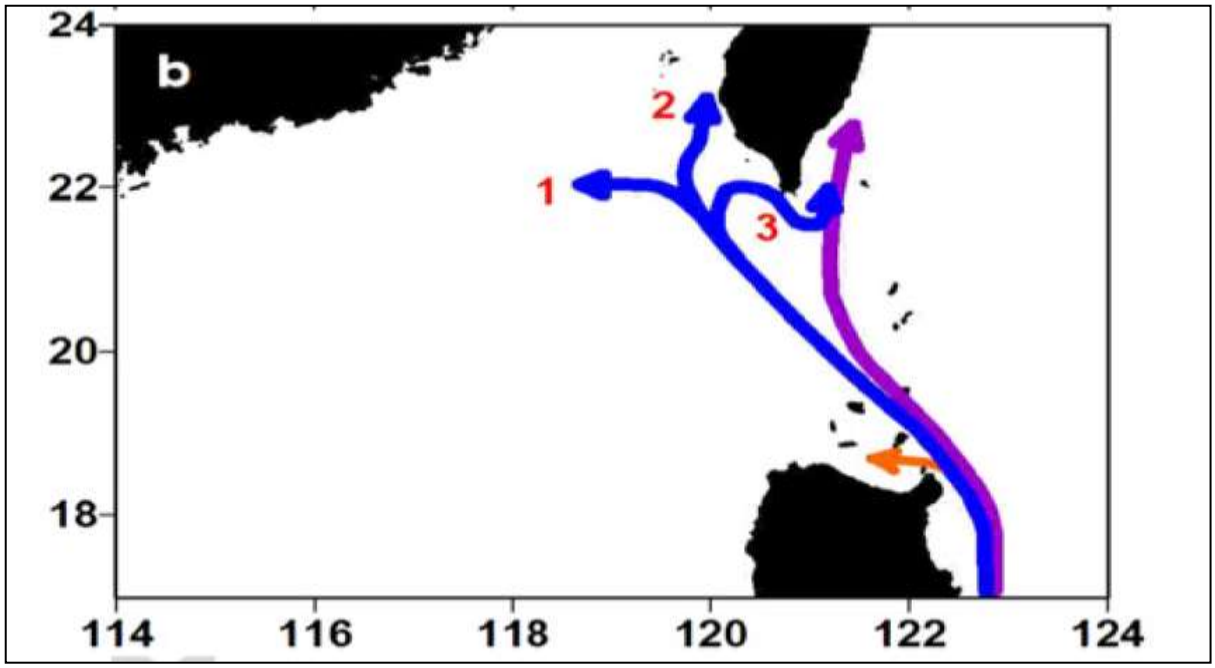


Figure 2.4-19. Different paths of Kuroshio Current across the Strait Source: Pañaflor et al, 2007

Wind Environment

The wind environment at the site can be illustrated with reference to historical data from PAGASA.

- *Wind Speed and Direction*

There are 2 prevailing wind directions recorded in Aparri station: northeasterly winds and southerly winds. Northeasterly winds are the most dominant and it prevails during the months of September to May with monthly average wind speed of 3-4 meters per second. **(Figure 2.4-20)**. Rate of wind is generally light all throughout the year with an average wind speed of 3 meters per second. The annual and monthly wind rose diagram applicable to the project site were taken from the Aparri station of PAGASA.

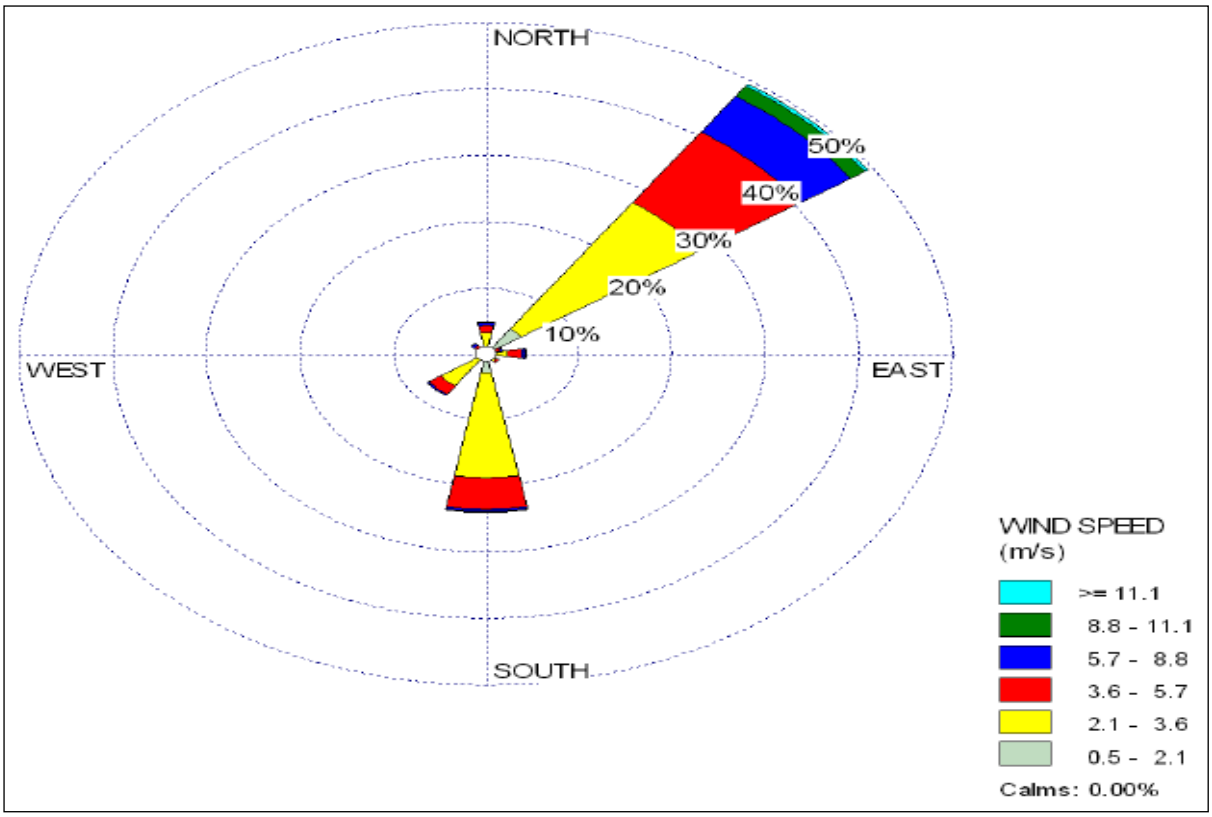


Figure 2.4-20. Annual Wind Rose at Aparri, Cagayan Synoptic Station. Period of Record: 1951 – 2006, PAGASA.

Table 2.4-24. 12-Month Data on Rainfall & Wind Speed

Month	Rainfall in mm.	No. of rainy days	Wind direction	Wind speed. m/s
January	106.3	13	NE	4
February	53.9	8	NE	4
March	40.7	5	NE	3
April	31.6	4	NE	3
May	110.5	9	NE	3
June	134,7	10	S	3
July	171.8	11	S	3
August	194.5	13	S	3
September	248.3	13	NE	3
October	359.5	16	NE	4
November	329.5	19	NE	4
December	185.1	17	NE	4

On a wider scale, wind environment discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

The average hourly wind speed in Cagayan experiences significant seasonal variation over the course of the year. The windier part of the year lasts for 3.4 months, from December 3 to March 16, with average wind speeds of more than 10.2 miles per hour. The windiest day of the year is January 15, with an average hourly wind speed of 13.6 miles per hour. The calmer time of year lasts for 8.6 months, from March 16 to December 3. The calmest day of the year is May 15, with an average hourly wind speed of 6.9 miles per hour.

The predominant average hourly wind direction in Cagayan varies throughout the year. The wind is most often from the south for 3.8 months, from May 31 to September 23, with a peak percentage of 60% on August 7. The wind is most often from the west for 3.7 weeks, from September 23 to October 19, with a peak percentage of 36% on October 9. The wind is most often from the east for 7.4 months, from October 19 to May 31, with a peak percentage of 56% on January.

- *Wind Wave*

The action of wind at the site, blowing across the sea “fetch” will develop distinct wave characteristics. The waves generated in Babuyan Channel is generally classified as wind wave, Sea waves are larger-scale, often irregular motions that form under sustained winds. These waves tend to last much longer, even after the wind has died, and the restoring force that allows them to propagate is gravity. As waves propagate away from their area of origin, they naturally separate into groups of common direction and wavelength. The sets of waves formed in this manner are known as swells.

The main dimensions associated with waves are:

- Wave height (vertical distance from trough to crest);
- Wave length (distance from crest to crest in the direction of propagation);
- Wave period (time interval between arrivals of consecutive crests at a stationary point); and
- Wave propagation direction.

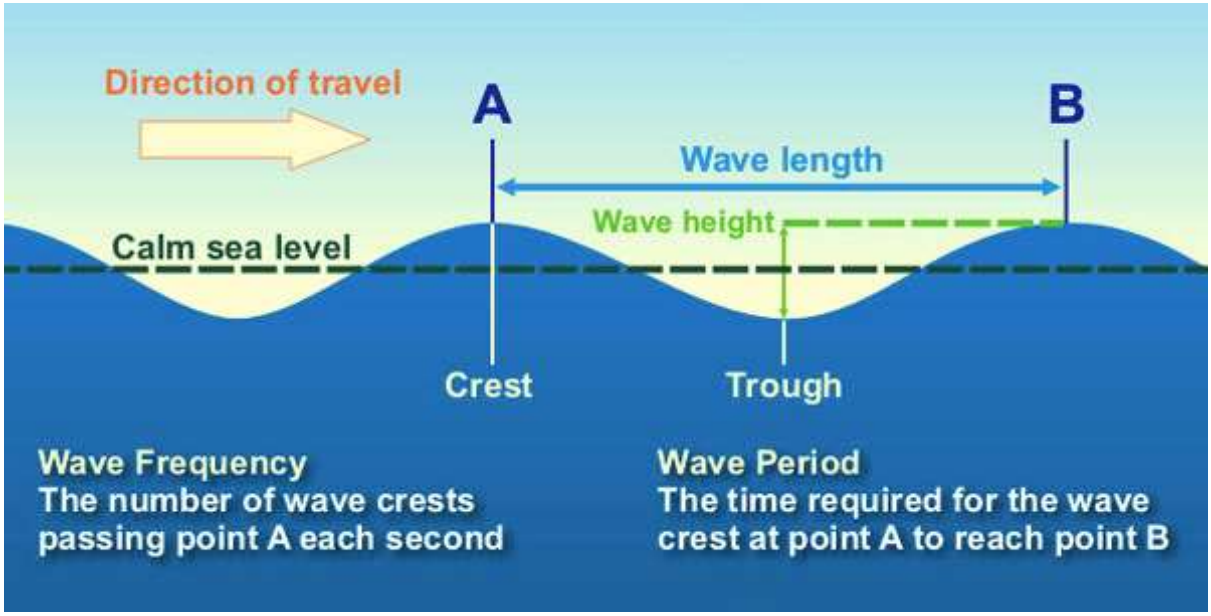


Figure 2.4-21. Wave Characteristics *Source: NOAA, 2016*

The speed of all ocean waves is controlled by gravity, wavelength, and water depth. Most characteristics of ocean waves depend on the relationship between their wavelength and water depth. Wavelength determines the size of the orbits of water molecules within a wave, but water depth determines the shape of the orbits. The paths of water molecules in a wind wave are circular only when the wave is travelling in deep water. A wave cannot "feel" the bottom when it moves through water deeper than half its wavelength because too little wave energy is contained in the small circles below that depth. Waves moving through water deeper than half their wavelength are known as deep-water waves. On the other hand, the orbits of water molecules in waves moving through shallow water are flattened by the proximity of the sea surface bottom. Waves in water shallower than 1/20 their original wavelength are known as shallow-water waves. Transitional waves travel through.

In Babuyan Channel, the direction of maximum fetch is northeast. This is a long narrow corridor bounded by Fuga Island and Camiguin Island and may run up to more than 200 kilometers. From the east, the fetch is only about 100 kilometers. Based on the above-mentioned fetch lengths that may control wave heights within the study area, the significant wave heights were calculated using nomograms of deep-water significant wave prediction curves as functions of wind speed, fetch length and wind duration. On the other hand, a Hongkong study produced the following data on maximum operational wave distribution is shown in **Table 2.4-25.**

Table 2.4-25 : Maximum operational wave distribution

Wind conditions			Wave size		
Wind speed in one direction	**Fetch**	**Wind duration**	**Average height**	**Average wavelength**	**Average period and speed**
12.5 m/s(25 knots) N, NE, E, SE	4.5 km (2.8 mi)	No data but water depth*= 5 – 12 m	1.2 m (4.0 ft)	No data	No data
12.5 m/s S	1.5 km (0.9 mi)	Depth = 4 m	0.7 m (2.3 ft)	No data	No data
12.5 m/s SW	3.0 km (1.8 mi)	Depth = 6 m	1.0 m (3.3 ft)	No data	No data
12.5 m/s W	> 10 km (6 mi)	Depth = 5 m	1.3 m(4.3 ft)	No data	No data
12.5 m/s NW	6.75 km (4 mi)	Depth = 8 m	1.4 m (4.6ft)	No data	No data
12.5 m/s S	0.75 km (.45 mi)	Depth = 2.2 m	0.5 m(1.6ft)	No data	No data
12.5 m/s W	2,7 km (1.6 mi)	Depth = 2 m	0.7 m(2.3ft)	No data	No data
12.5 m/s NW	9.0 km (5.5 mi)	Depth = 4 m	1.2 m(3.9ft)	No data	No data

Source: BMT

** - an allowance for storm surge has been included within the assessment of water depths*

The maximum operational waves (based on a limiting wind speed of approximately 25knots, 12.5 m/s) associated with these sites has been calculated using “fetch” limited wind driven forecast methods.

Local data Channel on a wave condition of a swell in Babuyan Channel **(Table 2.4-26)** shows a wave direction of NE with a significant height of 0.5 m for a duration of 9.7 s.

Table 2.4-26. Wave conditions in Babuyan

Location	Wave direction	wind | coast	wind | open water	Significant height	Wave period
Calayan	ENE (60°)	WNW (281°) 10 km/h	SSE (164°) 10 km/h	0.5 m	9.7 s
Sta. Ana	NE (50°)	N (6°) 14 km/h	S (188°)13 km/h	0.5 m	9.7 s
Abulug	NE (50°)	E (90°)10 km/h	ESE (103°) 18 km/h	0.4 m	9.3 s

The most frequent wave height will be about half the height of the significant wave - 0.3 m (0.2 m in Abulug). About 14% of waves will be higher than the significant wave height (about 1 in every 7 waves - 0.5 m (0.4 m in Abulug). It is normal to expect a maximum wave of twice the height of the significant wave about 3 times in 24 hours -.1.0 m (0.8 m in Abulug.

Excerpts from an EIS Report for another Project:

High winds push the ocean's surface that causes water to pile up higher than the ordinary sea level known as storm surges A seiche, on the other hand, is a standing wave oscillating (sloshing back and forth) in bays or gulfs. Seiches are typically caused when strong winds and rapid changes in atmospheric pressure push water from one end of a body of water to the other. When the wind stops, the water rebounds to the other side of the enclosed area. The water then continues to oscillate back and forth. Earthquakes, tsunamis, or severe storm fronts may also cause seiches.

Typhoons or Tropical Cyclones

From 2007 to 2010, the Philippines experienced a total of 67 typhoons or an average of 17 typhoons per year. The number of typhoons increased in 2008 and 2009 and then abruptly decreased in 2010. Most number of typhoons occurred in 2009 at 22 while the least happened in 2010 at 11. In Cagayan Valley (Region 2), the number of typhoons from 2007 to 2010 has an annual average of 9, the highest in the entire Philippines followed by Ilocos Region (Region 1) which has an average of 8 typhoon per year. (Israel, D., 2012).

Typhoon season in the Philippines occurs between June and December. Over 20 affect the country annually, with 8 or 9 making landfall (IPCC 4th Assessment Report, Working Group II, 2007). Typhoons come from the southeast, generally the strongest and affect Samar, Leyte, eastern Quezon province, and the Batan islands with the island of Luzon at a significantly higher risk than the southern areas. (Natural Disaster Risk Management in the Philippines: Enhancing Poverty Alleviation through Disaster Reduction. World Bank and Disaster Coordinating Council, Philippines, Report Base on 2003 research mission). Typhoons cause significant damage through heavy rainfall, flooding, and high winds.

Strongest typhoons in the area were FERDIE (Mirante) last September 2016 with 252 kph wind speed observed in Basco, Batanes and 288 kph observed at PAGASA Itbayat station, ODETTE (Usagi) last September 2013 with 215 kph observed in Itbayat, JUAN (Magi) last October 2010 measured by reconnaissance aircraft (Philippine Sea east of Isabela) and GADING (Peggy) last July 1986 with 220 kph observed in Vigan. The Project area, however, is shielded by the Sierra Madre and Cordillera mountains.

Visibility

The extraction and transhipment of the ores for will be impacted, like all other crafts in the Channel, by changes in the visibility within the approach channel and along the transit routes. Visibility within Babuyan Channel waters is at least 8 kms, and it is expected that there will not be a problem on visibility as we do not experience wintery conditions and very cold spells which causes fogs and mists, except for heavy rains. Periods of very low visibility (<1.0 km) are very rare or may not occur at all. This is not anticipated to cause hazard in Project operations, as there was no case of collision due to zero visibility.

a. Present Marine Traffic Environment

No information on traffic levels within the Babuyan Channel waters was collated from a few data sets to assist in the risk assessment of shipping operations. The traffic consists of ocean-going vessels (capesize, bulk carriers, tankers), interisland ships, barges, launches, cargo boats, ferries, outrigger

passenger boats and fishing vessels. No data on ship arrivals and ship capacity of ports are available. These boats ply the Babuyan Channel.

Cagayan Freeport

One information from CEZA was that Port Irene caters only to bulk carriers with no passenger ships. More people are discovering why tourist arrivals in the once-sleepy town of Santa Ana in Cagayan Province almost doubled in less than three years. *"Santa Ana has become a magnet for travelers with a desire for adventure"*, said Secretary Raul L. Lambino of the Cagayan Economic Zone Authority (CEZA) that runs the Special Economic Zone and Freeport. Aside from Palaui Island, which the Cable News Network (CNN) Travel named the third best beach in the world—even ahead of Boracay and El Nido. CEZA is also in the course of opening more tourism destinations. Tourists have responded in record numbers and CEZA and town officials predict that arrivals would likely hit more than the 338,621 visitors who came in 2018. *"That's a 99-percent increase from the 170,285 arrivals recorded at the start of the administration of President Rodrigo Roa Duterte in 2016"*, Sec. Lambino said.

The San Vicente Port is the take-off point to tourism destinations in the Cagayan Freeport, such as Palaui Island. Small boats are currently being utilized to ferry tourists from the said port to Palaui Island and other tourist areas in the zone. This aims to accommodate leisure fishing boats, sail boats and luxury yachts, and further advance the status of the Cagayan Freeport as a premier game fishing destination.

Capesize Vessels in the Channel

Ships in this class **(Figure 2.4-22)** are bulk carriers, usually transporting coal, ore and other commodity raw materials. The term capesize is not applied to tankers. The average size of a capesize bulker is around 156,000 DWT, although larger ships (normally dedicated to ore transportation) have been built, up to 400,000 DWT. The large dimensions and deep drafts of such vessels mean that only the largest deep-water terminals can accommodate them. Subcategories of capesize vessels include very large ore carriers (VLOC) and very large bulk carriers (VLBC) of above 200,000 DWT. These vessels are mainly designed to carry iron ore.

Figure 2.4-22. Capesize vessel (VLOC Berge Nord) *Source: Maritime Connector, 2007)*
(This is not an actual photo of the Siphon vessel to be used by the proponent)

Philippine container traffic went up drastically in the first 11 months of the year anchored on robust shipping and trade atmosphere and heightened domestic demand. Domestic box volume, somehow cushioned the decline in foreign overall volume, specifically export traffic.

Latest data from the Philippine Ports Authority (PPA) showed that total container traffic for the period in review inched up by 53% to 9.084 million twenty-foot equivalent units (TEUs) from 5.940 million TEUs a year earlier.

On the other hand, fishing is the livelihood of the communities that populate the coastal towns; hence, fishing vessels are scattered at the area specially during fishing season. Fishing boats **(Figure 2.4-23 and 2.4-24)** are predominant in Babuyan Channel (see **Table 2.4-27**). most fishing boats and gears operating are under the municipal fisheries sector. However, production is higher in the commercial sector suggesting higher fishing effort and catch rate was exerted by commercial fishing boats and gears in the fishing ground.

Table 2.4-27. Inventory of Fishing Boats in Babuyan Channel (2013)

Municipalities	Motorized	Non-motorized	Total
Calayan	104	197	301
Aparri	613	101	714
Buguey	122	77	199
Sta. Ana	306	16	322

Municipalities	Motorized	Non-motorized	Total
Gonzaga	206	49	255
Pamplona	124	123	247
Abulug	96	28	124
Ballesteros	77	20	97
Sanchez Mira	126	30	156
Total	1774	641	2415

Figure 2.4-23. Fishing boats: Fish landings are in Centro and Palawig in Sta. Ana, Batangan and Minanga in Gonzaga, Minanga and Centro in Buguey, Centro and Bagu in Abulug, Centro and Punta in Aparri.

Figure 2.4-24. Smaller fishing boats

V. Proposed Project

a. Project Components

Table 2.4-28 below shows the vessels in the current mining operations. These vessels are mostly stationary at place of extraction except when smaller vessels are getting food and supplies for replenishment. There will be times when the bigger vessels will also be changing positions in extracting the ores.

Table 2.4-28. Vessels to be Used for the Project

Current
• 1 Siphon vessel (dredge barge) • 3 Separator Barges • 1 Panamax Vessel • Gravity Separator • Magnetic Separator • Hopper / Chute • Generator Set

b. Project Extraction Methodology

The proponent considered the extraction of magnetite starting only within mine operational area from a distance of 15 km away from Cagayan shoreline. This is to prevent the negative impact of disturbed sand on the quality of water that was traditionally used by the people for fishing.

The extraction for magnetite sand will simply utilize a siphon vessel. The extracted sand will then be temporarily stored, dewatered, and separated from the non-magnetite sands on board barges. All the processes for extraction will be strictly mechanical, no chemicals will be used. In addition, all phases of the operation, from the extraction up to the magnetic separation, will be done offshore. The process is smaller in scale compared to the extraction methods to be used inland.

c. Exploration Phase

The exploration activities (Figure 19) conducted in the area consisted mainly of bathymetric survey/seabed profiling, initial diamond drilling and sampling, physical and chemical analysis of core samples, initial resource estimation and confirmation/infill drilling and final resource evaluation.

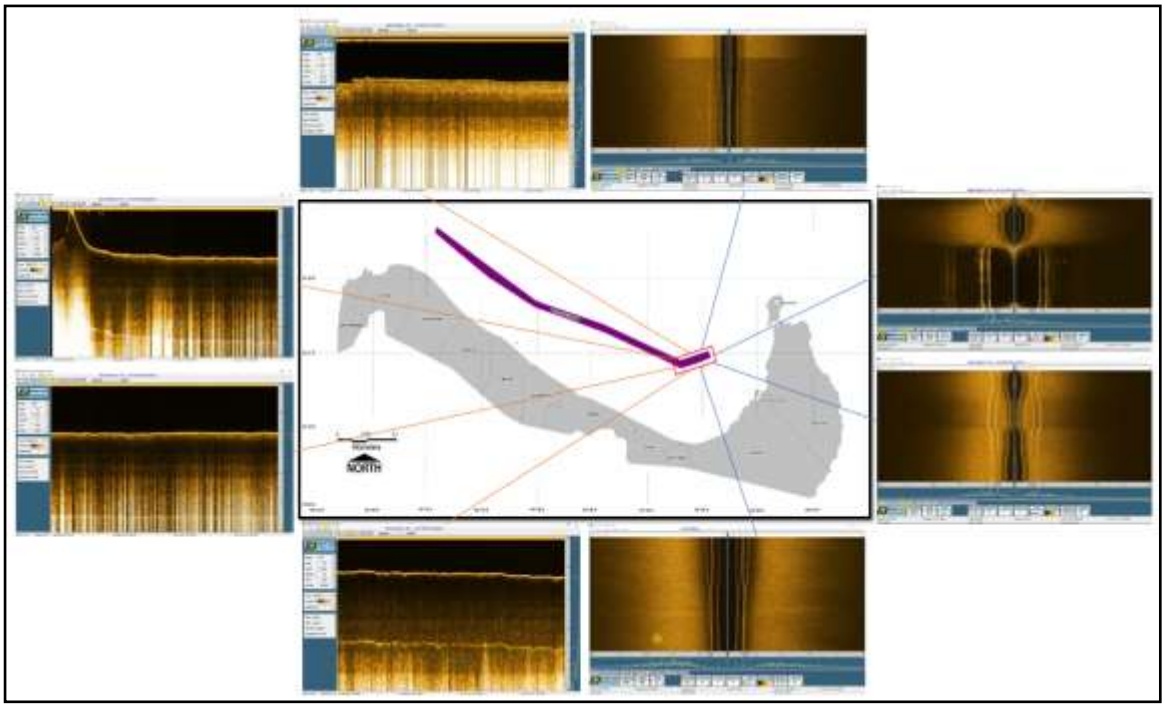


Figure 2.4-25. Side Scan and Sea Bottom Profiling

The extraction process is via siphon vessel with magnetic separator, and processing apparatuses on board. This system is no hazard at all and no social complication as the siphon vessel is stationed at the ocean far from the shore. The siphoning action of the Siphon Vessel for Magnetite Sand Offshore based on findings of the experts and specialists does not produce significant sea bottom topography disturbances due to the following reasons:

1. There is no explosive use, hence there is no blasting activities.
2. There is no permanent structure buried to the sea bottom;
3. The siphoning area underneath the sea agitated by the siphon pipe/s while it can cause localize turbidity, would immediately cave in upon pull out of the siphon pipe/s due t continuing action of the sea under current.
4. The magnetic separator on the siphon vessel would only qualify about 10% average for quality grading required hence, will return back to the same area the 90% of the lesser grade magnetite Iron Sand.
5. The sand mounds with lesser magnetite that can be created by the return after magnetic separation under the sea may even become series of new fishing areas during calm season nearer the shorelines, and

6. The continuing replacement every time it rains allow continuing replacement of the 10% extracted for higher grade as separated for export shipment.

d. Offshore Operations

The project involves the offshore mining of magnetite iron sand thru dredging/siphoning activity. It involves the use of a capesize vessel with built-in (7) seven production lines magnetic separator on board. The magnetite iron sand concentrate will be stockpiled onboard the vessel for shipment to prospective buyers. The waste or the non-magnetite materials (low magnetite content) will be returned to the sea floor. The dredging ship has 2,000 tons/hr. capacity.

The extraction is limited to the MPSA area as shown in **Figure 2.4-8**.

The operations will siphon and process using a capesize vessel about 606 million tons of raw sand with yearly feed to the siphoning vessel of 159.46 million tons of raw sand and will produce a yearly production of 30 million tons of iron concentrate. The average magnetic fraction (Mf) during the entire mine life is 19.79% (passing 2 stages of magnetic separation) will produce an average concentrate grade of <60% Fe. The magnetic separator efficiency is assumed at 95%. The concentrates are then stored in barges, prior to conveying it to bulk carriers for shipment to ports of the buyers (see **Figure 2.4-26).**

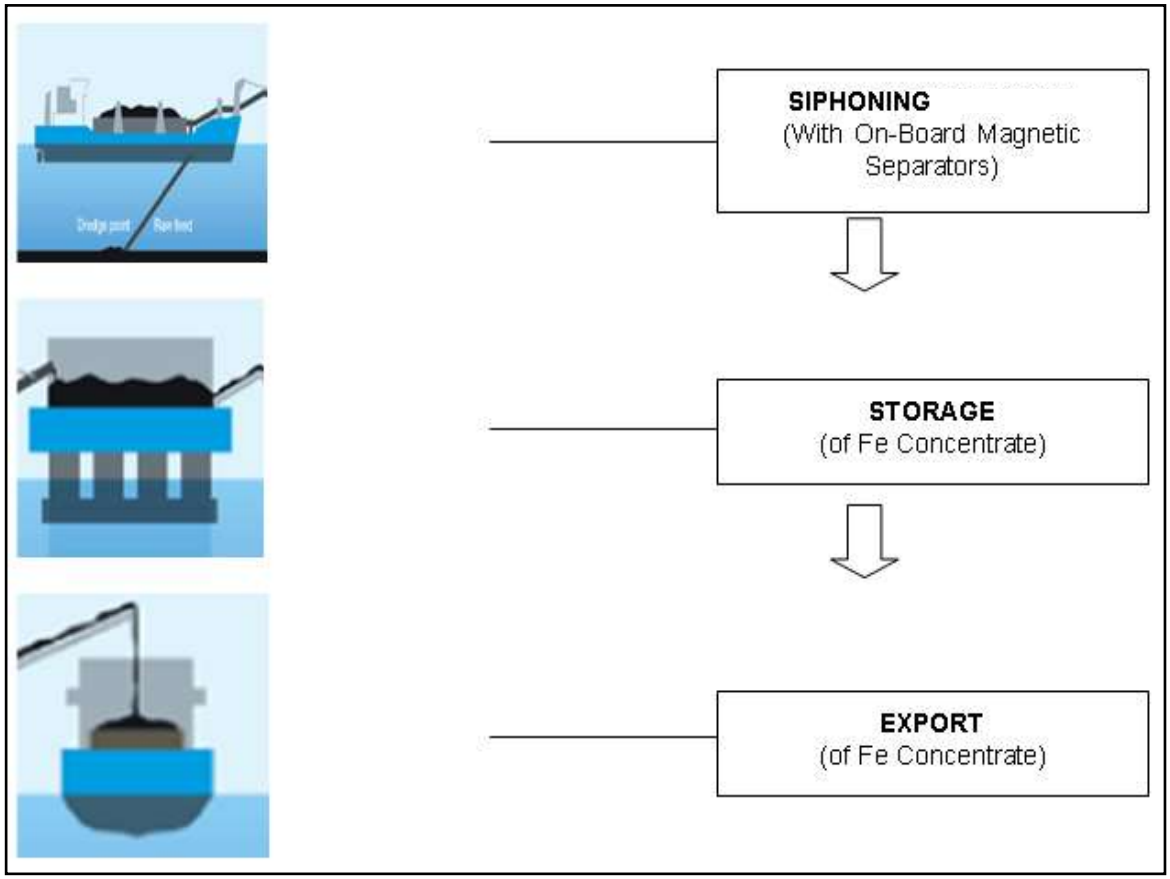


Figure 2.4-26: Offshore Mining Process Flowchart

a. Hazards within the Project Site

According to PCG, there are about 170 recorded annual marine accidents mostly involving Philippine-flagged vessels in the country's waters during the past 20 years. This number does not include marine accidents recorded by MARINA.

Table 2.4-29a. Summary of Maritime Accidents in the Philippines (1995-2006) All VESSEL TYPE

Type of Accident	1995	'96	'97	'98	'99	2000	'01	'02	'03	'04	'05	'06
Aground	58	19	5	42	44	21	27	22	35	48	19	21
Sunk	37	35	16	37	37	25	21	23	35	24	17	23
Collision	17	5	6	5	5	14	11	10	20	11	5	1
Caught Fire	23	6	8	9	11	7	10	15	12	7	7	8
Capsized	33	32	11	88	109	47	49	44	67	64	34	25
Missing	0	0	0	12	0	1	5	6	24	11	4	18
Drifted/Engine Trouble	13	9	9	8	0	14	17	20	37	29	12	17
Flooding	0	3	0	0	0	2	1	1	2	4	4	0
Rammed	0	10	2	6	0	3	6	5	15	5	4	1
Others	0	0	1	1	57	17	21	6	10	13	16	0

Source: Philippine Coast Guard (PCG)

*Note: * The source for 2003 data is the Maritime Industry in the Philippines Databook 2005*

Figures are the number of vessels.

Table 2.4-29b. Summary of Maritime Accidents in the Philippines (1995-2006) All VESSEL TYPE (con't)

Type of Accident	2013	2014	2015	2016	2017	2018
Aground	97	71	81	56	40	72
Sunk	61	31	40	11	2	2
Collision	18	43	15	20	36	9
Caught Fire	11	7	17	24	9	7
Capsized	75	56	61	124	89	54
Missing	59	31	51	91	---	---
Drifted/Engine Trouble	184	123	122	215	39	76
Flooding	4	2	0	0	59	---
Rammed	17	21	18	39	32	12--
Others	43	24	48	7	--	

Table 2.4-29 and 29b shows the number of marine incidents to all types of vessels in the Philippines as recorded by the Philippine Coast Guard. It should be noted that only collision and ramming are directly related to the traffic assessment. There is only one incident in the Babuyan Channel of a marine incident, and it was not involving another vessel. It happened to a motor banca, MBca Jen-Mar which capsized last December 14, 2008, near the vicinity of Linao, Aparri, Cagayan after its outrigger broke. The motor banca was carrying passengers more than its allowed capacity, and bad weather condition which was a contributory cause of its capsizing. It caused 47 deaths 30 missing 45 survivors.

The principal hazard posed by marine traffic is the potential for collision between a vessel (boat or ship) with another vessel. In this case, collision or ramming by a ship or boat of a vessel of the proponent while extracting ores in a stationary position or when traveling to a port. The consequences of collision incidents within the Babuyan Channel water, and what may be assumed for the present assessment, can be visualized as in **Table 2.4-30** below in a Hongkong study.

Table 2.4-30. Consequence of Vessel Collisions (within HKSAR waters)

Incident		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Collision / Contact	Incident	286	239	327	283	246	236	246	302	242	236	264
	Injury	44	18	25	20	38	15	34	48	33	27	30
	Fatality	6	2	0	2	5	6	12	0	1	14	5
Injury/Collision or Contact		0.15	0.08	0.08	0.07	0.15	0.06	0.14	0.16	0.14	0.11	0.11
Fatality/Collision or Contact		0.02	0.01	0.00	0.01	0.02	0.03	0.05	0.00	0.00	0.06	0.02
Frequency of other fatalities as a proportion of reported collision fatalities												1.27

Others = Stranding/Groundings, Foundering/Sinking, Fire/Explosion. Man Overboard, Capsized Listing & Others
Source: Marine Accident Investigation Branch *http://www.mardep.gov.hk/en/publication/pdf/portstat_2_y_e1.pdf*

It is conceived that; on average the injury rate may be 11% with a fatality rate per collision of 2%.

Figure 2.4-27 illustrates the average annual reported collisions within the HK Study Area for 2001 – 2003. 14 collisions were identified, approximately (14/200) 7% of the HKSAR occurrence of collision incidents in 2001 – 2003 in that study.

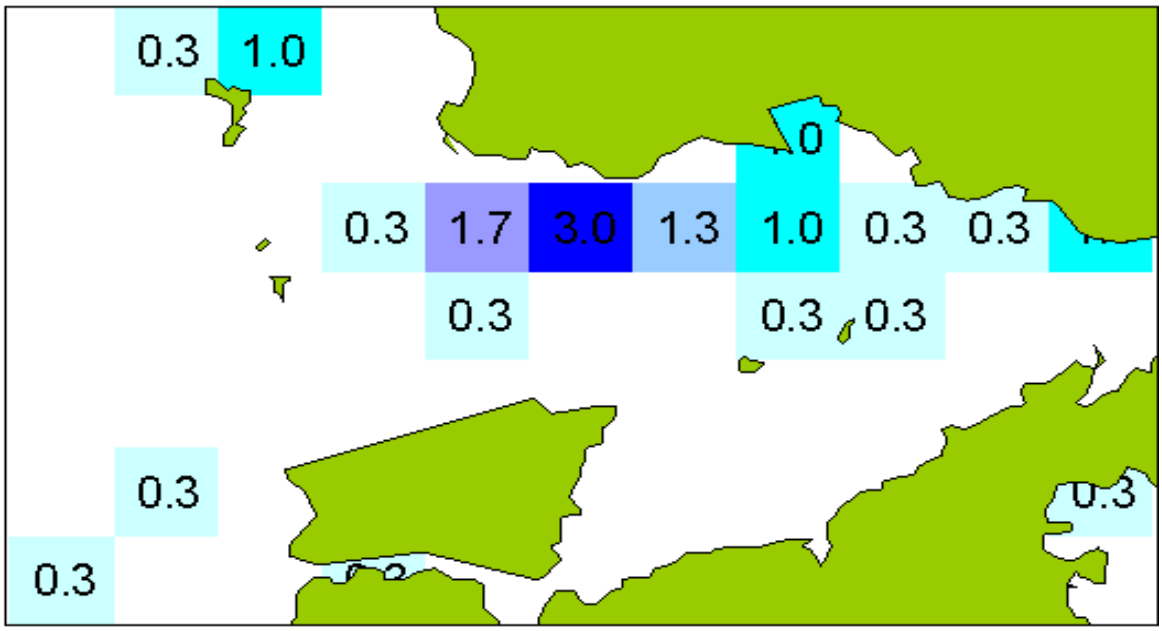


Figure 2.4-27: Average Annual Reported Collisions in the HK Study Area (2001-2003)

The above study is illustrated as we lack data and information on incidences in Babuyan Channel or incidences frequency of such collisions are far and wide, virtually nil. Report from PPA indicate no records of collisions/incidents in the area. Even incidence outside of the Study Area is very infrequent as shown in Table 10 and 11.

Table 2.4-31. Consequence of Vessel Collisions (within Manila Bay waters)

Incident		1992	1993	1994	1997	2003	2005	Average
Collision / Contact	Incident	1	1	1	1	1	1	1
	Fatality	0	0	0	140	73	0	35.5
Fatality/Collision or Contact		0	0	0	140	73	0	35.5

Table 2.4-32. Consequence of Vessel Collisions (other areas)

Incident		1980	1987	2000	2003	2013	Average
Collision / Contact	Incident	1	1	1	1	2	1.25
	Missing	N.A.	N.A.			82	N.A.
	Fatality	176	4341	0	0	152	778
Fatality/Collision or Contact		176	4341	0	0	152	778

These incidences are mostly between an interisland vessel/ferry colliding with cargo ships, tanker, or another passenger vessel, hence the fatalities are quite high. A commonly held misconception concerning the rules of marine navigation is that by following specific rules, a vessel can gain certain rights of way over other vessels. No vessel ever has absolute "right of way" over other vessels. Rather, there can be a "give way" (burdened) vessel and a "stand on" (privileged) vessel, or there may be two give way vessels with no stand on vessel. A stand on vessel does not have an absolute right of way over any give way vessel, for if there is a risk of collision, a stand on vessel may still be obliged under Rule 2 and Rule 17 of the International Regulations to give way to avoid it, if doing so will be effective and is practicable. Two power-driven vessels approaching each other head-to-head, are both deemed to be "give way" and both are required to alter course to avoid colliding with the other. Neither vessel has "right of way".

Current Status of Global Maritime Accidents

The annual average number of vessels involved in maritime accidents that needed rescue (vessels that needed rescue) in Japan's surrounding sea areas was 2,086 (167 fatalities and missing persons) for the period from 2001 to 2005. Although the number of vessels that needed rescue was up by about 11% over the number for the previous five-year period, 1,877 (170 persons), the annual average number of people who died or went missing was down by 2%. Moreover, about 54% of the deaths and missing persons had occurred on fishing boats, and about 18% had occurred on pleasure boats. During this period, in September 2002, a pleasure boat capsized in Lake Saloma in Hokkaido, claiming seven precious lives, and in 2004, there was a high incidence of grounding and capsizing accidents caused by the large-scale typhoons that arrived one after another. Furthermore, in September 2005, a saury fishing boat and a foreign cargo carrier collided off the coast of Nemuro in Hokkaido, claiming seven precious lives again.

The annual number of people who fell overboard was 204 (139 fatalities and missing persons) for the period from 2001 to 2005, down by about 3% from the number for the previous five-year period, 210 (165 fatalities and missing persons), and the number of people who died or went missing had also gone down by about 16%.

Moreover, the characteristics of the maritime accidents that occurred from 2001 to 2005 are as follows:

1. About 70% of all maritime accidents were due to so-called human-causes such as navigation errors including inadequate watchkeeping, improper ship handling and inattention to the weather and hydrographic conditions, and inappropriate handling of engines, which was similarly high to that of the previous five-year period.
2. Maritime accidents had occurred in all coastal areas of Japan, and over 90% had occurred in waters within 20 nautical miles from the shore. Particularly, maritime accidents that occurred in congested waters such as harbors and bays make up for about 40% of all maritime accidents.
3. The number of fishing boats that needed rescue is almost unchanged.
4. Among the vessels that needed rescue, pleasure boats account for the largest part, about 50% of all rescues. The accidents caused by extremely rudimental errors such as battery over discharge and lack of fuel were more frequent with pleasure boats than with other common vessels.
5. The number of people who died or went missing in maritime accidents or by falling overboard was still high, and among them, the number of people who died or went missing by falling overboard from a fishing boat was high. The possible reasons for this situation are that small fishing boats tend to be influenced by the weather and hydrographic conditions, and therefore capsize more easily than common vessels, and that the rate of the use of lifejackets (rate of the use of lifejackets by those who were thrown into the sea due to maritime accidents or going overboard) has remained low.
6. Compared to Japanese vessels, foreign vessels tend to have large numbers of deaths and missing persons when maritime accidents with deaths and missing persons occur. This is likely to be because many of the foreign vessels sailing around Japan are large vessels with large numbers of crew on board.
7. Maritime accidents caused by abnormal weather such as typhoons have resulted in many deaths and missing persons, and typhoons are the greatest cause of the increase of deaths and missing persons (annual range). In 2004, 10 typhoons, more than three times the average number of typhoons in the past 30 years (3 typhoons), hit Japan. Because of this, the number of deaths and missing persons in maritime accidents associated with the typhoons increased sharply to 36 persons (11 persons in 2003).

To safeguard and monitor incidences of collisions, the Philippines Ports Authority (PPA) has a Vessel Traffic Management System (VTMS).

The VTMS Control Center is a state-of-the-art vessel monitoring facility managed and operated by PPA on a 24/7 basis. The operation of VTMS focuses on giving round-the-clock assistance as well as relaying information to pertinent government agencies incidents of vessel distress, accidents, piracy, and others for appropriate action. Since its implementation, the VTMS has not only served as an effective navigational tracking tool but has likewise complemented and beefed up PPA's security measures at the ports where they are installed.

The existing VTMS facilities at North Harbor (Corregidor, Bataan) and MICT will continue to be operated by PPA while VTMS proposals in other ports will continue to be evaluated to ensure that overlapping of functions with the Philippine Coast Guard which has the mandate to build, operate, and maintain VTMS facilities will not be an issue.

e. Presence of Fishing Gears

It was reported that there may be fish pens, gillnets, fyke nets, lift nets, troll line, hook and line and other fishing gears along the navigation lane for the extraction vessels and transports getting food and

supplies It is indicated that these fishing gears were located within 10 kms from shore and about 5 kms away from the Project.

Inventory of Aquafarms, the following data was obtained from Bureau or Fisheries and Aquatic Resources (BFAR) Region 2:

- Brackish Water Fish Cage (Milkfish)
    1. Pamplona - 176 units
    2. Sanchez Mira - 16 units
    3. Sta. Ana - 16 units
- Brackish Water Fish Cage (Tilapia))
    1. Abulug - 13 units
    2. Buguey - 4 units
    3. Claveria - 23 units
    4. Gonzaga - 10 units
    5. Sta. Ana - 16 units

As to fishing grounds, fisherfolks are only fishing inside the municipal waters which is within the 15 kilometers limit. Moreover, their boats have no capacity to travel far beyond the 15 kilometers and back.

VI. Risk Assessment

a. Introduction

This section assesses the impact of both the exploration and operation phases of the offshore mining activity on the existing risk level within the Study Area. Marine risk has been reviewed for two principal scenarios: (i) the collision risk during navigation with other vessels or with fish gears within the whole Study Area and; (ii)the collision risk during operations at or near the work sites.

The following 2-time horizons have been examined within the risk assessment:

- Present (2020) activity
- Operation Phase (Future)

Present Marine Activity

Movement of the vessels are limited to the MPSA area and are stationary during the mining operations. With the current operation, only 4 barges are used with one panamax vessel for storage of concentrated ores. With the present production, it would take years to exhaust the mineral resources. Only smaller sea crafts ply from the site to the ports for ferrying of personnel and transport of food and supplies. The fuel and oil requirements of the equipment, ships will be sourced out from the locally available fuel-oil supplier on-shore. No refueling stations, will be allowed to be constructed at the site.These can be obtained from PETRON station in Aparri or from tankers. This equates to less than 10.0% of the traffic movement at a given time (excluding smaller sea crafts) within the local waterways.

Bulk carriers from Asian ports frequent Port Irene due to the presence of CEZA. Port Aparri has been a container port but has been dormant for 10 years due to heavy siltation from Cagayan River. Both ports are used in the transshipment of ores from Cagayan. The maximum size, however, of these ships is good only for a draft of 7.7 meters – hence dredging is done in Port Irene and Cagayan River (Port Aparri) for the ships to dock.

Cargo motor ridden boats ply from Abulog, Aparri and Port San Vicente to carry goods/products to the outlying islands of Camiguin Norte, Calayan and the rest of Babuyan Islands and to Batanes, carrying with them some passengers. Interisland boats/ferries and outrigger boats crisscross the Babuyan

Channel bringing passengers and tourists to Palaui and Crocodile Islands, Tuguegarao City, eastern coastal towns of Isabela, Aparri, Calayan Islands, Camiguin Norte, Angib Beach, Penablance, Callao caves and other tourist areas. Numerous fishing boats ply the Babuyan Channel from the coastal communities of Sanchez Mira, Pamplona, Abulug, Ballesteros, Aparri, Buguey, Gonzaga and Sta. Ana. Last but not least Babuyan Channel has been considered as an international navigation route for military naval ships and oceangoing liners of other nations. The current shipping operations, however, to date have been conducted with an acceptable level of safety.

Future Marines Facilities

A number of future facilities are planned within the Study Area which may impact the risks levels within the local water space.

Aparri Port is planned to revive Cagayan-China commerce. The restoration and reopening of the Port of Aparri will improve economic and trade relations between Cagayan province and China as well as with neighboring Asian countries. Aparri Port is recognized as a catalyst in unlocking the Region's potential as a major transshipment facility, thereby realizing the Region's development potential as an agro-industrial and tourism hub. The port would take in agricultural products and other goods to complement other Northern Luzon ports in Claveria town in Cagayan province and Currimao town in Ilocos Norte province.

On the other hand, Port Irene is envisioned to become the premier international port of Northern Philippines, capable of accommodating Panamax and cape-sized vessels catering to the Asia Pacific Region markets. It will be developed as a major international seaport that will serve as a gateway for exports and imports from neighbouring East Asian countries to the US West Coast, among others.

Figure 2.4-28. Ports Planned for Ship Building Industry

Moreover, Port Irene **(Figure 22.4-28)** was proposed as a new site for shipbuilding facility. The 54,000-hectare business hub of Cagayan Economic Zone Authority (CEZA) in Port Irene being primed to be the country's next world-class shipyard. Existing shipyards strategically located in the country whose owners are determined to enter shipbuilding arrangements with foreign investors
With the advent of having more and bigger vessels in the area, it will impact on the marine traffic, particularly on the smaller sea crafts.

With the use, however, of a capesize siphoning vessel with 7 production lines the Project output would tremendously increase from 1,3 to 30 MMt and the activity would just last a five years or more in Parcel

A. The proposed expansion of the Ports may not be finished in that time and the consequent shipping activity would not impact on the mining operations.

b. Basis for Forecast

Future traffic activity that may impact the Project has been forecast on the basis of taking into account international and local factors and makes reference to local data sources, as provided by the proponent.

The Port Cargo Forecast drives the growth of international and mainland cargo vessels, while MARINA, Philippines Port Authority (PPA) and Philippines Coast Guard (PCG)'s assessment of typhoon shelter requirements addresses vessel activity associated with the domestic economy.

The forecast data based on information from MARINA and PPA is summarised in the table below.

Table 2.4-33. Annual Cargo Increases projections

Cargo Throughput	2014 (1)	2016 (1)	Port Cargo Forecasts				
			2018	2020	2025	2030	2040
'000 TEU (2)	297,000	289,000	303,161	318,015	416,510	529,050	880,140

Source:(1) Harbor Center Port Terminal, Inc. (HCPTI)
(2) TEU = Twenty-foot Equivalent Units, by conversion

Due to lack of data, the growth rate can be based on the above table. On the other hand, most passengers and tourists travel inland or by plane to reach the place. It is only on island tours that boats ply the Channel, and the percentage is based on the increase in tourist arrivals. Tourists have responded in record numbers and CEZA and town officials predict that arrivals would likely hit more than the 338,621 Visitors who came in 2018. "That's a 99-percent increase from the 170,285 arrivals in 2016.

There are 1774 motorized and 641 non-motorized boats in the Study area and this is not expected to increase in 2 years' time. These boats, however, go to Babuyan Islands, Batanes and other islands. Not all boats will go out to sea on the same day. The Project component vessels are as follows:

Table 2.4-34. Present and proposed project components

Current	Future
• 1 Siphon vessel (dredge barge) • 3 Separator Barges • 1 Panamax Vessel • Gravity Separator • Magnetic Separator • Hopper / Chute • Generator Set	• 4 Siphon vessels equipped with generator sets, magnetic and gravity separators and hoppers / chute • 3 storage barges • Ship for transshipment of ores • Dredging ship

Capesize vessel shall be used for siphoning in the future.

c. Forecast

Table 14 provides a summary of traffic activity forecast in the Study Area for 2020 & 2025, based on data available.

Table 2.4-35. Daily Vessel Class and Volume in the Study Area

Type of Vessel	Population per Vessel	Number of Vessels	
		2020 (Current)	2025 (future)
Ocean-going	20	2	4
Dredging ship	60	1	1
Siphoning Vessels	5/60	1	4
Barges	5	3	3
Tugboats	10	2	1
Fast Launch	5	2	2
Interisland ships/Ferries	100	2	4
Outrigger boats	2	345	345
Total		**358**	**364**

The Project vessels are somewhat, stationary and won't affect the traffic, except obstructing the navigational lanes. The only risk is for other vessels to collide or ram the anchored vessels. Hence, the need for lighted buoys with synchronized flashing and for the vessels to maintain a lighting system/beacon in their ships at night.

d. Risk Assessment Guidelines

Risk acceptability is frequently assessed with respect to Potential Loss of Life (PLL). The PLL or "annual fatality rate" expresses the risk to the population as a whole and is the sum of each anticipated event and the associated fatalities. All fatalities are assumed equally important, irrespective of the number of lives which may be lost simultaneously in a major accident.

Societal risk is also expressed in the form of an F-N curve, which represents the cumulative frequency (F) of all event outcomes leading to N or more fatalities. This representation of societal risk highlights the potential for accidents involving large numbers of fatalities. There are commonly three regions identified:

- Acceptable region where risk is broadly acceptable.
- As Low As Reasonably Practicable (ALARP) region where risk is tolerable providing it has been to such a level; and
- Unacceptable region reduced.

A Hong Kong societal risk criteria (for the assessment of fixed Hazardous Installations) is illustrated in **Figure 2.4-29**. This may be used as a framework for the assessment of marine risk acceptability – although it must be stressed it is purely a guideline in this context and does not have the statutory context of the EIA regulation.

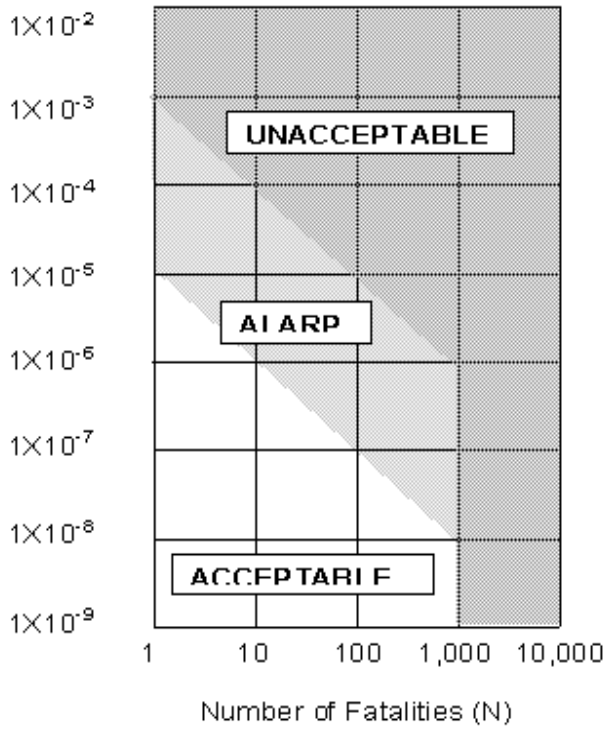


Figure 2.4-29: HKSAR Risk Criteria

So far there has been no fatality or injury suffered as a result of any collision of vessels in the area.

VII. SUMMARY

A review of the existing constraints and hazards as conducted and assessed leads to the following summary:

- The site and transit routes will be subject to relatively high current in the 2 to 2.5-knot range which would not affect the mining activities. Moreover, the currents are not affected by the wind environment and is considerably less exposed to wave impacts.
- It is apparent that periods of very low visibility (<1.0 km) are rare with only 0.4 days per year being probably impacted in such a manner,
- There are approximately 12 vessel movements per day through the water spaces of the Project area aside from the interisland, trading and fishing vessels plying adjacent to the site. Yet, almost all of the Project vessels are stationary.
- The activity level of shipping operations (at an average of 6 movements per day including interisland vessels and smaller sea crafts) equates to approximately 2% of marine traffic within the Study Area at a given time and fishing boats predominate at 95% but widely scattered.
- Operations to date have been conducted in a safe manner and future operations is perceived to have no or rare collision incidents. This is aided using the Vessel Traffic Management System by PPA and PCG, more so with the use of coastal or harbor pilots.
- The vessels are sufficiently equipped with navigational aids as required by MARPOL; The crews are sufficiently trained in naval operations.
- Navigational lanes of about 1-2NM from the Ports of Aparri, Claveria and Irene must be free from any obstruction for the entry/departure of vessels.
- There will be adequate time from typhoon or storm surge warnings to enable the vessel to dock at safe pier and not proceed to its voyage. The sailing time from project site to the point of the navigational lane is only 1 hour thus allowing sufficient time for the ship to be warned.

This does not imply that risk and hazard assessments and precautions are to be minimized but is a useful information on setting guidelines for protective measures. It may be concluded that the fish lift nets, or fishing gears or fish pens are comfortably safe from risks of damage from the transport vessels for the following reasons: the fish lifts are distant from the navigational lane of the vessels to the site and most of the vessels are stationary.

Having reviewed the operational historic performance and surrounding area, there is no significant marine constraints to the shipping operations by the Project.

VIII. Recommendations

A. Measures for Maritime Safety Traffic

There have been no large-scale maritime accidents in the Babuyan Channel in recent years. Although the overall number of vessels involved in maritime accidents has slightly increased, the number of deaths and missing persons caused by maritime accidents and from falling overboard has remained unchanged. Therefore, it is necessary to continue to promote various measures to prevent maritime accidents, and needs to vigorously implement more effective measures, including improvement and enhancement of the systems for prompt and proper lifesaving in coastal sea areas.

1. Improving the maritime traffic environment

To ensure safer and smoother movements of vessels and safety in ports and harbors, facing the increasing size and speed of marine vessels, the increasingly diverse use of marine environments, and the growing complexity of maritime traffic, there should be improvements to waterways, ports and harbors, fishing harbors and aids to navigation.

2. Improving the traffic safety facilities

To improve the safety and smoothness of sea traffic, as needed, the improvement works must be carried out on waterways that require regular development and maintenance, with consideration to coordination with the use of surrounding sea areas and fisheries and conditions of vessel traffic control. The improvement work includes setting up new waterways, expanding, deepening, or maintaining the depth of existing waterways, improving waterway lines and eliminating flotsam.

Particularly in major international waterways where large vessels and vessels carrying hazardous materials navigate or many vessels navigate, the agencies concerned shall also strive for both the safety of vessel navigation and efficiency of marine transportation by combining tangible measures such as increasing the width or the depth of existing waterways and intangible measures including review of the technical requirements for high-speed vessels and the improvement of the port information system.

3. Improving Ports and Harbors

In response to the vessels getting larger and faster, the government should promote improvements to breakwaters, waterways and berths, with the aim of securing safe and smooth navigation of vessels and safety of various activities in ports and harbors.

4. Improving the fishing harbors

Fishing harbors that serve as refuge ports for fishing boats, as well as breakwaters designed with a protective effect against tsunamis, berths, and facilities for keeping out rafts in order to improve port safety, should be improved.

5. Improving traffic control and distribution of maritime traffic information

In order to ensure the smooth movement of marine vessels in the face of the increasingly diverse use of seaways and the growing complexity of maritime traffic, the government should implement effective traffic controls, according to prevailing conditions, by promoting improvements to maritime traffic-related laws, while proactively providing information and instructions required to ensure vessel traffic safety.

In addition, to ensure vessel traffic safety, particularly in congested seaways, the government agency shall create maritime traffic environments that combine the safety and efficiency of maritime traffic by appropriately operating the maritime traffic information system that provides information on maritime traffic and controls vessel traffic in an integrated way, and improving and applying the next-generation aids to navigation systems and improving the means of control in major ports and harbors.

6. Promoting awareness of maritime accident prevention

The government agencies concerned shall work to generate and spread awareness of maritime accident prevention not only among people directly involved in marine affairs but also among the general public. In addition, they will promote improved knowledge, skills and behavior for preventing maritime accidents. To achieve these objectives, they will carry out maritime accident prevention activities tailored to the characteristics of each type of vessel by working together with private organizations to implement effective campaigns for preventing the occurrence of maritime accidents, and by providing on-site guidance for foreign vessels.

Also, in view of the importance of spreading awareness about the need to prevent maritime accidents, the government will make use of mass media such as newspapers, TV, and the internet to get its message across to a broad audience.

7. Promoting safety measures for fishing boats

Fishing boat accidents make up most of the accidents that involve deaths and missing persons, and the rate of fishing boat crews wearing lifejackets continues to remain very low at about 20%. Also, many maritime accidents are still caused by human-factors such as operation errors including inadequate watchkeeping and improper ship handling resulting from carelessness of crew members, and inappropriate handling of engines.

Under these circumstances, the government has to promote safety measures on fishing boats by heightening and educating safety awareness through maritime accident prevention workshops for fishing workers in cooperation with relevant government agencies, and by instructing these workers to observe safety precautions such as maintenance and checkups before departure, monitoring of sea conditions, understanding meteorological and hydrographic information in detail through the Maritime Information and Communication System, and to comply with all maritime-related laws.

Furthermore, to raise the safety awareness of fishermen, relevant government agencies are to work together and promote holding conferences for safety awareness education by fishermen themselves and the formulation of programs for promoting safety.

B. Administrative

Conduct IEC of the following:

A. Contractors/Operators for the Exploration and Extraction Activity:

1. All vessels working/sailing for the project have to comply with the local and international maritime requirements or protocol such as that prescribed by the Philippine Coast Guard and under the MARPOL.

   Some of the requirements are:
   - Communication procedures with Port Authorities;
   - Anchoring;
   - Towing;
   - Speed limitation within port; etc.

2. All vessels/barges must have valid harbor craft license or equivalent. Official inspections on the vessel regarding its construction and required safety appliances must be carried as per regulations. Prior to commencement of operations, all relevant notices (e.g. Notifications to Mariners; Port Marine Notices) shall be provided to the Master, who will verify them for implementation.

3. Safety Requirements of the Philippine Coast Guard (PCG) – These are essentially embodied in Memorandum Circular No. 06-2012

   a. Vessel Safety Enforcement Inspections embodying the following key requirements:

      The Vessel Safety Enforcement Inspection shall be carried out in order to assess whether the ship and/or crew, throughout its forthcoming work/voyage, will be able to:

      1. Exercise extraordinary diligence in ensuring the safe, fast, efficient and reliable conveyance of passengers;
      2. Navigate safely;
      3. Maintain adequate stability and trim condition;
      4. Safely handle, carry, secure and monitor the condition of the cargo;
      5. Maintain all propulsion and proper steering;
      6. Operate the ship's machineries safely;
      7. Fight fires and prevent flooding effectively in any part of the ship, if necessary;
      8. Prevent pollution of the environment;
      9. Maintain adequate watertight integrity;
      10. Communicate in distress situations if necessary;
      11. Provide adequate life saving devices corresponding to its maximum authorized passenger and crew capacity;
      12. Provide safe and healthy conditions on board;
      13. Complete officer and adequate crew complement corresponding to the proper observance of appropriate periods of work and rest from work;
      14. Weather condition does not merit the suspension of the voyage;
      15. Required operational and emergency readiness standards of crew is met;
      16. Documentations and certificates are complete and valid;
      17. Sufficient training of the crew based on actual "Operational Readiness Evaluation"; and
      18. Other analogous circumstances.

4. Compliance with the Philippine Merchant Marine Rules and Regulations (PMMRR) 1997

B. Ocean-going Ships Captains and Mates

- Observation of the International Regulations for Preventing Collision at Sea as per COLREGS

Steering and Sailing

Section I (Conduct of vessel in any condition of visibility)

Item 4. Application
The rules apply in any condition of visibility (e.g., in sight or in restricted visibility).

Item 5. Look-out
Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Item 6. Safe speed
Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

a) By all vessels:
   i. the state of visibility;
   ii. the traffic density including concentrations of fishing vessels or any other vessels;
   iii. the maneuverability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;
   iv. at night the presence of background light such as from shore lights or from back scatter of her own lights;
   v. the state of wind, sea and current, and the proximity of navigational hazards;
   vi. the draught in relation to the available depth of water.

b) Additionally, by vessels with operational radar:
   i. the characteristics, efficiency and limitations of the radar equipment;
   ii. any constraints imposed by the radar range scale in use;
   iii. the effect on radar detection of the sea state, weather and other sources of interference;
   iv. the possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;
   v. the number, location and movement of vessels detected by radar;
   vi. the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.

Item 7. Risk of collision
Vessels must use all available means to determine the risk of a collision, including the use of radar (if available) to get early warning of the risk of collision by radar plotting or equivalent systematic observation of detected objects. (e.g. ARPA, AIS).

If the distance of any vessel is reducing and her compass bearing is not changing much or it is a large vessel or towing vessel at close distance, or if there is any doubt, then a risk of collision shall be deemed to exist.

Item 8. Action to avoid collision
Actions taken to avoid collision should be:

- Positive
- Obvious
- Made in good time

Item 9. Narrow channels

- A vessel proceeding along a narrow channel must keep to starboard.
- Small vessels or sailing vessels must not impede (larger) vessels which can navigate only within a narrow channel.
- Ships must not cross a channel if to do so would impede another vessel which can navigate only within that channel.

Items 10. Traffic Separation Schemes
Ships must cross traffic lanes steering a course "as nearly as practicable" at right angles to the direction of traffic. This reduces confusion and enables that vessel to cross the lane as quickly as possible.

Vessel entering a traffic separation scheme should do it at an angle as small as practicable. A traffic separation scheme does not relieve any vessel from complying with other rules.

Section II (Conduct of vessels in sight of one another)

Item 11. Application
The following rules 11–18 applies to vessels in sight of one another. (Section III has specific requirements for restricted visibility)

Item 12. Sailing vessels
Two sailing vessels approaching one another must give-way as follows:

- Port gives way to starboard. When each has the wind on a different side, the vessel which has the wind to port must give way;
- Windward gives way to leeward. When both have the wind on the same side, the vessel which is windward must give way to the vessel which is leeward;
- Unsure port gives way. If a vessel, with the wind on the port side, sees a vessel to windward and cannot determine whether the other vessel has the wind on the port or the starboard side, they must give way.

For the purposes of this rule, the wind is considered to be coming from the side opposite the mainsail boom, or if the vessel is square rigged, opposite the largest fore-and-aft rigged sail, regardless of which side the true or apparent wind is on.

Item 13. Overtaking
Notwithstanding anything contained in the Rules ... ... an overtaking vessel must keep out of the way of the vessel being overtaken. "Overtaking" means approaching another vessel at more than 22.5 degrees abaft her beam, i.e., so that at night, the overtaking vessel would see only the stern light and neither of the sidelights of the vessel being overtaken. Note that the opening words of this rule make clear that this rule overrides all other rules.

Item 14. Head-on situations
When two power-driven vessels are meeting head-on both must alter course to starboard so that they pass on the port side of the other. "Head-on" means seeing the other vessel ahead or nearly ahead so that by night her masthead lights are actually or nearly lined up and/or seeing both her sidelights, or by day seeing a similar aspect of her. "If you see three lights ahead, starboard wheel and show your red."

Item 15. Crossing situations
When two power-driven vessels are crossing, the vessel which has the other on the starboard side must give way and avoid crossing ahead of her. The saying is "If to starboard red appear, 'tis your duty to keep clear"."...Act as judgement says is proper: port or starboard, back or stop her."

Item 16. The give-way vessel
The give-way vessel must take early and substantial action to keep well clear.

Item 17. The stand-on vessel
The stand-on vessel shall maintain her course and speed, but she may take action to avoid collision if it becomes clear that the give-way vessel is not taking appropriate action, or when so close that collision can no longer be avoided by the actions of the give-way vessel alone. In a crossing situation, the stand-on vessel should avoid turning to port even if the give-way vessel is not taking appropriate action. These options for the stand-on vessel do not relieve the give-way vessel of her obligations under the rules.

Item 18. Responsibilities between vessels
Except in narrow channels, traffic separation schemes, and when overtaking (i.e., rules/item 9, 10, and 13)

- A power-driven vessel must give way to:
  - a vessel not under command;
  - a vessel restricted in her ability to maneuver (this may include vessels towing one another);
  - a vessel engaged in fishing;
  - a sailing vessel.
- A sailing vessel must give way to:
  - a vessel not under command;
  - a vessel restricted in her ability to maneuver;
  - a vessel engaged in fishing.
- A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:
  - a vessel not under command;
  - a vessel restricted in her ability to maneuver.
- Any vessel other than a vessel not under command or a vessel restricted in her ability to maneuver shall, if possible, not impede the safe passage of a vessel constrained by her draft, exhibiting the signals in Rule 28.
- A vessel constrained by her draft shall navigate with particular caution having full regard to her special condition.

Section III (Conduct of vessel in restricted visibility)

Item 19. Conduct of vessel in restricted visibility
a) Rule 19 applies to vessels (not in sight of one another) in or near restricted visibility.

b) All ships shall proceed at a safe speed for the condition of visibility (see Rule 6). A power-driven vessel shall have her engine(s) on stand-by for immediate maneuver.
c) All ships shall comply with Section I of this Part e.g., Rules 5 (lookout), 6 (safe speed), 7 (risk of collision), 8 (action to avoid collisions), 9 (narrow channels), and 10 (TSS) with due regard for the visibility conditions.
d) If another vessel is detected by radar alone, and a close-quarters or collision risk is suspected, a vessel should take early and substantial action to avoid the other, but:
    i. avoid any turn to port for a vessel detected forward of the beam, except for a vessel being overtaken,
    ii. avoid any change of course toward a vessel abeam or abaft the beam.
    iii. When the fog signal of another vessel is heard, apparently forward of the beam, a vessel should reduce speed to the minimum at which she can maintain her course, or if necessary, stop, and navigate with extreme caution until there is no risk of collision.

- Local Regulation in Navigation

General

- Masters shall ensure that their vessels are navigated in full compliance with the International Regulations for Preventing Collisions at Sea, 1972 (COLREG), without exception.
- Prior to commencing any voyage Masters must ensure that a passage plan for the voyage has been developed and all Watch keeping/ Navigating Officers are familiarized with it.
- Masters must ensure that all necessary charts and nautical publications for the area of operation are carried on board the vessel and that they are up to date with all the latest amendments and corrections. Where the area of operation will include subsea assets and platforms, the Master must also ensure that he has the latest field charts on board the vessel.
- Unless advised to the contrary or for safety reasons, vessels shall make best safe economical speed at all times.
- Vessels involved will be equipped with bathymetry maps showing areas of sensitivities. Furthermore, these areas will be marked in the dredge survey computer.
- Vessels shall anchor at anchoring areas indicated by the port. Alternatively, PPA or PCG shall define designated safe anchoring zones outside sensitive areas. Vessels will not anchor outside designated anchoring areas unless in an emergency situation.
- Latest admiralty charts (ECDIS) will be provided of the working and sailing area to ensure that exclusion zones and subsea obstructions and installations are known to the officers.

Bridge Watch Keeping

- A safe navigational watch must be kept at all times and every opportunity must be taken to physically check the vessel's electronic position referencing systems against visual observation and charts.
- A proper visual lookout shall be maintained at all times and the Officer of the Watch shall be responsible for taking timely action in order to avoid collision, grounding or close quarter situations.
- During periods of reduced visibility, Master's shall ensure that additional lookouts are posted, appropriate sound signals are made and a radar watch is maintained on both long range (12 nm) and short range (6 nm or less).

2.4.9 Results of Perception Survey

MUNICIPALITY OF APARRI

A Perception Survey was conducted in the Municipality of Aparri, Province of Cagayan last January 30, 2020 at Gonzaga Riverview Hotel and Resort. A standard questionnaire was used in the conduct of the interview with a total of 52 participating individuals.

Demographic Profile

Respondents from the Municipality of Aparri are composed of 31 (60%) males, 20 (38%) females and 1 who did not disclose his/her gender. Age range of the respondents were also determined. Most of the respondents' age ranges from 51 – 60 (27%) and 61 – 70 (27%), while 21% of the respondents are ages 41 – 50 years old. There are also 13% who are ages 31 – 40, 8% are 21 – 30 years old while the remaining 4% of the respondents have no answer. This survey also shows that 65% of the respondents are married, 15% are single, 10% are widowed/widower and 4% are separated and among the 52 respondents 54% of them have 1 – 3 children, 23% have 4 – 5 children and 12%of them have 7 – 10 children.

Majority of the respondents are from the affected coastal barangays of direct host communities (64%) and the remaining numbers originated or were born from different barangays, municipality and province. In terms of ethnicity, 81% of the respondents are Ilocano, 10% are Ibanag, 2% are Muslim and Tagalog, respectively. With regards to religious affiliations, 75% of the respondents are Roman Catholic, 8% are Protestants while others are Baptist, Muslim, and Methodists. When it comes to the level of education they have attained, 56% of them are college degree holders, 40% have high school diplomas, and 4% finished vocational courses.

Migration or Settlement History

Respondents from different barangays of Aparri were asked regarding their migration and settlement history. Majority of the respondents 38% were living in the municipality for 41 – 50 years. Then there are about 23% of the respondents who are living for 51 – 60 years and 15% are 31 – 40 years living in the same community.

Perception About the Project

When it comes to the perception about the project, there are almost 67% of the respondents who have an idea regarding the proposed project and 33% of them have known this directly from the barangay officials. Then, there are 21% who are not aware of the said project.

The interviewers also gathered their thoughts about the positive outcome/impacts of the proposed project in their area. They stated that this project could help generate additional livelihood/employment (42%) for the community, quality service for the people from the government (19%), and develop roadways (11%). When it comes to the negatives effects this project may impose, loss of livelihood and the harm it may pose to aquatic life.

Household Income and Employment

Husbands are the economically productive member of the family with a total of 62% of the total respondents. Majority of the respondents' source of income came from farming (30%) and fishing (30%). There are also salary earning individuals (17%) and persons who engaged on contractual jobs

(11%) while others' source of income came from selling. There are 35% household whose average monthly income ranges from Php 5,000 – 9,999.

Community

Major problems in their community were also determined such as: lack of source of livelihood and job opportunities, numerous jobless people, improper solid waste management, proper drainage system, undeveloped roads (rough roads), lack of provision of seawalls and dikes. Some are worrying about the rising of sea level that causes flooding in their community during heavy rains and causes damage to agriculture. Others are not having enough budget in their barangay for development of multipurpose halls that also serves as their evacuation area and other projects. Their suggested solutions are additional source of alternative livelihood and job opportunities, constant road development, additional budget for the local government to implement projects for the people and additional SDMP fund from the proponent. Provision of seawall and dikes for protection from storm surge. Implementation of proper solid waste disposal. Projects of local government to attract investors.

Land and Water Resources

When it comes to land status, 54% of the respondents who owned a land while there are 13% who are tenants and renting, respectively. Most of their crops harvested and cultivated are rice (30%), vegetables *(nateng)* (24%), sweet potato (11%), saba (8%) and corn crops (4%). The top 3 marine resources that can be caught in their marine water are fishes, shrimp, and shells. Others are squid, *espada*, crabs, seaweeds, fingerlings (*dilis*), *gakka, bulong unas, aramang, angrat, balaki,* and *maunanom*.

Health Situation

Based on the data gathered thru this survey, 24% of the respondents only have 1 family member who got sick and the most common sickness they have are fever, common colds, and diarrhea. They seek medical assistance mostly from a private clinic (40%) while others are going to health centers (26%).

Their source of domestic water usually came from deep well, water system and spring. The types of toilet they have are mostly water sealed (33%), house with hole in the ground (21%) and toilets with flush.

MUNICIPALITY OF BUGUEY

A Perception Survey was conducted in the Municipality of Buguey, Province of Cagayan last January 31, 2020, at Crab Hotel. A standard questionnaire was used in the conduct of the interview with a total of 121 participating individuals.

Demographic Profile

Respondents from the Municipality of Buguey are composed of 75 (62%) males, 43 (36%) females and 3 (2%) who did not disclose his/her gender. Age range of the respondents were also determined. Most of the respondents' age ranges from 41 – 50 (27%) followed by 51 – 60 years old (26%), while the least number of age ranges from 15- 20 years old with only 3% of the total number of respondents. This survey also shows that 75% of the respondents are married, 8% are single and widowed, respectively, 4% are separated and among the 121 respondents 51% of them have 1 – 3 children, 31% have 4 – 6 children and 5%of them have 7 – 10 total number of children.

Majority of the respondents are from the affected coastal barangays of direct host communities (78%) and the remaining numbers originated or were born from different barangays, municipality and province. In terms of ethnicity, 91% of the respondents are Ilocano, 5% are Tagalog, 2% are Ibanag. With regards to their religious affiliations, 85% of the respondents are Roman Catholic and when it comes to the level of education they have attained, 41% of them are high school graduates, 35% have college degree, and 10% finished vocational courses.

Migration or Settlement History

Respondents from different barangays of Buguey were asked regarding their migration and settlement history. Majority of the respondents or 24% were living in the municipality for 41 – 50 years. Then there are about 21% of the respondents who are living for about 51 – 60 years of their life and 16% are living for 61 and above years in the same community.

Perception About the Project

When it comes to their awareness about the project, there are almost 79% who have an idea regarding the proposed project and 53% of them have known this directly from the barangay officials. Then, there are 15% who are not aware of the said project and 6% who have no answers in this question.

The interviewers also gathered their thoughts about the positive outcome/impacts of the proposed project in their area. They stated that this project could help generate additional livelihood/employment (52%) for the community, quality service for the people from the government (22%) and develop roadways (8%). When it comes to the negatives effects this project may impose, loss of livelihood and harms it may pose to the different marine life existing.

Household Income and Employment

Husbands are the economically productive member of the family with a total of 54% of the total respondents. Majority of the respondents' source of income came from farming (31%) and fishing (31%). There are also salary earning individuals (15%) and persons who engaged on contractual jobs (4%) while others' source of income came from selling. There are 34% household whose average monthly income ranges from Php 1,000 – 4,999.

Community

Major problems in their community were also raised during the survey, such as: lack of source of livelihood and job opportunities, numerous jobless people, improper solid waste management, proper drainage system, undeveloped roads (rough roads), lack of provision of seawalls and dikes that may cause flooding and storm surge, and lack of methods for transportation. Some states that this project could pose hazards to their community and may pose hazards to their way of living. Additional funding for the barangays to implement their proposed projects and BFAR personnel looking out after and banning their fishing activities.

Their suggested solutions are additional source of alternative livelihood and job opportunities, strict implementation of laws for discipline, additional budget for the local government to implement projects for the people and financial assistance from the government to support their livelihood. Proper solid waste management in every community. Provision of seawall and dikes for protection from storm surge.

Land and Water Resources

When it comes to land status, 51% of the respondents who owned a land while there are 28% are tenants and 7% are renting lands to cultivate crops. Most of their crops harvested and cultivated are rice (33%), vegetables *(nateng)* (20%), sweet potato (11%), saba (9%) and corn crops (5%). The top 3 marine resources that can be caught in their marine water are fishes, shrimp and shells. Others are squid, *espada*, crabs, seaweeds, fingerlings (*dilis*), *gakka, bulong unas, padam,* and *rasa.*

Health Situation

Based on the data gathered thru this survey, 29% of the respondents only have 1 member of the family who got sick and the most common sickness they have are fever, common colds, and diarrhea. They seek medical assistance mostly from a private clinic (37%) while others are going to health centers (35%).

Their source of domestic water usually came from deep well (56%), water system (12%) and spring (6%). The types of toilets they have are mostly water sealed (52%), house with hole in the ground (16%) and toilets with flush.

MUNICIPALITY OF GONZAGA

A Perception Survey was conducted in the Municipality of Gonzaga, Province of Cagayan last January 30, 2020, at Gonzaga Riverview Resort and Hotel. A standard questionnaire was used in the conduct of the interview with a total of 59 participating individuals.

Demographic Profile

Respondents from the Municipality of Buguey are composed of 61 (61%) males, 21 (36%) females and 3 (2%) who did not disclose his/her gender. Age range of the respondents were also determined. Most of the respondents' age ranges from 41 – 50 (27%) followed by 51 – 60 years old (24%), while the least number of age ranges from 21 – 30 years old with only 8% of the total number of respondents. This survey also shows that 83% of the respondents are married, 7% are single and widowed, respectively, 2% are separated and among the 59 respondents 58% of them have 1 – 3 children and 37% have 4 – 6 total number of children.

Majority of the respondents are from the affected coastal barangays of direct host communities (78%) and the remaining numbers originated or were born from different barangays, municipality and province. In terms of ethnicity, 86% of the respondents are Ilocano, 8% are Tagalog, 2% are Ibanag. With regards to their religious affiliations, 86% of the respondents are Roman Catholic and when it comes to the level of education they have attained, 37% of them have finished college degree, 31% are high school graduates, and 25% have elementary education.

Migration or Settlement History

Respondents from different barangays of Gonzaga were asked regarding their migration and settlement history. Majority of the respondents or 27% were living in the municipality for 31 – 40 years. Then there are about 24% of the respondents who are living for about 51 – 60 years of their life and 17% are living for 61 and above years in the same community.

Perception About the Project

When it comes to their awareness about the project, there are almost 58% who have an idea regarding the proposed project and 42% of them have known this directly from the barangay officials. Then, there are 10% who are not aware of the said project and 6% who have no answers in this question.

The interviewers also gathered their thoughts about the positive outcome/impacts of the proposed project in their area. They stated that this project could help generate additional livelihood/employment (49%) for the community, quality service for the people from the government (15%) and develop roadways (11%). When it comes to the negatives effects this project may impose, loss of livelihood, and harms it may pose to the different marine life existing.

Household Income and Employment

Husbands are the economically productive member of the family with a total of 63% of the total respondents. Majority of the respondents' source of income came from fishing (35%) and farming (14%). There are also salary earning individuals (15%) and persons who engaged on contractual jobs (4%) while others' source of income came from selling. There are 33% household whose average monthly income ranges from Php 1,000 – 4,999.

Community

Major problems in their community were also raised during the survey, such as: lack of source of livelihood and job opportunities, numerous jobless people, improper solid waste management, proper drainage system, undeveloped roads (rough roads), lack of provision of seawalls and dikes that may cause flooding and storm surge due to typhoon. Sea levels rise due to climate change and erosion of seashore.

Their suggested solutions are additional source of alternative livelihood and job opportunities, and additional budget for the local government to implement projects for the people. Proper solid waste management and drainage system. Provision of seawall and dikes for protection from storm surge and flooding due to typhoon. Financial assistance to support livestock production.

Land and Water Resources

When it comes to land status, 43% of the respondents who owned a land while there are 19% are tenants and 5% are renting lands to cultivate crops. Most of their crops harvested and cultivated are rice (25%), vegetables *(nateng)* (20%), corn crops (18%), sweet potato (10%), saba (7%) and. The top 4 marine resources that can be caught in their marine water are fishes, shrimp, seaweeds, and shells. Others are squid, *espada*, *kabalyas*, fingerlings (*dilis*), and *aramang.*

Health Situation

Based on the data gathered thru this survey, 24% of the respondents only have 1 and 2 members of the family who got sick and the most common sickness they have are fever, common colds, and diarrhea. They seek medical assistance mostly from a private clinic (34%) and health centers (35%).

Their source of domestic water usually came from deep well (33%), water system (23%) and spring (17%). The types of toilets they have are mostly water sealed (31%), house with hole in the ground (22%) and toilets with flush.

2.4.10 Impacts Assessment and Mitigation

Potential Hazards/Impacts	Proposed Options for Prevention or Mitigation or Enhancement
Displacement of Settler/s Displacement/Disturbance of properties Change/Conflict in land ownership Change/Conflict in right of way	The project site is located 14 – 15 kilometers away from the shoreline of the municipalities of Aparri, Buguey, and Gonzaga. Likewise, the office of its employees is located in the existing facilities of CEZA. Hence, there will be no displaced settlers and/or properties, ownership of land, and right of way conflict.
In-migration and Cultural / Lifestyle Change: - Through interaction, cultural adjustments may naturally follow but not always. Understanding and adjusting with other cultures takes time. - Inter-marriage might also happen that will add up to population increase.	To mitigate potential impacts due to in-migration, the following management measures shall be implemented: • Implement priority local hiring policy for qualified local workers; • Coordinate with barangay or/and municipal LGU as to relevant ordinance on providing opportunities for local employment; • Conduct consultation with barangay LGUs on requirements and process of hiring to maximize employment of local residents; • Require and monitor contractor commitments on providing local employment; • Coordination with the municipal and barangay peace and order councils to ensure peace and order; and, • Coordination meetings shall also be undertaken regularly with the LGUs to identify threats and vulnerabilities in the society as well as to develop programs to prevent foreseen social problems. In terms of cultural or lifestyle change, there are no identified IP groups in the impact areas. The company must initiate social gathering to help in-migrant workers to assimilate with the culture of local community. The implementation of the project will not alter the lifestyle of the residents since the project site is located 14 – 15 kilometers away from the shore. On the other hand, improved community services through the company's SDMPs and CSRs are also expected from the project. The company's community relations officers must conduct regular or annual social functions like sports competition to be able to gain good social relationships among in-migrants and local residents with respect to their ethnicity or culture.

Potential Hazards/Impacts	Proposed Options for Prevention or Mitigation or Enhancement
Threat to Delivery of basic Services / Resource Competition	Some of the basic needs of mining workers have to be provided by the company so that they will not compete with the local residents. Housing, medical and health facilities, recreation, are just some of the needs that the workers will receive. Electricity can be provided by the company thru generators, but the local electric cooperative assures the company of power supply that will not interfere with that of the community's.
Threat to Public Health and Safety: - Entry of migrant workers with families which might cause health problems due to diseases, overuse of public utilities /services, competition of resources, social conflicts, peace and order, increase in pollution due to solid and liquid wastes. - impact of climate change	 - Coordinate with the local government unit in the management of entry of migrant workers. Workers should secure health/medical certificate from the LGU prior to hiring into the project. - Gender Responsive Climate Change Adaptation DENR Special Order 2007-653; R.A.10121 Gender Responsive for Disaster Risk Reduction Management in the Barangays of men and women; establishment of protection measures for determination of areas most vulnerable to natural hazards.
Employment, Livelihood Opportunities and Additional Revenues for the LGU	Employment during the development and operations of the mine can create an improved economic condition of the host municipalities. Even though it is not a lifetime job opportunity, it will considerably help them raise their families and invest for other income generating activities. One of the opportunities of mining operation is the growth of downstream economy in the host municipalities. The basic needs of the community will grow, and the demands should be met. It can create various business-related activities like retailing, services, buy and sell, planting, and others. The company's operation is subject to excise tax from which a portion of the gross income is allotted to LGUs and divided into percentages for the provincial government, the municipal government, and the barangay government. The community is also entitled to additional benefits that are covered by 1% of the mining cost.
Marine Traffic	There have been no large-scale maritime accidents in the Babuyan Channel in recent years. Although the overall number of vessels

Potential Hazards/Impacts	Proposed Options for Prevention or Mitigation or Enhancement
	involved in maritime accidents has slightly increased, the number of deaths and missing persons caused by maritime accidents and from falling overboard has remained unchanged. Therefore, it is necessary to continue to promote various measures to prevent maritime accidents, and needs to vigorously implement more effective measures, including improvement and enhancement of the systems for prompt and proper lifesaving in coastal sea areas.

3. IMPACT MANAGEMENT PLAN

Impacts Management Plan (IMP) discusses the measures that will be implemented by JDVC Resources Corporation to mitigate or enhance most likely environmental impacts mentioned in the preceding chapter. The procedure for implementation and the schedule are also outlined. The measures indicated in the plan have been drawn up jointly by the proponent to sustain the quality of the environment in the area where magnetite will be extracted.

In general, the Environmental Management Plan provides the framework for the proponent to deal with pollution risks associated with magnetite extraction. The IMP, in essence, describes the processes that the organization will follow to maximize its environmental compliance and minimize its impact to the environment. The EMP contains the following:

- Impacts identification during different phases of the project;
- Environmental aspects that will be affected by identified impacts;
- Options to mitigate or enhance the identified impacts;
- Roles and responsibilities of entities to implement the mitigating or enhancement measures;
- Schedule of implementation;
- Corresponding costs of identified mitigating measures; and
- Staff training and awareness

Since the identified negative impacts cited in this study can be avoided or mitigated, the measures presented in the succeeding table intend to reduce the magnitude of specific impacts. The recommended measures were based on the experience of similar extraction projects locally and around the world. On the other hand, positive impacts such as employment generation and additional income for the municipality in the form of taxes are enhanced to further maximize its benefits to the stakeholders.

During the operational phase of the project, implementation of the environmental management plan shall be the sole responsibility of the proponent.

Table 3-1: Summary of Predicted Impacts and Options for Prevention, Mitigation and Enhancement

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
Operational Phase				
1. Positioning of the Siphoning vessels with the use of Anchor Handling Tugs	Disturbance to marine biodiversity	• Vessels' movements will be bounded by the marked mining block/grid currently being mined to minimize disturbance to marine environment. Once the first block is exhausted of iron ore, the vessel will then be positioned to the next mining area. • Siphon vessels will be operated in the boundaries of the mining block to enforce a form of progressive mining. This process will give the impacted organisms time to recolonize the previously mined out area.	• 1% to very minimal impact to marine biodiversity. • Reversible effect to the environment.	• Proponent / MMT
2. Use of Siphon vessels in extracting the magnetite iron sand 3. Processing of extracted sand in the magnetic separator with sand and water separation process 3. Transport/loading of magnetite iron sand from Siphon vessels to foreign vessel thru conveyor belt for export	Disturbance of marine biodiversity	• Vessels' movements will be bounded by the marked mining block/grid currently being mined to minimize disturbance to marine environment. Once the first block is exhausted of iron ore, the vessel will then be positioned to the next mining area. • Siphon vessels will be operated in the boundaries of the mining block to enforce a form of progressive mining. This process will give the impacted organisms time to recolonize the previously mined out area.	• 1% very minimal impact to marine biodiversity. • Reversible effect to the environment.	• Proponent / MMT
	Increased water turbidity which can result to sedimentation due to	• Use of suction pipe to extract the sand and return the non-magnetic sand to the seafloor. A pollution prevention curtain or	• 100% Compliance with Clean Water Act and its implementing rules and regulations	• Proponent / MMT

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
	extraction of magnetite sand from the seafloor and non-magnetic sands returned to the sea	screen / silt curtain will be used to lessen the impact of turbidity. - Specifications of a silt curtain: > Tube frame for upper – 60.5mx5.5m > Middle frame – 60.5mx5.5m > Lower weight frame – 76.3mx7m > Belt chat set for ditto – 35mm x 4m > Curtain #800 – 2mx60m > Bracket for curtain – 60.5mx5.5m • Quarterly monitoring of water quality to mitigate and prevent negative impacts of pollution to marine water • The water for disposal should pass the parameters for class SD.		
	Contamination of water body due to oil spills from equipment/vessel	• Daily and/or weekly checking for oil leakage and monthly maintenance of all equipment including vessels will be done. Oil spill kit on standby. • In the event of oil spill accident, immediate clean-up of affected areas will be performed and reported to authorized agencies for assistance. • The company will include strategies to reduce and mitigate the negative impacts of oil spill in water body and marine life. - Institute and implementation of oil spill containment protocols to be followed during development in cases of occurrence. - Oil spills hall be reported, contained, and cleaned up promptly and properly in accordance with the Marine Environment Protection and Policies of PCG.	• 100% implementation of environmental best practices in handling marine vessels including proper management practices in handling fuels for regular maintenance of vessel and equipment. • 100% compliance with MARPOL 73/78 for the prevention of pollution from ships • Separate storage and proper handling and labelling of used oil for identification • In case of oil spill, oil spill response equipment and qualified personnel will be available on the anchor handling tug or vessel.	• Proponent / MMT

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
		- Oil spill kits will be ready in case there will be accidental spills.	• Short term; Irreversible effect to the environment	
	Emission of CO_2, SO_2 and NO_2	• The vessels will document its daily, weekly, monthly, every 6 months and yearly maintenance activities of the extraction equipment and the vessel itself. No maintenance work will be conducted offshore to minimize the risk of spillage of oil. • The proponent will ensure that the siphon vessels and suction equipment are in good condition. A preventive or scheduled maintenance system, condition maintenance system, and corrective or breakdown maintenance will be implemented (Chapter 1: Section 1.5.4 Maintenance of Vessels). • International and local rules and regulations on minimizing air pollution will be implemented during operations.	• 100% conduct of assessment, monitoring, and maintenance of all vessels and equipment involved in this project will be strictly implemented. • 100% compliance with MARPOL (Maritime Pollution) 73/78 and Marine Environmental Protection Rules and Regulations of Philippine Coast Guard (PCG) • Long term, Reversible effects to the environment	• Proponent / MMT
	Noise generation	• Use of low noise diesel generator set with enclosure and muffler for the vacuum pump. • Weekly, semi-annual, and yearly maintenance of equipment and vessels to maintain good working condition. • Equipment including vessels will be operated at low speed and/or power whenever practical and switched off when not in use.	• 100% compliance with DENR Air quality standards, noise level set by DENR and EQPL. • Regular inspection and maintenance of vessels and equipment prior to start of daily operations. • Long term, Reversible once operations are done.	• Proponent / MMT
	Disturbance of local/traditional fishing grounds	• Operational area will be set on an annual basis so as to better identify the municipality affected. The proponent and	• 1% to very minimal impact to marine biodiversity.	• Proponent / MMT • Municipal and Barangay LGUs

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
	Disturbance for fish breeding areas	its CRU in cooperation with the LGU will identify projects that will be included in the SDMP to be implemented by the project. • Buffer zones from the vessels to allowable distance of 500 m for fishing boats.	• Reversible effect to the environment.	• BFAR
	Displacement of Fisherfolks and social unrest of sectors in the community	• Alternative livelihood for days that they can't fish in the area where operations are occurring (please see Tables 5-2a and Table 5-2b on the alternative livelihood). • Proponent to initiate programs that will promote livelihood, skills development, health and nutrition, disaster risk reduction and response, initiate intensive IEC activities to update stakeholders on the status of the project, and other similar activities as part of the proponent's Social Development Plan.	•	•
	Maritime Traffic	• Coordinate with PCG and/or PPA on the traffic routes or schemes that are likely to be used by large vessels	• 100% compliance with the government agencies with jurisdiction in the Philippine waters • Long term, Reversible	• Proponent / MMT • PCG • PPA
	Possible accidents and exposure to occupational hazards	• Provision of PPE to all workers and implementation of strict safety protocols especially when onboard the vessels • Conduct safety orientation prior to employment	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Short term, Irreversible	• Proponent / MMT

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
		• Conduct regular trainings and drills (at least twice a year) in handling and responding to accidents and disasters		
4. Other mine operational activities	Entry of migrant workers with families which might cause health problems due to diseases, overuse of public utilities /services, competition of resources, social conflicts, peace and order, increase in pollution due to solid and liquid wastes	• The company will prioritize employment of qualified residents. Proponent will coordinate with every barangay in terms of employment • Management of entry of migrant workers by increasing and/or training barangay tanods to be deployed in areas where migrant workers reside. • Proponents provide Health clinic with a Doctor, Nurse and Health workers. Health certificate for workers prior to hiring into the project. • Partner with LGUs in the implementation of the Social Development and Management Program.	• 100% conduct of population survey and monitoring of migrant workers in coordination with LGU • Short term, Reversible	• Proponent / MMT • Municipal and Barangay LGUs
	Possible proliferation of diseases	• Require health examination and submission of health certificate prior to employment • Require fit to work certification for returning workers from illness • Implement proper health and sanitation protocols and facilities	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Short Term, Reversible	• Proponent / MMT
	Possible effects on health and sanitation	• Workforce will be provided with clean and potable water and sanitary toilets • Domestic wastes segregation shall be practiced and strict implementation of solid waste management	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Short term, Reversible	• Proponent / MMT • LGUs

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
	Generation of Solid/Domestic Wastes	• Proper segregation and disposal of domestic wastes shall be coordinated with CSEZF in Port of Sta. Ana and LGU • The company will promote the 3R's of solid waste management • Color-coded garbage bins/trash bins placed in relevant areas	• 100% compliance with RA 9003 • Collected wastes shall be weighed to monitor volume of generated wastes • Long term, Reversible	• Proponent / MMT • LGUs
	Domestic solid wastes maybe indiscriminately disposed in adjacent areas	• A solid waste management plan will be strictly enforced;	• 100% compliance and implementation of management plan • Long term, Reversible	• Proponent / MMT • DENR-EMB
	Generation of Hazardous wastes – generation of waste oil during maintenance activity of the vessels and the equipment	• The proper storage and documentation of the used oil and oily rags will be implemented as stated in RA 6969. The waste will then be properly disposed of using PPA or DENR accredited waste handlers/ transporters. • Grease traps installed to prevent discharge of oily material	• 100% in compliance with RA 6969 in proper handling and management • Long term, Reversible	• Proponent / MMT • DENR-EMB
	Generation of sewage	• Vessels to be engaged for the operation shall be provided with either holding tanks, a marine sanitation device or a sewage treatment plant with fecal coliform count not exceeding 250 thermotolerant coliforms per 100mL/MPN. To enable the connection of reception facility pipes to the ship's discharge pipeline, both lines shall be fitted with standard discharge connection in accordance with minimum requirement stated in the Philippine	• 100% compliance and implementation of RA 9275 • 100% compliance with MARPOL (Maritime Pollution) 73/78 and of Philippine Coast Guard (PCG) • Long term, Reversible	• Proponent / MMT • DENR-EMB

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
		Coast Guard's Marine Environment Protection Implementing Rules. • Provision of septic vaults and usable toilets for the workers/staffs for infectious wastes		
	Generation of employment opportunities	• Prioritizing qualified residents from affected Municipalities • Only qualified locals will be hired for operation phase • Conduct of training programs to develop and enhance skills of residents for a high chance of employment	• 100% compliance to DOLE and Occupational Health and Safety Standards and Guidelines • Long term, Reversible	• Proponent / MMT • LGUs
	Increase in government revenues	• As part of the proponent's corporate social responsibility, the local government together with the affected communities will benefit from the project by hiring of local workers, remit taxes to the LGU, and implement Social Development Programs (SDP). While the national government will benefit from to the high demand and use of magnetite sand in steel manufacturing industry.	• 100% assurance that due and fair benefits shall be given to the LGU	• Proponent / MMT • LGUs
Abandonment Phase				
1. Pulling out of marine vessels from the mining area	Marine water pollution from oil and grease, etc.	• The proper storage and documentation of the used oil and oily rags will be implemented as stated in RA 6969. The waste will then be properly disposed of using PPA or DENR accredited waste handlers/ transporters.	• 100% compliance and implementation of RA 9275 • 100% implementation of environmental best practices in handling marine vessels including proper management practices in handling fuels for	• Proponent / MMT • LGUs • DENR • PCG • PPA

Project Activity	Potential Impacts	Option for Prevention, Mitigation and/or Enhancement	Target Efficiency	Mandated Agency / Office to Monitor Compliance
			regular maintenance of vessels and equipment. • Separate storage and proper handling and labelling of used oil for identification • In case of oil spill, oil spill response equipment and qualified personnel will be available on the anchor handling tug or vessel. • 100% compliance with MARPOL 73/78 • Long term, Reversible	
	Maritime traffic congestion	• Coordinate with PCG and/or PPA on the traffic routes or schemes that are likely to be used by large vessels	• 100% compliance with the government agencies with jurisdiction in the Philippine waters	• Proponent / MMT • PCG • PPA

Operation Phase

Water Quality Control

It is expected that the magnetite extraction will have impact on the water quality of the area of operation. Although the major contributor of turbidity of the water is the discharge of the Cagayan River, the proponent will minimize the possible impacts of the project to the water quality. To reduce turbidity in the seawater, long pipes and a pollution prevention curtain will be used to let the aggregates fall to the seafloor as close as possible to lessen the impact on marine habitat. Any effluent shall comply with the SD standards for water quality.

Air Quality Control

There will not be much impact on the generation of pollutants coming from the vessels since it will operate outside the municipal waters. Winds blowing in the sea will easily dissipate the pollutants coming from the emission of the diesel engine. The proponent shall also implement regular maintenance activities for the equipment and the vessels to minimize the production of pollutants and breakdown of the equipment.

Noise Control

Sources of noise during the operation phase will come from the diesel-powered generator set and vacuum pump. The Generator set will have insulated covering while the vacuum will have a muffler installed to minimize the generation of noise. For the safety of the workers, they will be encouraged to wear ear muffler to prevent damage to ear drums of the workers.

Health and Safety

The proponent will ensure the health and safety of all workers in the ship. The company shall have a written health and safety policy and program that will be the basis for its implementation. Fire extinguisher will be installed in the ship to avert possible fire related incidents.

4. ENVIRONMENTAL RISK ASSESSMENT & EMERGENCY RESPONSE POLICY AND GENERIC GUIDELEINES

JDVC Resources Corporation is committed to safe and healthy working conditions in its operations and aims to enhance, develop, promote, and maintain safe and productive work practices and adhere to the highest standards of occupational safety and health for its human resources.

Safety and Health programs involve every level of the organization. Every employee has the right to safe and healthy workplace with each personnel accepting personal responsibility in ensuring and protecting the safety and health of themselves and their co-employees. Employees on-board the Siphoning Vessel should wear personal protective gear all the time during the operations.

There were no recorded or history of accidents/incident to date since the project have not yet started their commercial operations.

4.1 ENVIRONMENTAL RISK ASSESSMENT (ERA)

4.1.1 EVALUATED RISK

Risks that may compromise the Safety & Health of the workers range from heavy rains or storms / severe weather, oil spillage, explosion, vessel worthiness (offshore) and fire.

To minimize the hazards, safe work procedures are designed and the use of Personal Protective Equipment will be provided at no cost to all employees, making it available in accordance with the type of work performed.

Objectives

It is the company's objective to integrate total loss control into the management system so that people, equipment, materials and the environment are amply protected from accidents and the line managers take direct responsibility in pursuing loss prevention activities through the following standards:

Personal Injury and Loss of Life Prevention

The company upholds the dignity and importance of every individual employee and is determined to protect him by giving adequate training in the performance of his duties and by providing safe working conditions, facilities and the necessary protective equipment. The employee in turn expected to learn conscientiously to follow prescribed standards.

Property Damage and Wastage Control

The company provides the authority and available issuances to the line organization to prescribe measures or remedial actions so that the plants, materials, supplies and equipment is adequately protected from any downgrading incident that results in a loss. The company considers all incidents outside the standard established for fair wear-and-tear, including those, which result in the wastage of resources.

Comfortable Health Care Environment

The company on its commitment in providing a health and comfortable environment offers sufficient programs to its employees in every workplace throughout the company and the neighboring communities. A health program is formulated to materialize its implementation.

4.1.2 SAFETY, HEALTH, AND ENVIRONMENTAL POLICIES

Workplace safety is an important company goal. JDVC's Safety and Health programs involve every level of the organization. Individuals within the organization have the right to a safe and healthy workplace with each person accepting personal responsibility ensuring and protecting the safety and health of others.

JDVC aims to sustain the development and social responsibility through an environmentally sound mining operation through its conformity to Philippine Mining and Environmental Laws, pollution, prevention, control, environmental rehabilitation, and information dissemination.

Community Policy

The company will establish the transparency in the implementation of Social Development and Management Programs with the involvement of different stakeholders, providing best practices in promoting the community socio-economic status and institutionalizing different existing organizations through community development.

The policy posted in central areas would serve as constant reminder on the management commitment and employee responsibility in safety and health.

The company also maintained government rules and regulations or standard such as the revised Mine Safety and Health Standards of DAO 2000-98, Occupation Safety and Health Rules and Regulations, the Mechanical Code of the Philippines, the Electrical Code of the Philippines, DOLE D.O. 16 Occupational Safety and Health Standards etc., the Marine Environment Protection Policies, conduct emergency disaster and preparedness drills in cooperation/coordination with the host communities or concerned local government, and assess the effectiveness of the protocols formulated by the company during emergencies.

Duties and Responsibilities

The Management team will have a primary responsibility in setting up and continuously improve the Safety and Health targets with collective responsibility from the contractor during the phase.

Key Safety and Health responsibilities for each discipline manager that is part of the management team shall include the following:

- Establishing and maintaining the project Safety and Health culture.
- Reviewing and authorizing key management standards and initiatives.
- Committing sufficient resources to achieve the objectives
- Ensuring the involvement by all employees and contractors
- Establishing a clear work responsibilities and accountabilities; and
- Participating in audits and reviews

The Project Management Team recognizes that management leadership and commitment is the most basic and essential element of any program that aims to achieve excellence in Safety and Health management. It is important to note that actions begin from the most senior management and extend downward to every supervisor level in all function departments.

Organizational Rules and Procedures

The General Safety Rules will be drafted outlining the standards of behavior at the workplace by prohibiting certain behaviors/work practices. The safety rules shall be issued to all employees and contractors and shall be included in the induction of new employees.

As a guide, the following items shall form part in the formulation of said rules and regulation:

- ***DAO 2000-98 / MEPRR series of 2014***

  The provisions of DAO 2000-98, "Mine Safety and Health Standards", that are applicable in the operation of project. For its offshore operation, the proponent will also implement safety and hazard management requirements as detailed in the Marine Environmental Protection Rules and Regulations of the Philippines as implemented by the Philippine Coast Guard.

Meeting

JDVC will establish functional safety committees with health and safety responsibilities to bring together varying viewpoints and achieve sounder decisions. These committees will help formulate the company policy on health and safety and give broad direction and impetus to a safety program (corporate level) it will examine proposed new processes, facilities or equipment (technical level), review the safety aspects of standard operation, plant safety rules and statistical trends of occupational illness and injury causes (management level). Likewise, it will investigate, inspect and report of rectifying errors against unsafe act or unsafe condition within an operating unit or department and suggest/recommend corrective action (Supervisor-in site level)

The safety committees can make excellent proposals or the direction and maintenance of a safety but since the enforcement and execution of these proposals depend on company authorities, it is highly recommended that a company official act as chairperson to ensure that decisions acted upon with force and effect.

Committees serve to bring more employees into active participation in safety work. To maintain their interest and continued participation it is important that the chairman prepares in advance a meeting program that is sufficiently provocative or informational to stimulate all members. A continuing written record of all meetings be kept, and these minutes should be reviewed of each meeting to assure a continuity of effort. Copies of these minutes are distributed to organizations or individuals that may be responsible for implementing the committee's recommendations.

- *Central Safety and Health Committee Meeting*

  To carry out the Safety and Health Program and to promulgate any safety policy that may enhance the accident prevention program is the primary aim of the committee. The committee will meet once a month to discuss matters relevant to safety operations. In case of accident, the committee will meet to discuss and give appropriate recommendations to eliminate same accident in the future.

- *Departmental Meeting*

  For every department, there is a monthly meeting conducted for the employees. This meeting promotes good relationships between employees and their department heads. The department head or supervisor must ensure to offer a time for employees to discuss issues: when

employees are asked on their opinions, they may feel more valued by their superior as well as the company.

- *Contractors Meeting*

  The safety section of the company conducts the monthly contractors meeting. Any relevant matter about the mining operation and concerns were discussed within the group.

  Contractor's Safety and Health Responsibilities:

  - The accountabilities of contractors and supplier must include:
  - Full adherence to set Safety and Health Standards
  - Full adherence to labor and safety laws, rules, and regulations
  - Strict observance of established priorities on hiring based on applicant's place of origin or habitation in addition to skills and training
  - Full disclosure of product or service information relating to safety and health
  - Safe transport and delivery of products or services
  - Minimum pollution and risks in the delivery of products and services and
  - Immediate response to environmental incidents

  Contractors must be liable for any human, property, or environmental damage they may cause. Liability may take several forms, namely: compensation, clean-up, remediation, and criminal liability. Contractors may be brought to task for their negligence, bad housekeeping, unlawful act, unsound practice, or disregard of the proponent's environmental and social policies. Their contract may be terminated, or the contractor blacklisted.

  Contractors must be made aware of their responsibilities and accountabilities. The management and mitigating measures relevant to the contractor's product or service are the responsibility of the contractor. The responsibilities must be articulated in the contracts for the project.

- *Safety Pep Talk*

  Safety Pep Talk is a 10–15-minute on-the-job meetings held to keep employees alert to work-related accident or illnesses. Safety Pep talks have proved their worth by alerting to workplace hazards, and by preventing accidents, illnesses, and on-the-job injuries. "Pep-talk" talks about practices, machinery, tools, equipment materials, attitudes, and anything else that may cause or contribute to work-related accidents or illness.

  It could also be used to address the actual problems on the job or in the shop. The supervisor leading the meeting can draw on the experience of workers and use that experience to remind all employees – especially newer ones – of the dangers of working with particular kinds of machinery, tools equipment and materials.

4.1.3 MANAGEMENT AND EMPLOYMENT TRAINING

All employees and contractors will undergo the basic training program joining the company to ensure that all phases of the project activity are commenced with appropriately qualified, trained, Safety and Health focused and motivated workforce. Refresher training conducted quarterly during safety meetings. When employees change areas or departments, the department supervisor shall provide training on their new emergency responsibilities and procedures.

Safety training should be mandatory to all employees of the company. Some elements of the training program are:

Pre-employment Safety Orientation

To develop the proper safety attitude of new employees, the Safety Department holds 2-days safety orientation with the new employee(s) to discuss company safety policy, safety rules, and safety practices. The new employee training program will provide for all new employees and will be specific for the duties performed. New employee training conducted before an employee operates equipment or machinery or exposed to hazards.

After the general safety instructions, the new employee goes to a guide tour of the shops or mine where he/she is to work. Accompanied by the safety inspector, he/she acquaint himself/herself with his/her working place, the safety hazards and control measures to be adapted.

Standard First Aid Training

This training conducted only once a year and shall be offered to interested and dedicated personnel to become one composite first aid team, belonging to different departments. They are responsible to give immediate care and attention to injured patients before they undergo to proper medication.

Emergency Response and Rescue Training/Drills

To increase the level of awareness of the people in the company as well as the local community, the Emergency Response and Rescue Training was being implemented. The Emergency Response and Rescue Training drill is conducted to regularly update employees on the proper attitude in times of critical situations. Information and education campaign on the other hand is also very beneficial to promote constantly the importance of emergency and disaster preparedness program.

Basic Fire Fighting Training

This can increase the safety and reduce damage by quick action in case of fires specially while on board the vessel.

Occupational Safety and Health Seminar

Safety Officers, Inspectors, Occupational Health Physician/ Nurse/ First Aider and members of the Safety and Health Committee will be sent by the company for the Occupational Mine Safety and Health Seminar, Loss Control Management Training and other safety related trainings sponsored by the accredited training institutions like the Safety Organization of the Philippines, Inc. (SOPI), Association of Safety Practitioner of the Philippines Inc. (ASPPI) and the Occupational Safety and Health Center (OSHC). All the employees will be thoroughly trained to perform their jobs safely and productively. All trainings will be documented and reviewed as necessary to ensure consistent safe and healthful work practices.

4.1.4 PLAN SAFETY INSPECTION

A hazard is something in the workplace that has potential to cause harm and can affect the people and the environment.

Key critical success factors of hazard reporting process include accessibility ease of use and corrective action. Hazard Report Form and Hazard Control Log drafted by the Safety Department as the simple

method of assisting employees and which can be used as corrective action tracking system for evaluation of hazard management at the workplace.

The project's inspection program has two components. These are the external component which will audit and evaluate the project's annual performance of safety rules and regulations, health and accident prevention and the internal component which will conduct inspection daily in all working areas and evaluate the safety and health performance of every department including that of contractors.

Inspection follow-up and monitoring

Review the information obtained from regular inspections to identify where immediate corrective actions needed. Identify trends and obtain timely feedback. Analysis of inspection reports may show the following:

- Priorities for corrective action
- Need for improving safe work practices
- Insight about why accidents are occurring areas
- Need for training in certain areas
- Areas and equipment that require more in-depth hazard analysis

The health and safety committee should review the progress of the recommendations, especially when they pertain to the education and training of employees. It is also the committee's responsibility to study the information from regular inspections. This will help in identifying trends for the maintenance of an effective health and safety program.

Committee Inspection

Through the cooperation of the Safety & Health Committee, the latter established the Housekeeping Inspection Team. This team is composed of one representative from the Environment Section, one from the Safety Section and one from the Health Section. The inspection is done once or twice every quarter to monitor the good housekeeping practice of the company including that of the contractors.

Tripartite Inspection

The Mines and Geosciences Bureau will be conducting the Mechanical & Electrical Inspection once a year and the Semi-annual Safety Inspection twice a year to ensure that the company and its existing Safety & Health Regulations are complied.

4.1.5 ACCIDENT/INCIDENT ANALYSIS AND STATISTICS

An initial draft of incident investigation and reporting procedure has been developed to ensure that all significant and potentially significant incidents do not recur. The MGB Monthly Accident Report Format will be used in reporting to the said agency. The proponent believes that if all the key contributing factors are identified and both remedial and preventative actions are identified and completed in a timely manner, then repeat incidents should be minimized.

It is important to recognize that the causes of incidents cannot be addressed if the incidents are not reported. A common reason that incident go unreported is that, in some circumstances, the incident investigation can become a search for the guilty, rather than a search for the facts. An effective incident identification and program will be a key element for objective incident reporting.

Employees from all levels should be involved in incident investigations where their knowledge and skills in the operations and maintenance are critical to a complete investigation including the development of appropriate remedial and preventative actions. Once the investigating team has completed its report, in addition to the normal distribution, a copy of the report and recommendations should be displayed within the area in which the incident occurred. Completion of identified preventative and remedial actions will be included as part of the audit program.

Identification of Potential Risks and Emergencies

Emergencies are sudden conditions or situation that are caused either by natural forces or man-made that calls for immediate action so us to prevent or minimize the destructive effects to the people, property and to the environment.

As an initial step to develop effective and workable response policy, the possible emergency scenarios that could possibly occur during the operation of the project are identified and tabulated in **Table 4-1** below:

Table 4-1: Possible Emergency Scenarios

Possible Risk Scenarios	Possible Cause	Destructive / Negative Effects
Fire	Man-made	- Partial or total loss of properties such as facility, equipment, and machinery. - Injuries and loss of lives of personnel.
Weather Conditions - Tropical Storms - Storm Surges - Tsunami - Flooding	Natural	- Partial or total destruction of equipment, vessel, and facilities. - Injuries and fatalities to Workers. - Loss of lives and properties.
Oil Spills	Man-made	- Pollution of Marine waters - Damage to Marine environment - In severe cases, loss of livelihood to fisherfolks
Release of Toxic Substances	Man-made	- Pollution of Marine waters - Damage to Marine environment - In severe cases, loss of livelihood to fisherfolks
Security Risk	Man-made	- Partial or total loss of properties such as building, equipment and machinery. - Injuries and loss of lives of personnel.
Physical (Vessel Worthiness)	Man-made	- Partial or total loss of properties such as building, equipment and machinery. - Injuries and loss of lives of personnel.

4.1.6 EMERGENCY RESPONSE AND PREPAREDNESS PROGRAM

To comply with Rule 637 of DENR Administrative Order 2000-98, JDVC shall prepare an Emergency Response and Preparedness Program (ERPP) covering its operations.

The coverage of the program shall initially cover identified risk inherent to the operation. Scenarios shall be prioritized in its likelihood to occur as well as the mitigation to be introduced to counter it. The persistency of any scenario despite of the mitigating measures to be incorporated shall be the subject of emergency response and preparedness drills that shall be conducted by JDVC in accordance with the existing statutory requirements.

The ERPP shall include the following:

1. Organization of crisis management group;
2. Purchase of appropriate logistics/equipment;
3. Provision for alarm/warning system;
4. Formulation of procedures or protocols to address the perceived threats/scenarios;
5. Selection and training of response teams in emergency procedures; and
6. Conduct of emergency response and preparedness drills.

Communication and Training

Department managers, supervisors, employees and contractors shall be required to undergo safety and health trainings to equip them the necessary knowledge and skills to recognize, evaluate and introduce remedial measures to any safety and health risks that may arise in their respective areas of responsibility. The knowledge and skills to be learned by the employees and contractors will create positive attitudes in instilling a culture of safety. The following trainings shall be administered by JDVC or sourced out from other safety training providers:

- Orientation and re-orientation of newly hired or old employees;
- Basic occupational safety and health seminar;
- First aid and emergency care seminar;
- Possible emergency and response scenarios due to weather conditions, storm surge, tsunamis, flooding; and
- Fire Fighting.

Emergency Response Team

The Emergency Response Team (ERT) shall be created to deal with emergency situations through a systematic, orderly, and effective response to minimize destruction of properties. The primary roles and responsibilities of the ERT are the following:

- In-charge of the operation during emergency situations.
- Monitor the safety performance of daily operation, including the emergency response procedures.
- Train personnel and secure necessary permit for members of ERT.
- Issues appropriate warning and advisory to all concerned prior, during and post emergency scenarios.
- Perform actual rescue and retrieval of mine personnel and equipment in times of emergency.
- Formulate plans and programs for effective and proper response procedure to a particular emergency scenario.
- Provide the necessary finance requirement, supplies, equipment for the operation of ERT.

The ERT is composed of four (4) units as follows:

- Rescue Unit
- Fire Brigade Unit
- Planning, Intelligence, and Information Unit
- Logistic and Finance Unit

The number of personnel to man the ERT will be determined during its organization.

For the typical Organization Chart, please refer to **Figure 4-1.**

For the Emergency Response Plan and flow diagram, please refer to **Figure 4-2**.

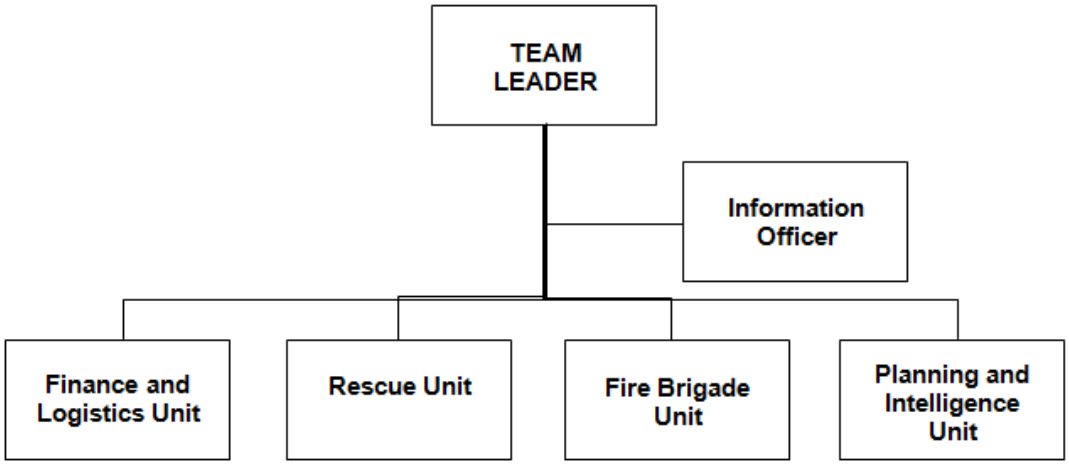


Figure 4-1: Emergency Response Team Organizational Chart

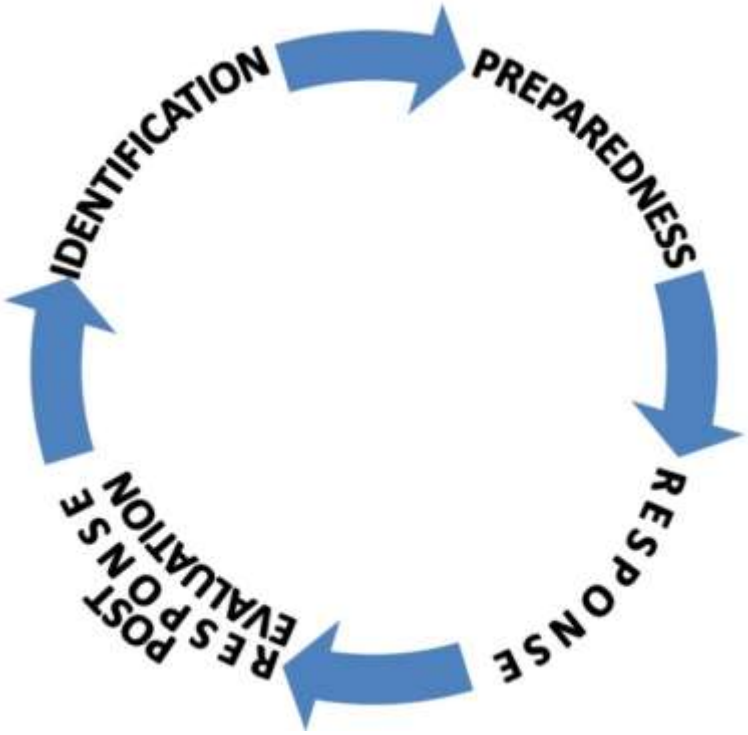


Figure 4-2: Emergency Response Plan and Flow Diagram

A Health and Safety Unit (HSU) may be established to supplement the Emergency Response Team (ERT) or the same team (ERT) may function as a HSU as the situation requires. The following are the requirements for the different personnel to be engaged in the Health and Safety Unit (HSU):

- Certified First Aiders, trained by the Philippine National Red Cross
- Safety Officers who have completed the minimum prescribed safety and health course as required by Rule 1030 of the Occupational Health and Safety Standards (OHST). Only accredited safety personnel by the concerned safety regulating agency shall be engaged on a full-time basis.

4.1.6.1 General Procedures for Vessel Operations Safety and Health Management

1. Vessels shall be equipped with lifesavers, life jackets and lifeboats to a total of at least one and a half times the number of persons who are on the vessel.
2. The operations shall have at least standby motorboat available which is capable of being launched fully loaded and shall accommodate at least one and a half times the number of person on the vessel.
3. Adequate and suitable firefighting equipment shall be made available.
4. All supervisors and workers shall be trained on the proper use of firefighting equipment.
5. Vessels shall always carry along full-time occupational health nurse, part-time occupational doctor and first aiders as may be deemed necessary and shall be provided with medicines, equipment and facilities.
6. A potable and adequate supply of drinking water shall be provided and maintained, conveniently accessible and clearly marked as drinking water for all persons.
7. Prior to repairs, modifications or alterations to be carried on the ship that may affect its strength, buoyancy and stability, the company shall obtain the following:
    - Approval from the concerned agency to carry out such work;
    - Plans, specifications, drawings and design calculations to be submitted to the agency concerned indicating extent and nature of such work;
    - Approval of governing government agencies.
8. All lifesaving equipment shall be kept in a conspicuous place that is easily accessible and shall be immediately repaired or replaced when it is damaged.
9. No employee shall be allowed to interfere or tamper with any lifesaving equipment provided on the vessels except:
    - For purpose of saving lives;
    - During the conduct of a training exercise approved by the manager; and
    - As otherwise authorized by the manager.
10. The manager shall ensure so far as practicable to post warning signs in conspicuous places to warn persons of danger from headlines, sidelines, and others.
11. A rescue or pick up boat shall be provided.
12. Effective means of communication shall always be provided. Where possible, there shall be radio or telephone; an alternative means of signaling shall also be provided. All such equipment shall be used only by a suitably trained and competent operator. Communication equipment shall be efficient, properly installed, regularly tested, and kept in good condition. In case of electrical storms which could affect the transmission, no radio signals shall be given, in which misunderstandings might lead to an accident.
13. A suitable provision shall be made for effective treatment of injured and ill employees. An adequate first aid kit shall always be readily available to be used by the first aider.
14. Proper housekeeping shall always be maintained.

4.1.6.2 Emergency Plan

4.1.6.2.1 Fires

The objective of this plan is to ensure the safety of personnel as well as reduce if not to totally avoid damage to property and equipment. Likewise, it is intended to prevent or control the spread of fire.

The alert notification system for fire incidents shall be based either on information received from the seafarers on board or the sounding of fire alarms.

The following measures shall be established to ensure the safety of persons on the vessels in the event of a potential incident to which this regulation applies –

a) an alarm system shall be installed, and a procedure has been established for activating the system;
b) a procedure shall be established for the prompt notification of rescue and firefighting teams;
c) a procedure shall be established for evacuating personnel;
d) all seafarers shall be adequately trained and retrained in emergency procedures and the use of emergency equipment and facilities; and
e) emergency drills shall be conducted on a regular basis.

Prevention

The proponent shall hold a regular meeting to constantly monitor the strict implementation and assess the system's efficiency to manage emergency situations.

Besides the regular meetings, all engaged contractors shall be required to conduct their own monthly safety briefing discussing government mandated and company safety requirements.

Safety Inspection

Generally, all vessels to be engaged are required to conduct a safety inspection at least once every quarter. On an annual basis, the Company shall inspect the whole facility for fire hazards and inefficiencies of the fire safety equipment installed.

Preventive Maintenance

Vessel

All ship components that may pose fire hazard will be inspected for fire risk by a competent person. This inspection should include a check of:

- the fuel system (integrity of the fuel tank filler cap, fuel lines and their connections as applicable);
- electrical harness (adequacy of protection from rub and wear damage);
- the emergency engine shutdown device (if operates in accordance with manufacturer's specifications and is fail safe);
- replacement of parts that are defective or that may pose fire hazard; and
- the battery (integrity and is effectively protected from any adverse effects of heat).

Where a blow torch, welding, cutting or other hot work equipment is used in a location where a fire may endanger or may jeopardize the safety of persons, implementation of standard written procedures for the safe use of such equipment is essential.

Fire safety and Firefighting Facilities
Procedures and suitable firefighting facilities should be in place and notices placed close to electrical installations to ensure correct procedures are followed in case of fire. Firefighting equipment is best located on the ventilation intake side of the hazard.

Training
A regular and effective training program is probably the most crucial factor in determining the success of personnel protection strategies. The management shall ensure that all personnel including those of the contractor shall understand the appropriate action to take in a fire emergency. Scheduled and random drills shall also be implemented within the project site.

Safety Awareness

Information and education materials on safety will be posted on all boards and will regularly be provided to all personnel. Postings will also include the contact number/s that have to be contacted during emergencies.

Fire Emergency Response

General:

1. Evacuate according to established company procedures and obtain a head count confirming location of those accounted for and those missing.
2. Notify the captain or other senior official.
3. Any person who detects smoke or locates a fire shall attempt to extinguish it with the closest available extinguisher.
4. If the fire cannot be immediately extinguished, the person shall raise the alarm by shouting “fire” and initiating the nearest fire alarm pull station.
5. Check the evacuation plan and procedures for the vessel.
6. A vessel official or other senior official will conduct a head count and advise the Central Health and Safety Office.
7. Evacuate to the predetermined safe area, record all names of workers, and check numbers to determine whether any individuals are missing.

4.1.6.2.2 Storm/Typhoon/Storm Surge/Flooding

Preparedness

All seafarers are required to participate in drills that will be conducted. These exercises may or may not have prior notice.

Emergency Response

The alert for such situation shall be based on weather forecasts from PAGASA. Alert Levels will be designated to determine appropriate response procedures to be followed:

- Public Storm Signal No. 1 – Level 1
- Public Storm Signal No. 2 – Level 2
- Public Storm Signal No. 3 – Level 3
- Public Storm Signal No. 4 – Level 4 (Major Emergency)

Level 1

1. Regular updates shall be provided to all personnel through their supervisors.
2. Employees and vessel personnel will be briefed on the course of actions to be done if the typhoon signal has elevated.
3. Level 2 procedure numbers 1, 2 and 3 may be initiated if typhoon is directly towards the vessel.

Level 2

1. Activation of the Emergency Response Team.
2. An initial meeting shall be initiated by the captain and land-based officer, to plan the overall actions required. The agenda should include:

a. evaluation of possible evacuation of personnel;
b. the evacuation planning for all personnel, vessel and equipment and other items; and
c. planning for the provision and protection of required resources of the evacuees (food, water, medicines, standby power, fuel, transport and other basic needs) and other logistics such as hand held radios, laptop computers (for typhoon updates), cellular phones, satellite phones, standby vehicles and other required resources.

3. After the preliminary meeting, the Emergency Response Team shall ensure that coordinators are provided with an official communication to distribute to their supervisors and personnel.
4. In the event that the vessel needs to dock to a safe port, all personnel shall ensure that all equipment is evacuated or secured to designated areas. Nonpriority resources may also be evacuated as time permits.
5. All electrical equipment should be waterproofed and moved away from possible wet areas (if any).
6. Equipment shall be securely anchored in a protected area.
7. All personnel should prepare for possible evacuation.

Level 3 and 4

1. The Emergency Response Team will determine the possible course of action to be undertaken. Evacuate measures or to remain in the originally assigned areas shall be based on the assessment done during the preliminary meeting.
2. The Emergency Response Team leader shall only call for an evacuation upon confirmation by the Manager and/or the Head Office.
3. Generally, a first aider and a standby electrician should be stationed in preparation for possible emergencies.

Post Emergency Procedure

Inspection after major storms shall be undertake as the weather conditions will allow to be able to evaluate the extent of possible damage.

As part of emergency plan, a work protocol that considers extreme weather condition should be established. For instance, this would include stoppage of regular operation prior to the onset of typhoons to prepare and conduct safety evaluation of equipment, reinforcement of barriers and silt fences if needed and evacuation of vital equipment (such as the capsize siphoning vessel and others) into safe areas.

4.1.6.2.3 Tsunami

The main damage from tsunami comes from the destructive nature of the waves themselves causing loss of lives and property. Secondary effects include debris acting as projectiles which then run into objects, erosion that can undermine the foundation of structures built along coastlines, and fires that result from disruption of gas and electrical lines. Other effects include loss of crops and water and electrical systems that could lead to famine and disease depending on the extent and gravity of the tsunami.

Prediction and Early Warning

For areas at great distances from the source earthquake that could have great potential for generating tsunamis, there may be ample time for warnings to be sent and coastal areas evacuated, even though tsunamis travel at high velocity across the sea. For earthquakes occurring anywhere on the subduction

margin of the Pacific Ocean, there is a minimum of 4 hours of warning before a tsunami would strike any of the Hawaiian Island.
Warning system consists of an international network of seismographic stations and tidal stations around the region that can send vital information via satellite to countries in the region. When an area earthquake occur in the area, the data is immediately analyzed by these systems, looking for a sign that the earthquake could have generated a tsunami. Our very own PHIVOLCS receive and communicate with these regional agencies for such warning and data which in turn are used to warn localities, through their respective LGUs, that may be affected.

Like all warning systems, the rate of effectivity of tsunami early warning system depends strongly on the local authority's ability to determine that their area is in danger, to disseminate information to those potentially affected, and on the education of the public to heed warnings and remove themselves from the area.

Preparedness

The vessel shall establish onboard emergency procedures posted or filed for the shipmaster to initiate upon receipt of the notice or warning. The ship's communication system will be maintained to always have connection with the designated regional or local channel that releases tsunami warnings. All seafarers are required to participate in drills that will be conducted. These exercises may or may not have prior notice.

Emergency Response

The alert for such situation shall be based on warnings from PHIVOLCS, PAGASA or other government designated agencies

For Vessels on Port

If the tsunami message issued is received indicating that a tsunami has been generated and the expected arrival is more than 3 hours, the person in charge of ship master is advised to:

- Try to collect tsunami information through a ship operator or agent or PORT AUTHORITIES to take corresponding actions.
- Order vessels in the port to move to deeper areas at least 320'/100m or to secure vessels to the best of their abilities and time permitting.
- Indicate that vessels at sea, should stay offshore in areas deeper than at least 320'/100m (UNESCO, 2008).
- If one is on a boat or ship and it is moored on port and there is ample time as the warning indicates, move the vessel to deeper waters at least 100 fathoms deep. If it is a case that there is a concurrent severe weather, it may be safer to leave the boat at the pier and physically move to higher ground.
- Keep away personnel, workers, tourists, residents from the port facilities once the 1st wave arrival time is close (at least 1 hour).
- Indicate a secondary port to attend the vessels evacuated or redirect those that could not enter to the port, until the emergency concludes.
- Any other consideration that may apply [ask for support from local government aerial force to overfly the area, recommend to evacuated vessels to maintain a fuel reserve capable of bringing them back to port, etc..
- Once the Tsunami All Clear and/or Cancellation are issued, disseminate to the port users. Need to take into consideration not only wave heights, but also currents. These phenomena could affect the port more than 6 hours after the earthquake.

For Vessel Offshore

Vessels at sea, should stay offshore in deeper areas at least 320'/100m, recommended by UNESCO (2008). In the case of the project, anchorage shall be removed and from the seabed to allow the vessel to move freely with wave patterns. Equipment and vessel components must be secured to prevent unnecessary movement that may cause damage to the vessel and its crew. The shipmaster shall report its current location to the port authorities its latest location and status. All crew members and shall be gathered aboard at designated assembly area and accounted for until all clear advisory is issued.

sOnce the Tsunami All Clear is issued, such is disseminated to the port users and vessels at sea as communication would allow. It is necessary to take into consideration not only wave heights, but also currents. These phenomena could affect the port more than 6 hours after the earthquake. Hence shipmasters should be guided of the conditions at the designated port before returning to any port facility.

4.1.6.2.4 Hazardous / Noxious Liquid Material Spills (including Oil as applicable)

Prevention

- Storage and Handling

All hazardous materials must have a corresponding Material Safety Data Sheet (MSDS). The MSDS should be readily available in areas where the material is stored and/or handled.

Hazardous materials should be properly labeled, stored and handled. Storage shall be at designated areas in accordance with specified separation distance and inventory limits (as applicable). Only duly approved containers or storage vessels shall be used for storage and handling.

- Drills

All personnel are required to participate in drills that shall be conducted by the CHSC. These exercises may or may not have prior notice. This exercise shall be conducted at least twice a year.

- Personal Protective Equipment (PPE)

JDVC shall eliminate the identified occupational hazards through the introduction of hierarchy control measures whereby the use of personal protective equipment shall be monitored and strictly implemented. JDVC shall comply, as provided for under the existing Safety and Health Standards, to provide employees free of charge personal protective equipment to ensure that their physical well-being are amply protected while performing their assigned tasks. Employee shall be issued personal protective equipment in accordance with the type of occupational hazards that they may likely be continuously exposed to as determined by the Safety and Health Office.

Emergency Response

Any spills shall be reported, contained, and cleaned up promptly and properly in accordance with prescribed procedures particularly in accordance with the Marine Environment Protection Policies of the PCG.

A. Every ship of 150 gross tonnages and above certified to carry noxious liquid substances in bulk shall carry on board a shipboard marine pollution emergency plan for noxious liquid substances approved by the MEPCOM.

B. Such a plan shall be based on the Guidelines developed by the MEPCOM and written in a working language or languages understood by the master and officers. The plan shall consist at least of:

    1. the procedure to be followed by the master or other persons having charge of the ship to report a noxious liquid substances pollution incident based on the Guidelines developed by the MEPCOM;

    2. the list of authorities or persons to be contacted in the event of a noxious liquid substances' pollution incident;

    3. a detailed description of the action to be taken immediately by persons on board to reduce or control the discharge of noxious liquid substances following the incident;

    4. and the procedures and point of contact on the ship for coordinating shipboard action with national and local authorities in combating the pollution.

C. In the case of ships to which Chapter II also applies, such a plan may be combined with the shipboard oil pollution emergency plan. In this case, the title of such a plan shall be ''Shipboard Marine Pollution Emergency Plan''.

Shipboard Oil Pollution

A. All oil tankers of 150 tonnes deadweight and above and every ship other than an oil tanker of 400 tonnes deadweight and above shall carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) approved by the MEPCOM.

B. Always ensure the availability of SOPEP for inspection and evaluation.

C. Prior to approval of the SOPEP, the MEPCOM shall conduct an Emergency Readiness Evaluation (ERE) on the ship's crew to determine their knowledge of the provisions of the SOPEP and if the procedures indicated therein are enough to combat an oil spill. Likewise, the crew should conduct regular drills/exercises and periodic review of the plan at least every year to keep up with changes in these Regulations. To ensure compliance of this requirement, MEPCOM shall supervise the aforesaid drills/exercise and shall certify thereon.

D. SOPEP of every ship shall consist at least of:

    1. Procedures to be followed by the master or other persons having charge of the ship to report an oil pollution incident.

    2. List of authorities or persons to contact in the event of an oil pollution incident.

    3. Detailed description of actions to be taken immediately by persons on board to reduce or control the discharge of oil spill incident.

    4. Procedures and point of contact on the ship for coordinating shipboard action with national and local authorities in combating pollution.

5. Necessary assistance to the master in meeting the demands of a Tier III spill should it involved one.

6. Arrangement of SOPEP Provisions:

    a. MEPCOM report on actual and probable discharge

    b. Ship's lay-out and plans appendices.

    c. National and local coordination entities and their roles in case of emergencies falling within their jurisdiction.

E. Shipowners or shipping companies shall submit a copy of the proposed plan in writing to the Commander, MEPCOM for evaluation and approval prior to its implementation aboard ship.

Decontamination Procedure

Decontamination will make an individual and/or their equipment safe by physically removing toxic substances quickly and effectively. Extra care should be taken during decontamination, because absorbed agent can be released from clothing and skin as a gas.

Spill Emergency

- Notify all personnel around the spill immediately
- Cordon off the area
- Do not touch or swim through the spilled material as much as possible. However, if this cannot be avoided, the response personnel should wear the appropriate PPE during environmental decontamination. Adequate protective equipment must be worn.
- Stop the spillage if it is possible to do so without risk to personnel.
- Avoid contact of water runoff to the spilled material.
- Remove other materials, equipment, or containers in the path of the spill.
- All spilled material must be disposed properly.
- Adequate location of first aid kit should be adhered and available in strategic locations.
- Adequate locations of Eyewash facilities must be available.

Oli spill response equipment and qualified personnel will be available on the anchor handling tug or vessel in case of any accidents would happen. Minimum Oil Spill Response equipment:

- Oil Spill boom with storage systems (length to cover the entire vessel)
- Oil Skimmers
- Power Packs
- Low pressure Air blower
- Oil Traps, bags and tanks
- Oil Absorbent Materials (Booms, Rolls, and pads, etc.)

Post Emergency Procedure

Likewise, an incident report shall be made with the corresponding assessment on the cause of the incident which will be prepared to prevent future occurrences and/or determine lapses or efficiency of control and handling procedures. A risk assessment will be undertaken and included in subsequent

reviews of this document to ensure the controls are adequate for management of all material handling and disposal options.

4.1.6.2.6 Security Related Emergencies (Bomb Threats and Security Issues)

Prevention

Simple activities that can reduce the threat are as follows:

- Secure all non-essential entrances/exits and minimize access points in the vessel.
- Exercise control over personnel who intend to board the vessel, including registration and escort by host.
- Supervise all 3rd party work.
- All project members and visitors will wear identity cards.
- Search incoming goods, in particular incoming mail, and packages.

Good Housekeeping Practices

The following practices are an aid to reducing the potential places in which articles can be hidden:

- Keep rooms, stairways, corridors, and halls clean and tidy.
- Lock unoccupied rooms and areas.
- Encourage project members to know the vessel well.
- Encourage project members to look out for and report suspicious or unusual behavior.
- Challenge unknown persons who are in an area in which they should not be. Ensure that packages and parcels are delivered under observation and are being checked.

Emergency Response

The Safety/Security officer is responsible for directing the action to be taken in response to any bomb threat. Responsibilities include the following:

Response Actions:

- Producing a risk assessment;
- Devising and maintaining a search plan of the vessel;
- Devising and maintaining an evacuation plan;
- Liaising with the responsible authorities; and
- Arranging project members awareness and bomb threat practices

Evacuation routes should be identified and clearly marked allowing the free movement of personnel in the event of an emergency. A responsible individual should be identified to expedite evacuation if ordered. Muster drills should be conducted at all locations so that all personnel are fully conversant with the evacuation procedures.

Post Emergency Procedure

- Review all actions and procedures.
- Implement improvements from the lessons learned.

4.2 EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

The company will create a Task Force to study and implement emergency responses with the end view of assisting the vessel in an emergency situation and also helping the coastal communities during extreme weather events, making sure that no lives will be lost, injuries lessened and damage to properties minimized or even prevented.

With the issuance of the Memorandum Circular No. 2016-05 *"Guidelines on Offshore Mining"* by Mines and Geoscience's Bureau, the proponent shall initiate the following Emergency Response Policies. The company is committed to adhere and implement the provisions of the MGB Guidelines on Offshore Mining Guidelines.

The proper coordination with the Philippine Coast Guard will be crucial in all the emergency situations. Proper coordination with the Philippine Navy should also be included in the procedures. The Philippine Navy will be crucial for security during export of the sand.

Guidelines will also be formulated on how to react to natural hazards. Areas will be designated as evacuation or treatment centers. Groupings will be organized - each of which will be assigned a pre-identified supervising staff. Paramedics will be trained adequately particularly in the evacuation and treatment procedures. Coordination with local government units will be systematized. Resources will be identified as early as possible to optimize their uses. Trainings will be done on regular basis for key personnel. Drills will also be initiated to actualize the system and procedures designed for emergency or even disaster responses.

Emergency Response Team

The Emergency Response Team (ERT) shall be created to deal with emergency situations through a systematic, orderly, and effective response to minimize destruction to/of properties. The primary roles and responsibilities of the ERT are the following:

- In-charge of the operation during emergency situations.
- Monitor the safety performance of daily operation, including the emergency response procedures.
- Train personnel and secure necessary permit for members of ERT.
- Issues appropriate warning and advisory to all concerned prior, during and post emergency scenarios.
- Perform actual rescue and retrieval of mine personnel and equipment in times of emergency.
- Formulate plans and programs for effective and proper response procedure to a particular emergency scenario.
- Provide the necessary finance requirement, supplies, equipment for the operation of ERT.

Composition of the Emergency Response Team

The ERT is composed of four (4) units as follows:

- Rescue Unit
- Fire Brigade Unit
- Planning, Intelligence, and Information Unit
- Logistic and Finance Unit

The number of personnel to man the ERT will be determined during its organization. For the typical Organization Chart, please refer to **Figure 4-1**. The Emergency response plan flow is shown in **Figure 4-1.**

An Operational Health and Safety Team (OHST) may be established to supplement the Emergency Response Team (ERT) or the same team (ERT) may function as an OHST as the situation requires. The following are the requirements for the different personnel to be engaged in the Operational Health and Safety Team (OHST):

- Certified First Aiders, trained by the Philippine National Red Cross
- Safety Officers who have completed the minimum prescribed safety and health course as required by Rule 1030 of the Occupational Health and Safety Standards (OHST). Only accredited safety personnel by the concerned safety regulating agency shall be engaged on a full-time basis.

General Procedures

1. Vessels shall be equipped with lifesavers, jackets and lifeboats to a total of at least one and a half times the number of persons who are on the vessel.
2. The operations shall have at least standby motorboat available which is capable of being launched fully loaded and shall accommodate at least one and a half times the number of persons on the vessel.
3. Adequate and suitable firefighting equipment shall be made available.
4. All supervisors and workers shall be trained on the proper use of firefighting equipment.
5. Vessel shall always carry along full-time occupational health nurse, part-time occupational doctor and first aiders as may be deemed necessary and shall be provided with medicines, equipment, and facilities.
6. A potable and adequate supply of drinking water shall be provided and maintained, conveniently accessible and clearly marked as drinking water for all persons.
7. When operations and certain activities such as inspection and/or visitation are ongoing, appropriate first aid and rescue equipment shall be provided.
8. Prior to repairs, modifications, or alterations to be carried on the ship that may affect its strength, buoyancy and stability, the company shall obtain the following:
    - Approval from the Bureau to carry out such work;
    - Plans, specifications, drawings and design calculations to be submitted to the Bureau indicating extent and nature of such work;
    - Approval of governing government agencies.
9. All lifesaving equipment shall be kept in a conspicuous place that is easily accessible and shall be immediately repaired or replaced when it is damaged.
10. No employee shall be allowed to interfere or tamper with any lifesaving equipment provided on the dredge except:
    - for purpose of saving lives;
    - In the course of the conduct of a training exercise approved by the manager; and
    - As otherwise authorized by the manager.
11. The manager shall ensure so far as practicable to post warning signs in conspicuous places to warn persons of danger from headlines, sidelines and other dive lines or mooring lines
12. The manager shall ensure that each anchor for headline, sideline or mooring line is of adequate strength;
13. A rescue or pick up boat shall be provided.
14. Effective means of communication shall always be provided in the ship. Where possible, there shall be radio or telephone; an alternative means of signaling shall also be provided. All such equipment shall be used only by a suitably trained and competent operator. Communication

equipment shall be efficient, properly installed, regularly tested and kept in good condition. In case of electrical storms which could affect the transmission, no radio signals shall be given, in which misunderstandings might lead to an accident.

15. A suitable provision shall be made for effective treatment of injured and ill employees. An adequate first aid kit shall always be readily available to be used by the first aider.
16. Proper housekeeping shall always be maintained.

Shipboard Oil Pollution Emergency Plan (SOPEP)

Vessels to be engaged by the proponent shall adhere to the general provisions of the PCG's Marine Environmental Protection Implementing Rules and Regulations (MEPIRR) governing shipboard oil pollution, shall device a Shipboard Oil Pollution Emergency Plan (SOPEP) that will be subject to the PCG's review, evaluation, and approval prior to its deployment to sea and operation of the project. The PCG shall determine the readiness of the crew to handle such an emergency and the sufficiency of the SOPEP's provisions to mitigate and/or manage and remedy an oil spill. The SOPEP shall cover the minimum requirement of the MEPRR as follows:

1. Procedures to be followed by the master or other persons having charge of the ship to report an oil pollution incident.
2. List of authorities or persons to contact in the event of an oil pollution incident.
3. Detailed description of actions to be taken immediately by persons on board to reduce or control the discharge of oil spill incident.
4. Procedures and point of contact on the ship for coordinating shipboard action with national and local authorities in combating pollution.
5. Necessary assistance to the master in meeting the demands of a Tier III spill should it involved one.
6. Arrangement of SOPEP Provisions:

    a. MEPCOM report on actual and probable discharge
    b. Ship's lay-out and plans appendices.
    c. National and local coordination entities and their roles in case of emergencies falling within their jurisdiction.

Shipboard Marine Pollution Emergency Plan for Noxious Liquid Substances (SOPEP)

Vessels to be engaged by the proponent shall adhere to the general provisions of the PCG's Marine Environmental Protection Implementing Rules and Regulations (MEPIRR) governing shipboard marine pollution emergency plan for Noxious substances and shall consist of the following:

1. the procedure to be followed by the master or other persons having charge of the ship to report a noxious liquid substances pollution incident based on the Guidelines developed by the MEPCOM;
2. the list of authorities or persons to be contacted in the event of a noxious liquid substances pollution incident;
3. a detailed description of the action to be taken immediately by persons on board to reduce or control the discharge of noxious liquid substances following the incident; and
4. the procedures and point of contact on the ship for coordinating shipboard action with national and local authorities in combating the pollution.

Safety Signages

Safety signages shall be provided in order to warn the workers and the public of existing hazards in the workplace. It shall be posted in appropriate areas of the vessel and should be understandable. All signages shall be kept clean and be inspected regularly. Damaged signages should be removed and replaced.

Accident/Incident Investigation and Analysis

All accidents and incidents associated with the operation shall be investigated, results of which shall be used to formulate remedial measures to prevent recurrence of same nature of accidents/incidents. After investigation, a report shall be made and submitted to the manager. In case of a fatal accident, the manager and/or safety officer shall immediately report the same to the office of the Mines and Geosciences Bureau Regional Office II and the Regional office of the Philippine Coast Guard (PCG) within 24 hours. Investigation shall be conducted immediately and said report shall be furnished the MGB R2 and PCG Regional Office within the prescribed period of 15 days. The Safety Officer shall accomplish the Monthly safety statistics report to analyze the performance of the exploration activity. The findings shall be the basis in coming up of remedial measures particularly if the accidents are repetitive.

5. SOCIAL DEVELOPMENT AND MANAGEMENT PROGRAM (SDMP) AND INFORMATION, EDUCATION, COMMUNICATION (IEC) FRAMEWORK

5.1 Social Development and Management Program (SDMP)

JDVC Resources Corporation has implemented its five (5)-year SDMP as a tool for development and extend to the communities its assistance through community programs, projects and activities in full partnership with the host and neighboring communities. It is a way of the Contractor's appreciation for the acceptance of the host and neighboring communities to the mining project. Aside from the their mission to be socially responsible and environment conscious, it also aims to enhance productivity of the people and improve the quality of life of its employees, families and the host and neighboring communities. The program is basically anchored on the framework of sustainable development with its core values on People Empowerment.

In compliance with the provisions of Sections 134 to 136 of DAO No. 2010-21, the Implementing Rules and Regulations for SDMP, JDVC shall allocate 1.5% of its operating and processing costs, hence, JDVC has come up with this programs to address the requirement as part of the company's MPSA.

Goals and Objectives

The goal of the project is: *"To Uplift the Quality of Life of the Host and Neighboring Communities of the Mining Project Through People Empowerment".*

Below are the objectives of the approved SDMP:

1. To optimize the advancement of human resources through capacity-building and people empowerment to attain a self-reliant and resilient community;
2. To increase the income by providing livelihood programs of beneficiaries/recipients such as handicraft making for women, production of high value crops for farmers and advanced methods of fishing in coordination with LGU MPO, TESDA, DAR, DA, etc. Job skills trainings for qualified seamen/workers will also be given attention, thus, decreasing dependency on the benefits derived from the Mining Company;
3. To provide opportunities for students to have access in better education and to improve the skills of the residents, thus enhancing employment potentials. This includes the nonformal education to uplift the literacy of host and neighboring communities and implement high school, technical, and college scholarship programs for those students who excel in school but cannot afford a higher education;
4. To collaborate and partner with different stakeholders in meeting the minimum basic needs of the community and contribute to the enhancement of human welfare and reduction of social ills;
5. To assist to maintain the peace and order of the host and neighboring communities;
6. To assist the local units in improving the health of the community by proper sanitation thru solid waste management, and providing water sealed toilets, support establishment of "botika" and provide supplemental feeding to malnourished children;
7. To conduct environmentally friendly community by reforestation and establishing forest nurseries; to conduct awareness on the regulations on illegal fishing; and
8. To protect the socio-cultural values and local patterns amidst improved economic condition and human advancement.

Methodology

The crafting was designed in accordance with Sections 135 and 136 of DAO No. 2010-21 and the basis for the implementation shall be the operating costs estimates contained in the approved Mining Project

Feasibility Study. This is in consultation with the municipal officials and staffs, Barangay Officials, Barangay Development Council (BDC) and other sectors of the community such as the Women's Group, Youth sector, fisherfolks, Senior Citizens and other Community-based Organizations (CBOs). Informal interviews and series of consultation with the residents/stakeholders were conducted coupled with community profiling and assessment. Other data were also secured from the existing LGUs. The process recognized the needs of the community/ies. The latest Comprehensive Land Use Plan (CLUP) of each municipality were also used as basis in crafting the SDMP and some plans are also adopted.

For sustainability, the Social Development Technical Working Group sits as Ad hoc Committee in coordination with JDVC Community Relations Officer to oversee the implementation of the SDP and make their report to the Multi-partite Monitoring Team. Following are the details of the major programs and summary of proposed activities in **Table 5-2a** below.

An indicative Social Development and Management Program **(Table 5-2b)** was also formulated to address some of the additional needs of the community. This is done through consultation activities, Information, Education and Communication (IEC) and Public Scoping with the participation of the decision makers of the project affected communities to include the Municipal Executive Office, Municipal Councils, Municipal Government Department Heads, Barangay Councils, Sectoral Representatives and the concerned Government agencies such as the Department of Environment and Natural resources – Environmental management Bureau (DENR-EMB) Region 2, DENR-CENRO, Municipal Fisheries and Aquatic Resources and Management Council (MFARMC), Mines and Geosciences Bureau (MGB) Region 2, Philippine Ports Authority (PPA) Northern Luzon, Bureau of Fisheries and Aquatic Resource (BFAR) Region 2, Department of Public Works and Highways (DPWH) Region 2, and Philippine National Police (PNP) Region 2.

Table 5-1: Summary of Consultation Activities

Activity	Date of Consultation
IEC Consultation	November 06, 2019 and November 29, 2010
Public Scoping	January 30, 2020 and January 31, 2020
Public Hearing	(to be determined)

The various program identified were in the areas of health and safety, education, peace and order, and environment and sanitation including spiritual. The Indicative Social Development Program was conceptualized by the stakeholders in consideration of their mandate to deliver services to the barangays and in coordination with the LGU. The process considered the Barangay Development Plans to maximize the resources with the JDVC's Socio-economic commitments as mandated by law.

The information collected from the perception survey will also form part of the indicative SDMP that mainly address the following issues:

- Perceived fears of environmental "destruction" or degradation due to pollution of land, air, water resources, and health risks;
- Possibility of losing their coastal areas;
- Possibility of losing their source of livelihood; and
- Address the lack of budget to implement their community development.

Table 5-2a: Matrix Presentation of the Programs/Projects/Activities (PPAs) of the Approved 5-Year Social Development and Management Program of JDVC Resources Corporation for the Host Communities

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Human Resource Development and Institutional Building									
Purchase of Desktop Computer	Brgy. Casitan, Gonzaga		/					More efficient service work	
Training on Baking and Pastry	Brgy. San Jose, Gonzaga	- Skills training - Procurement of paraphernalia - 30 beneficiaries identified by the Committee	/					Beneficiaries can generate a sustainable livelihood project as their additional income; Improved standard of living	
Training on Smoke Fish making	Brgy. San Jose, Gonzaga	- Skills training - Procurement of paraphernalia - 30 beneficiaries identified by the Committee	/					Beneficiaries can generate a sustainable livelihood project as their additional income; Improved standard of living	
Capacity Building Trainings	Brgys. Cabaritan, Mala Weste, Minanga Weste, Centro, Paddaya Weste, Paddaya Este, Centro West, Mala Este, Sta. Maria, San Isidro, Villa Leonora, Leron in Buguey Fisherfolks association, Barangay Police, Barangay Officials, BFAR, BFP, PNP, MLGU, and JDVC	- Basic Water Safety and Rescue/First Aid Training (at 30 participants for 3 days, meals and snacks, equipment, supplies and materials, venue rental, transportation, and honorarium of resource person, etc.)	/					30 participants trained to benefit community members 1 rescue team formed	With counterparts from other stakeholders (e.g., budget, equipment, as resource person)

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
	MLGU Buguey - Community-based Organizations (CBOs), Cooperatives - Out-of-School Youths	- Organizational Management Trainings - Financial Management Trainings - Enterprise Development Trainings - Technical / Skills Trainings	/	/	/	/	/	CBOs, Cooperatives formed and sustainably managed organization and established enterprises; OSY applied training and gainfully employed	
Purchase of Computer Set for Barangay Office	Brgy. Cabaritan, Buguey BLGU-Brgy. Secretary, Treasurer, Officials, MLGU, and JDVC	- Purchase 1 desktop with printer and digital recorder	/					1 desktop with printer and 1 digital recorder purchased; Proper and systematic records	With BLGU counterpart for repair and maintenance
Purchase of Communication and Office Equipment	Brgy. Minaga Weste BLGU-Officials, Day Care Center, and JDVC	- Purchase of laptop with printer (2 units) for Barangay Hall and Day Care Center		/	/			Day Care Center and Barangay Council Benefited	With counterpart fund of BLGU for maintenance
Purchase of Computer Set for Barangay Office	Brgy. Paddaya Weste, Buguey	- Purchase of 1 desktop with printer and digital recorder				/		1 desktop with printer and 1 digital recorder purchased; Proper and systematic records	With BLGU counterpart for repair and maintenance
		-							
Enterprise Development and Networking									
Concreting of Barangay Road	Brgy. Amunitan, Gonzaga	- Meeting - Preparation of Work Program - Concreting of barangay roads	/					Improved/concreted barangay road	
Augmentation of Multi-purpose Gym	Brgy. Amunitan, Gonzaga	- Meeting - Preparation of Work Program		/				Augmented multi-purpose gymnasium	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
		- Augmentation of multi-purpose gym							
Continuation of Augmentation of Multi-purpose Gym	Brgy. Amunitan, Gonzaga	- Meeting - Preparation of Work Program - Continuation of Augmentation of multi-purpose gym			/			Augmented multi-purpose gymnasium	
Paving of Barangay Road	Brgy. Amunitan, Gonzaga	- Meeting - Preparation of Work Program - Paving of barangay road				/		Paved barangay roads	
Completion of the Concreting of Barangay Road	Brgy. Amunitan, Gonzaga	- Meeting - Preparation of Work Program - Continuation of the Concreting of barangay roads					/	Paved barangay roads	
Micro-financing for Farmers	Brgy. Callao, Gonzaga	- Identification of Beneficiaries	/					Improved standard of living	
				/					
		- Micro-financing			/				
						/			
							/		
Livestock Production – Cow Raising	Brgy. Callao, Gonzaga	- Identification of Beneficiaries	/					Improved standard of living	
				/					
		- Micro-financing			/				
						/			
							/		
Micro-financing	Brgy. Casitan, Gonzaga	- Identification of Beneficiaries - Micro-financing		/				Improved standard of living	
Micro-financing for Livelihood Capitalization - Buy and sell of fish - Talipapa - Sari-sari store	Brgy. Minanga, Gonzaga	- Identification of Beneficiaries (ass'n/coop)	/	/	/	/	/	Improved standard of living	
			/	/	/	/	/		
		- No. of Beneficiaries / Ass'n - Canvass Form	/	/	/	/	/		
		- Micro-financing	/	/	/	/	/		

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
- Fish Net									
Livelihood Project - Hog raising (2 piglet/household)	Brgy. San Jose, Gonzaga	- Identification of beneficiaries (ass'n/coop) - No. of beneficiaries/ass'n - Canvass form - Micro-financing	/						
- Poultry production			/						
- Giving of fish net			/						
- Fishpond maintenance (fingerlings Malaga and Bangus)			/						
Hog-raising (5 piglet per Purok)	Brgy. Sta. Cruz, Gonzaga	- Identification of beneficiaries - Micro-financing	/	/	/			Sustainable livelihood project; Improved standard of living	
Livelihood Assistance	Brgy. Tapel, Gonzaga	- 200 identified Senior Citizen beneficiaries - Micro-financing	/	/	/	/	/	Beneficiaries can generate a sustainable livelihood project as their additional income; Improved standard of living	
Livelihood Assistance for Nipa Weaving Project	Brgy. Cabaritan, Buguey	- Formation of Nipa Weaver Association (NWA) - Construction of Nipa Weaver Center (5x6 meters) - Provision of Financial Assistance or Seed Money for the production, buy and sell business of Nipa Weaver Association	/	/	/			1 association formed; 100 families benefited	With counterpart beneficiaries
Livelihood Project	Brgy. Minanga Weste	- Purchase of fish cages	/	/	/	/	/	10 families benefited	With counterpart beneficiaries for the purchase and maintenance
	Brgy. Paddaya Weste					/	/	5 families benefited	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
	Brgy. Paddaya Este	- Purchase of fishing boat with engine and fish net			/	/			With BLGU counterpart for repair and maintenance
	Brgy. Villa Leonora, Buguey			/	/	/			With BLGU counterpart of beneficiaries for the purchase and maintenance
	Brgy. Mala Este, Buguey				/	/	/	10 families benefited	
Livelihood Assistance for Fisherfolks	Brgy. Sta. Maria, Buguey	- Provision of fish cages and fingerlings (bangus and tilapia) at 5 units		/				Additional income for Fisherfolks Association per year	With counterparts of Fisherfolks Association for purchase and maintenance
	Brgy. San Isidro, Buguey	- Provision of fishing boat with engine and complete accessories (5 units)		/					
	Brgy. Leron, Buguey	- Purchase of fish nets (10 units)		/				10 families benefited	With BLGU counterpart of beneficiaries for the purchase and maintenance
	Brgy. Centro West, Buguey	- Provision of fish nets	/	/	/	/		Additional income of Fisherfolks Association per year	With counterparts of Fisherfolks Association for purchase and maintenance
Livelihood Assistance for Farmers Association	Brgy. San Isidro, Buguey	- Purchase of Kuliglig with engine and complete accessories			/			Additional income of Farmers Association per cropping	With counterparts of Farmers Association for purchase and maintenance
	Brgy. Centro West, Buguey	- Provision of sprayers	/	/				Additional income of Farmers Association per cropping	
Agri/Fishery/Forestry Based Livelihood Program	MLGU Buguey - CBOs like women;s group, OSY, fisherfolks, farmers, etc.	- Support in the establishment and management of identified livelihood, to include marketing and networking of products	/	/	/	/	/	Different organizations sustainably managed their identified livelihood with established markets and linkages	With partnership/collaboration to different NGAs like DTI, DOST, TESDA, BFAR, DA, DAR

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
	- Cooperatives								
Assistance to Infrastructure Development and Support Services									
Rehabilitation of Health Center	Brgy. Baua, Gonzaga	- Meeting - Preparation of Work Program - Rehabilitation of Health Center	/					Rehabilitated Health center; Better access of medicines and medical assistance	
Construction of Evacuation Center	Brgy. Baua, Gonzaga	- Meeting		/				To have an Evacuation Center to be used during calamities	
		- Preparation of Work Program			/				
		- Construction of Evacuation Center				/			
							/		
Multi-purpose Gymnasium	Brgy. Caroan, Gonzaga	- Meeting - Preparation of Work Program - Construction of Multi-purpose Gymnasium	/					Constructed multi-purpose gymnasium	
Extension of Senior Citizen Building	Brgy. Caroan, Gonzaga	- Meeting - Preparation of Work Program - Construction of the extension of Senior Citizen Building	/					Constructed extension of Senior Citizen building	
Roofing of Gymnasium	Brgy. Caroan, Gonzaga	- Meeting - Preparation of Work Program - Renovation of roofing of the multi-purpose gymnasium		/				Constructed a safe roofing of gymnasium	
Street Lights	Brgy. Caroan, Gonzaga	- Preparation of Work Program - Erection of street lights				/		Safe and bright roads	
Improvement of stage / auditorium	Brgy. Caroan, Gonzaga	- Meeting - Preparation of Work Program - Improvement of stage / auditorium					/	Improved auditorium	
Construction of Palay Shed (Zone 1)	Brgy. Casitan, Gonzaga	- Preparation of Work Program - Construction of Palay Shed	/					Constructed palay shed located at zone 1 for farmers	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Water Pump	Brgy. Casitan, Gonzaga	- Preparation of Work Program - Installation of water pumps	/					Constructed water pump; Better access of water for farmers	
Solar / Street Lights	Brgy. Casitan, Gonzaga	- Canvass Form - Erection of street lights	/					Safe and bright roads	
Deep Well	Brgy. Casitan, Gonzaga	- Preparation of Work Program - Construction of deep well	/					Constructed deep well; Better access of potable water or residents	
Construction of Open Drainage Canal	Brgy. Casitan, Gonzaga	- Preparation of Work Program - Construction of open drainage canal			/			Constructed open drainage canal	
Improvement of Mini-gymnasium	Brgy. Casitan, Gonzaga	- Preparation of Work Program - Improvement of mini-gymnasium				/		Improved mini-gymnasium	
Continuation of the improvement of mini-gymnasium	Brgy. Casitan, Gonzaga	- Preparation of Work Program - Improvement of mini-gymnasium					/	Improved mini-gymnasium	
Rehabilitation of Municipal Road	Brgy. Ipil, Gonzaga	- Construction of main roads located at Burattok st., Ipil, Gonzaga - Preparation of Work Program - Canvass Form	/					Rehabilitated municipal roads	
Rehabilitation of Barangay Road	Brgy. Ipil, Gonzaga	- Construction of barangay road		/				Rehabilitated barangay roads	
		- Preparation of Work Program			/				
		- Canvass Form				/			
							/		
Construction of Namuyukan Bridge in Sitio Namuyukan	Brgy. San Jose, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Construction of *(dimension)* of Bridge located at Namuyukan, San Jose		/				Improved accessibility to basic services for National Government and LGUs	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Rehabilitation/Concreting of Farm-to-Market Road	Purok 2 to Purok 4, Brgy. San Jose Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Construction of *(length)* of road			/			Rehabilitated/improved access road	With counterpart of MLGU, BLGU, and Purok residents
	Brgy. San Isidro, Buguey	- Concreting of road (50x5 meters)				/		50 meters concreted road and residents benefited	
	Varilla St., Brgy. Leron, Buguey	- Concreting of road (250 meters length)		/	/			250 meters concreted and residents benefited from the project	
Water System of Barangay Residents	1 major water system and 1 windmill per purok in Brgy. San Jose, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Construction of water system: (1) major, and (1) windmill per purok				/		Better access to potable water to beneficiaries/households	
Improvement of Barangay Hall Fence	Brgy. Sta. Cruz, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Construction of hall fence	/					improved accessibility to basic services for National Government and LGUs	
Maintenance of Street Lights	Brgy. Sta. Cruz, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Rehabilitation of street lights		/	/			Improved lighting and safe streets	
Water System	Brgy. Sta. Cruz, Gonzaga	- Preparation of Work Program - Construction of water system	/					Improved accessibility of water	
Rehabilitation of Barangay Roads	Brgy. Sta. Cruz, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Rehabilitation of barangay roads						Rehabilitated barangay roads	
Concreting/Improvement of Barangay Roads	Brgy. Sta. Cruz, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer - Concreting/improving of barangay roads						Concreted and improved barangay roads	
Continuation of Multipurpose Building	Brgy. Tapel, Gonzaga	- Preparation of Work Program noted by the Municipal Engineer	/	/	/	/	/	Constructed multi-purpose building; Improved standard of living	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
		- Continuation of construction and electrification of *(length)* of multi-purpose building							
Construction of 2-storey Livelihood/Processing Center (Phase I)	LGU Gonzaga	- Meeting - Preparation of Work Program - Construction of 2-storey livelihood/processing center (phase I)	/					Improved standard of living	
Construction of 2-storey Livelihood/Processing Center (Phase II)	LGU Gonzaga	- Meeting - Preparation of Work Program - Construction of 2-storey livelihood/processing center (phase II)		/				Improved standard of living	
Construction of 2-storey Livelihood/Processing Center (Phase III)	LGU Gonzaga	- Meeting - Preparation of Work Program - Construction of 2-storey livelihood/processing center (phase III)			/			Improved standard of living	
Construction of Road leading to Sanitary Landfill	LGU Gonzaga	- Meeting - Preparation of Work Program				/		Improved standard of living	
		- Construction of Road					/		
Concreting of Barangay Road	Brgy. Mala Weste, Buguey	- Concreting of road (50 meters)	/	/				50 meters concreted road and residents benefit from the project	With counterparts of MLGU and BLGU
Livelihood Project	Brgy. Mala Weste, Buguey	- Construction of Barangay Talipapa/Marker		/				10 families of vendors benefited; Increased income of Barangay	Rental fee per stall

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Construction of Fish Landing	Brgy. Mala Weste, Buguey	- Concreting of fish landing (30 meters long)			/	/	/	1-unit fish landing at 30 meters constructed and residents benefited	With counterparts of BLGU
Construction of Barangay Stage	Barangay Hall, Brgy. Minanga Weste	- Concreting of Stage					/	1-unit stage at 7x10 meters completed and benefited the residents	With counterparts of BLGU
Provision of Solar Lights	Brgy. Centro, Buguey	- Purchase and installation of solar lights	/					20 units of solar lights installed and safety of all residents	With BLGU and residents' counterpart for labor
Livelihood Project (BLGU Managed)	Brgy. Centro, Buguey	- Construction of Fish Processing Center with complete amenities and capital			/	/		100 families of fisherfolks and vendors benefited; Increased income of barangay	BLGU will manage the project with rental fee from users. Policies for the usage and maintenance will be prepared.
Construction of Barangay Drainage System	Brgy. Centro, Buguey	- Concreting of drainage					/	Constructed 50-meter drainage; residents benefited	With labor counterparts of BLGU
Provision of Solar Lights	Brgy. Paddaya Weste, Buguey	- Purchase and installation of solar lights	/			/	/	50 units of solar lights installed and safety of all residents	Labor counterpart from BLGU and residents
	Brgy. Villa Leonroa, Buguey								
Improvement of Barangay Hall	Brgy. Paddaya Este, Buguey	- Improvement of Barangay Hall building			/			Barangay Officials and residents benefited	With labor counterparts of BLGU
Construction of Earth Protection Dike	Brgy. Paddaya Este, Buguey	- Construction of earth protection dike		/	/			2.5 kilometers dike constructed	With counterparts from BLGU and residents
Desilting of Small Water Impounding Project (SWP)	Brgy. Paddaya Este, Buguey	- Desilting of SWP using backhoe and manual labor				/	/	3 hectares SWP desilted to benefit the farmers and protection from flooding	With counterparts from BLGU and residents
Construction of Barangay Police or Tanod Outpost	Brgy. Paddaya Este, Buguey	- Construction of outpost		/				1-unit outpost constructed and residents benefited	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
	Brgy. San Isidro, Buguey			/					With BLGU counterparts for construction and maintenance
	Brgy. Villa Leonora, Buguey						/		
	Brgy. Sta. Maria, Buguey			/					
	Brgy. Centro West, Buguet				/				
Construction of Fish Landing	Brgy. Centro West	- Concreting of fish landing				/		1-unit of fish landing constructed and resident benefited	With counterparts of BLGU
	Brgy. Sta. Maria, Buguey	- Concreting of fish landing at 30 meters ling			/	/	/	1-unit of fish landing at 30 meters long constructed and resident benefited	
Construction of Barangay Road	Brgy. Cabaritan, Buguey	- Concreting of road at 100 meters				/		100-meter concreted road and residents benefited	With counterpart of MLGU, BLGU, and Purok residents
	Zone 2, Brgy. Villa Leonora, Buguey	- Construction of road at 60 meters length			/	/		60-meter concreted road and residents benefited	
	Brgy. Mala Este, Buguey	- Construction of Phase III at 80 meters length			/	/	/	80-meter concreted road and residents benefited	
Rehabilitation of Barangay Gymnasium	Brgy. Cabaritan, Buguey	- Repair roof and bleachers			/			Rehabilitated and repair Barangay gymnasium	With counterparts of BLGU
	Barangay Hall, Brgy. San Isidro, Buguey					/			
	Brgy. Minanga Weste, Buguey	- Repair of wall and roof				/		1-unit gymnasium repaired and residents benefited from the project	
Improvement of Barangay Facility	Brgy. Centro West, Buguey	- Upgrade of barangay facility					/		

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Establishment of Agri-Business Center and Farm Mechanization Center	MLGU Buguey - MLGU, BLGU - Coop	- Construction of center with complete amenities and production-related products and technical advice/demo	/	/	/	/		Accessible place for farmers (and fishermen) to purchase agriculture and aquaculture related production needs and technical knowledge	
Establishment of Fish Processing Center with Complete Facility	MLGU Buguey	- Construction of a center for fish processing including purchase of related equipment		/				Minimized wastage of fish caught and served as value-added, hence, increased income for fisherfolks	
Protection of the Watershed Area	Villa Cielo, Buguey - MLGU and BLGU	- Construction of one unit watch tower			/			Enhanced security of the watershed from poachers and illegal loggers	
Installation of Street Lights	MLGU Buguey	- Installation of streetlights along the roads				/		Maintain and enhanced peace and order and public safety in the Municipality	
Access to Education and Educational Support Program									
Scholarship Grant	Brgy. San Jose, Gonzaga Brgy. Sta. Cruz, Gonzaga	Financial assistance to identified students	/					Improved standard of living	
Establishment of E-Classrooms to E-Schools	LGU Gonzaga	- Meeting - Preparation of Work Program - Procurement of computers			/			Better educational services specially in Information and Communication Technology	
Rehabilitation of Day Care Center Building	Brgy. Paddaya Este, Buguey	- Improvement of day care center building - tiles					/	Pupils benefited	With counterpart of BLGU
	Brgy. Cabaritan, Buguey	- Improvement day care center building						Improved basic services and pupil benefited	
	Brgy. San Isidro, Buguey								

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Improvement of Day Care Center	Brgy. Centro West, Buguey	- Repair and rehabilitation of day care center			/			Pupils and teachers benefited	With counterparts of BLGU and DepEd
	Day Care Center, Brgy. Hall, Mala Este, Buguey	- Improvement of Day Care Center building (6 window frame with blade, 1 comfort room, 1 toilet bowl, and washing area)	/						With counterpart of BLGU
Construction of Covered Walk	Elementary School, Brgy. Sta. Maria, Buguey	- Establishment of covered walk (50 meters)					/	Pupils and teachers benefited	With counterparts of BLGU and DepEd
Provision of Books and Supplies	Elementary School, Brgy. Sta. Maria, Buguey	- Purchase of books and school supplies	/					Pupils and teachers benefited	With counterparts of BLGU and DepEd
Provision of School Supplies for Day Care Center and Elementary Pupils	Day Care and Elementary Schoo, Brgy. San isidro, Buguey	- Purchase and distribution of school supplies for Day care and elementary pupils	/		/		/	Pupils benefited	In coordination with stakeholders for distribution
Expansion of Day Care Center Building	Brgy. Paddaya Weste, Buguey	- Construction of extension of day care center building			/			Pupils benefited	With counterparts of BLGU
Establishment of Day Care Learning Center	Brgy. Leron, Buguey	- Construction of day care center building					/	Pupils benefited	With counterparts of BLGU
Construction of Day Care Center	Brgy. Mala Weste, Buguey	- Construction of building				/		Pupils benefited	With counterparts of BLGU
Repair and Rehabilitation of School Buildings	MLGU Buguey	- Installation of screen windows and doors in all elementary schools	/	/	/	/	/	Secured vulnerability of school children from dengue fever	
Assist to Health Services, Health Facilities, and Health Professionals									
Purchase of mini-ambulance	Brgy. Caroan, Gonzaga	- Meeting - Canvass Form - Purchase of mini-ambulance			/			More efficient medical services	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Clinic Center (Aircon)	Brgy. Casitan, Gonzaga	- Canvass Form - Purchase of aircon for Clinic Center	/					Improved standard health services	
Construction of Health Clinic	Brgy. San Jose, Gonzaga	- Meeting - Preparation of Work Program - Construction of the health clinic					/	More efficient medical service	
Procurement of Health Center Equipment	Brgy. Sta. Cruz, Gonzaga	- Canvassing of health center equipment - Purchase of health center equipment	/					More efficient medical services	
Feeding Program	Brgy. Tapel, Gonzaga	- Identification of beneficiaries; malnourished residents (0-59 m/o)	/	/	/	/	/	Minimized the undernourished residents Improved standard of living	
Purchase of X-Ray Machine	MHO, LGU Gonzaga	- Meeting - Procurement of X-Ray Machine	/					More efficient health services	
Purchase of Diagnotic Ultra Sound Machine	MHO, LGU Gonzaga	- Meeting - Procurement of diagnostic ultra sound machine		/				Better access of medical services	
Purchase of ECG Machine	MHO, LGU Gonzaga	- Meeting - Procurement of ECG machine			/				
Purchase of Municipal Ambulance	MHO, LGU Gonzaga	- Meeting - Procurement of ambulance				/			
Purchase of Municipal Ambulance AED and Suction Machine	MHO, LGU Gonzaga	- Meeting - Procurement of ambulance with AED and suction machine					/		
Construction of MRF	Brgy. Centro West, Buguey	- Construction of 1-unit MRF	/					1-unit of MRF constructed benefitting the whole community	With counterparts of BLGU

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
Improvement of Barangay Health Center	Brgy. Centro West, Buguey	- Repair and rehabilitation of Barangay Health Center		/				1-unit BHC repaired benefitting the whole community	With counterparts of BLGU
Conduct of Regular Patrolling and Rescue during Calamities and Disasters	Brgy. Mala Este, Buguey	- Purchase of rescue vehicles, materials, equipment and supplies of Barangay Police and Officials		/			/	More efficient response to calamities and disaster; Improved standard of living benefitting the whole community	With counterpart fund of BLGU and MLGU for maintenance and repair
Provision of Medical Equipment and Apparatus	Brgy. Cabaritan, Buguey	- Purchase of nebulizers, weighing scale, and blood pressure apparatus		/				Improved medical services and residents/patients benefited	With counterparts from MLGU-MHO and JDVC
	Brgy. San Isidro, Buguey		/				/		
	Brgy. Leron, Buguey		/						With counterparts from MLGU-MHO
Renovation of Barangay Health Center	Barangay Hall, Brgy. Sta. Maria, Buguey	- Renovation of building (roofing, tiles, and paint)			/			1-unit health center improved and patients benefited	With counterparts of BLGU
Provision of Medical Equipment and Apparatus and Fire Control Equipment	Bgry. Sta. Maria, Buguey	- Purchase of nebulizers, weighing scale, blood pressure apparatus, and fire extinguisher				/		Patients and residents benefited	With counterparts from MLGU-MHO and JDVC
Purchase of Rescue Vehicle	Brgy. Leron, Buguey	- Purchase of rescue vehicle (multicab) with complete amenities				/		1 rescue vehicle with complete amenities purchased and residents benefited	With counterparts of BLGU for driver and maintenance
Rescue and Patrol Vehicle	Brgy. Centro, Buguey	- Purchase of rescue and patrol vehicle with complete amenities		/					
Sanitation Program	Brgy. Paddaya Weste, Buguey	- Construction of toilet with septic tank and provision of water sealed for 30 households	/		/	/		30 households benefited	Labor counterpart from beneficiaries

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
	Zone 6 and 7, Brgy. Villa Leonora, Buguey	- Construction of toilet with septic tank and provision of water sealed for 125 households	/	/	/	/	/	125 households benefited from the project	
	Brgy. Minanga Weste, Buguey	- Construction of toilet with septic tank and provision of water sealed for 80 households	/	/	/			80 households benefited from the project	
Ecological Solid Waste Management (ESWM) Program	Brgy. Centro, Buguey	- Construction of barangay MRF					/	1 MRF constructed	With BLGU counterpart for labor and maintenance
	Brgy. Minanga Weste, Buguey			/					With BLGU counterpart for labor and management
Construction of Centralized Septic Tank	Zone 6 and 7, Brgy. Villa Leonora, Buguey	- Construction of septic tank		/				1-unit septic tank constructed and residents benefited from the project	With counterparts of BLGU
Nutrition Program	Brgy. Minanga Weste, Buguey	- Feeding program for malnourished children		/	/			Undernourished/Malnourished children benefited	With counterparts from parents and BLGU
Construction of Barangay Health Center	Brgu. Mala Weste, Buguey	- Construction of building					/	1-unit building improved and pupils benefited from the project	With counterparts of BLGU
Construction and Enhancement of Barangay Health Station with Health Facility and Equipment	MLGU Buguey	- Purchase of health facility and equipment	/	/	/	/	/	Improved and sustainable delivery of health care services to the community	
Program for the Vulnerable Sectors	MLGU Buguey	- Construction of rehabilitation facilities for the elderlies, differently abled persons, and children	/	/				Sustainable delivery of serviced to the vulnerable sector of the community	

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
DRRM Program	MLGU Buguey	- Purchase of rescue vehicle/boat					/	Emergency prepared and responsive MLGU for different types of calamities	
Protection and Respect of Socio-Cultural Values									
Assistance during cultural events	Brgy. Caroan, Gonzaga	- Meeting	/					Preservation of local traditions and cultures	
		- Identification of cultural events		/					
					/				
		- Conduct of cultural events				/			
							/		
	Brgy. Sta. Cruz, Gonzaga	- Identification of cultural events	/	/	/				
Barangay Fiesta	Brgy. Paddaya Este, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, and certificates	/					Residents and players benefited	With counterparts of BLGU and players
	Brgy. Paddaya Weste, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, and certificates			/		/		
	Brgy. Centro West, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, prizes, and certificates	/			/	/		
	Brgy. Cabaritan, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, and certificates		/			/		
	Brgy. Sta. Maria, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, prizes, and certificates				/			
	Brgy. Leron, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, and certificates			/				

Program/ Project/Activity	Location / Stakeholders Involved	Specific Activities	Timeframe					Expected Results/ Outcomes of the PPA	Remarks
			2018	2019	2020	2021	2022		
	Brgy. Villa Leenora, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, prizes, and certificates					/		
	Brgy. Mala Weste	-							
Barangay and Municipal Fiesta	Brgy. Minanga Weste, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, and certificates			/		/	Residents and players benefited	With counterparts of BLGU and players
Barangay Fiesta, Patronal Fiesta, and Sport Activities	Brgy. Mala Este, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, prizes, and certificates		/	/	/		Residents and players benefited	With counterparts of BLGU and players
Municipal, Barangay, and Patronal Fiesta	Brgy. San Isidro, Buguey	- Purchase of sound system, uniform or players, decorations, costumes, and certificates			/		/	Residents and players benefited	With counterparts of BLGU and players
Patrol Vehicle	Brgy. Paddaya Weste, Buguey	- Purchase of patrol vehicle		/				1 patrol vehicle purchased and residents benefited	With counterpart of BLGU for driver and maintenance

Table 5-2b: Indicative Social Development and Management Program

Concern	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency and Services*	Proponent	Indicative Timeline	Source of fund
Gender Responsive *Livelihood and Credit Facilities* (Men, Women, Youth & elderly): • women handicraft skills • high value crops for farmers • method of fishing for fisherfolks *Employment* - job priority skills training for qualified workers	• Barangay Chairperson • Association Chairperson • Qualified Project Affected Men, Women, Youth & Elderly	• LGU Municipal Planning Office • MSWD • SEA – Kaunlaran livelihood projects • TESDA/TLRC – Skills training in handicraft and technical mechanic, driving • DA / BFAR – Technical training farming/fishing methods • Organize FARMC and BAFC – Provide seed/ seedlings; Provide production training for high value crops	JDVC Community Relations Officer - Equity among the men and women in the access and control of econimic opportunities - Create opportunities for the barangays to address their most basic asset in growth and development	Operation	LGU –IRA/ JDVC
Health and Safety: • Renovation of Brgy. Health Center • Health services • Potable water and sanitation • Supplemental feeding to malnourished children • Assistance to Senior Citizens and Persons with disability • Climate Change • Community awareness on Disaster Risk Reduction and Preparedness / Strengthening community-based disaster preparedness	• Barangay Kagawad for Health • Barangay Health Workers • Barangay Disaster Risk Reduction Coordinating Council	MHO / MSWD / MDRRMO • Provide Health services • Provide potable water • Provide supplemental feeding to malnourshed children • Community Health Awareness Project • Provide assistance to Senior Citizens and Persons with disability • Water and Sanitation Program • Barangay Disaster Management Training Program • Formulation of Disaster Preparedness and Response Program/Plan together with the Barangay and Municipal Council to minimize vulnerabilities, reduce the effect of disaster, and prepare the communities in times of disaster and emergencies.	JDVC Community Relations Officer - Training and Capacity Building - To be included also DRRM Plans in the Annual Health and Safety Program - Medical Mission	Operation	LGU –IRA/ JDVC

Concern	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency and Services*	Proponent	Indicative Timeline	Source of fund
		• Conduct of capacity training, identification of disaster risk and mitigating measures, and Information, Education Campaign to increase community resilience, awareness, response and preparedness of community in times of calamity (i.e. storms, typhoons, storm surge, tsunamis) • Conduct of IEC on safety, response, and preparedness in times of calamities with an aid of different information materials published by government agencies. • Disaster Risk Reduction Management (DRRM) Program through the purchase of rescue vehicle/boat, including equipment and supplies for the communities to become emergency prepared and responsive for different types of calamities. • Construction/rehabilitation and/or enhancement of evacuation areas			
Education and Recreation: • Community/School children lack of training for disaster preparedness • Acknowledge about the mining operations • Scholarship for qualified students • Nonformal education	• Barangay Kagawad for Education • Barangay Schools Head Teacher / Principal	DepEd/MDRRMO/MSWD/MEO • Setting-up of scholarship program for qualified students • Literacy programs & non-formal education • Disaster Preparedness and Response Program • Construction/rehabilitation of additional school buildings • Provision/Hiring of additional teachers	JDVC Community Relations Officer - Traning and Capacity Building	Operation	LGU –IRA/ JDVC

Concern	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency and Services*	Proponent	Indicative Timeline	Source of fund
- Alternative education for persons who lack literacy and numeracy skills • Maintenance of Culture and Sports school activities		• Literacy Programs & Alternative education – School on Wheels by JDVC Resources Corporation • Technical education and skills development program – opening of technical or vocational courses			
Environment and Sanitation: • Brgy. Solid Waste Management Plan • Water sealed toilets • Awareness of law and regulations on illegal fishing • Unpaved roads • Reforestation • Mangrove Area protection and preservation - Potential livelihood development - Natural protection to storm surge, etc.	• Barangay Kagawad for Environment • Barangay Disaster Risk Reduction Coordinating Council	MPDO/MENRO/MHO/MDRRMO/ BFAR • Enforcement/Implementation of Ecological Solid Waste Management Ordinance and Integrated Solid Waste Management Plan R.A. 9003 • Development of Solid Waste Management System • Health programs • Provide water sealed toilets • Road Rehabilitation • Reforestation (tree planting) • Establishment forest nurseries • Environmental monitoring-training • Assessment of mangrove areas in need of rehabilitation, enhancement, and preservation • Plantation of mangroves offers possible livelihood or income to locals by appointing them as the cultivators. • LGU partnership to a non-government organization's project that aims to help on conservation and protection of the environment. • The discussion of the potential livelihood development in the mangrove area in each	JDVC Community Relations Officer - Traning and Capacity Building	Operation	LGU –IRA/ JDVC

Concern	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency and Services*	Proponent	Indicative Timeline	Source of fund
		municipality differs from each other considering the species and economic benefits in the respective municipalities. The following are suggested/recommend: - Buguey : as per approved 5-Year SDMP of the municipality under its Livelihood Assistance for Nipa Weaving Project, the concerned stakeholders : JDVC, MAFSO,BFAR, MLGU and BLGU shall provide Financial Assistance or Seed Money for the production , buy and sell business of Nipa Weavers Association. - Gonzaga: The approved 5 - Year SDMP of Gonzaga does not include mangrove areas for development. According to the MENRO, there are no identified areas for development. However, in lieu of the mangrove development, the company has proposed and requested to the DENR Regional Office in coordination with the Municipal LGU thru its Municipal Environment and Natural Resources Officer that the existing beach project of the municipality be expanded, developed and enhanced for local ecotourism that could generate income to the local community. - Aparri: The SDMP of Aparri shall be crafted and formulated through a participatory approach with the active participation of stakeholders. Once the company has operated progressively in the municipalities of Gonzaga and Buguey.			

Concern	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency and Services*	Proponent	Indicative Timeline	Source of fund
Infrastructure: Improve and rehabilitate Barangay roads	• Barangay Chairperson • Barangay Kagawad for Infrastructure	MPDO/MEO/DPWH • Road rehabilitation	JDVC Community Relations Officer	Operation	LGU –IRA
Peace and order: Barangay Tanods to maintain peace & order	• Barangay Kagawad for Peace and order • Barangay Tanods	LGU/PNP • Capacitate & Strengthen Barangay Tanods in peace keeping	JDVC Chief Security Officer	Operation	LGU –IRA/ JDVC
Spiritual: (Improvement of Church Facilities)	• Barangay Assigned Catholic Priest/s • Pastor/s of different denomination/s	Parish Priest Pastor	JDVC Community Relations Officer	Operation	LGU –IRA/ JDVC

5.2 Implementation and Status of Social Development and Management Program (SDMP)

The Five-Year Social Development and Management Program of the Company for the Municipality of Gonzaga has been approved last July 4, 2019, by MGB Region 2 (attached as **Annex 5**) JDVC Resources Corporation have submitted the 2021 Annual SDMP 2021 last December 15, 2020, for approval (see proof of submission attached as **Annex 6**). If the submitted 2021 ASDMP is approved, this will be the first-year implementation of the Five-Year SDMP of JDVC Resources Corporation which is relevant to the declaration of commercial operation this year.

On the other hand, the Five-Year SDMP (CY 2020-2024) for the Municipality of Buguey was submitted last December 13, 2019, awaiting for approval its approval (see proof of submission attached as **Annex 4**). Likewise, the SDMP for the Municipality of Aparri is still in process. Also attached in the annexes of this report are the documentation and attendance sheets during the SDMP Consultation and Workshop in the Municipalities of Gonzaga and Buguey.

5.2.1 JDVC Corporate Social Responsibility

As part of the JDVC's social responsibility, the company has identified the framework for the development strategies for the identified host and neighboring community's needs, problems or concerns. These programs contain primary areas of concern such as limited source of income, low level of educational attainment, unemployment and health problems.

Enterprise Development and Networking

1. Goals

    - To assist and the LGUs and the government agencies concerned by increasing the productivity of the farmers and fishermen through optimum and proper utilization of agriculture and fishery technologies.
    - To provide livelihood assistance programs to organized groups and beneficiaries as well as provide capability training, financial grants, improve facilities and equipment to enhance their entrepreneurial skills.

2. Objective

    To augment the income of program beneficiaries/recipients.

3. Strategy

    - The contractor shall provide financial assistance and capital funding to registered cooperatives/organizations/beneficiaries in order for entrepreneurial activities;
    - The contractor shall initiate training on small-business management and marketing strategies, and related training in partnership with the DTI;
    - The contractor shall assist in the (a) establishment of livelihood training and production display centers, and (b) organization of cooperatives and other people's organization and associations.

Human Resource Development and Institution Building

1. Goals

    - To improve the level of education attainment of beneficiaries thru formal, non-formal education and skills training.
    - To provide assistance to educational institutions in order to improve the standard of education in the host and neighboring communities.

2. Objective

To provide opportunities for students to have access to better education and to improve the skills of the residents that will enhance their employment potentials.

3. Strategy

   a. Implementation of elementary, high school, technical and college scholarships programs for poor but deserving students. The scholarship program will be open only to public schools so that more numbers of recipients will be accommodated. The scholarship program shall cover payment for all basic school fees and expenses, such as tuition fees, book allowances, miscellaneous fees, uniforms and stipend/monthly allowances. This is to ensure that scholars are able to pay for and attend school regularly.
   b. Implementation of Adopt-a-School program to enhance the facilities of the adopted school by way of donation textbooks and possibly computer(s), and fixtures, providing assistance to improve the facilities, conduct of training and others.
   c. Implementation of skills training such a masonry, welding, electrician, etc. in coordination with the LGU and TESDA.

Employment Promotions

1. Goals

   - To improve the skills of unemployed person of the host and neighboring communities; and
   - To give employment to qualified unemployed persons of the host and neighboring communities during the conduct of exploration activities.

2. Objective

   To assist in decreasing the unemployment of host and neighboring communities.

3. Strategy

   - The contractor shall provide more trainings and education to the unemployed. This could help improve workers' expertise, e.g., computer literacy, skill, etc., and communication to build their confidence, competence and employability.
   - The contractor shall limit the hiring of non-highly specialized personnel to the unemployed persons of the host communities.

Below are the CSR Programs/Projects/Activities of JDVC:

A. Computer-On-Wheels (COW) Program

Computer School on Wheels Program or COW is part of the CSR initiatives of JDVC to provide training on basic computer skills to the host and neighboring communities in the entire project area.

This program is intended to educate the recipients on basic computer literacy and provide computer technicians so that they can be competent and relevant in keeping up with the demands of the present time's technological advancement, particularly in the academic and business sectors. Thus, the recipients of basic computer literacy will acquire basic computer skills while the recipients of computer technician will be knowledgeable in diagnosing, repairing, and maintaining hardware and software components to ensure smooth running of computer systems.

This program that was then Computer School-On-Wheels Project was born out of the desire of BHFI to provide accessible services to the greater public through basic computer education, especially to those who would want to avail of the program but simply can't afford to go to the centers that the foundation have established. Bearing in mind the idea to literally bring a computer school to the most remote and

depressed area possible in the country, they have painted in a container van with cow spot and converted it into a classroom that is equipped with 20 computer units and necessary teaching tools.

JDVC started its Corporate Social Responsibility to the town of Gonzaga, Cagayan by deploying its skills development program via a Computer School on Wheels (COW) in partnership with Bagong Henerasyon Foundation, Inc. (BHFI).

B. Distribution of Rechargeable Flashlights, Transistor Radios, Life Jackets, and T-shirts

The Distribution of Rechargeable Flashlights, Transistor Radios, Life Jackets and T-shirts are also a part of the CSR initiatives of JDVC to ensure the safety of the recipient, particularly of the fisherfolks of the host and neighboring communities since they are vulnerable to occupational hazards and accidents. Also, the distributions are coupled with information drive on how to properly use their life jackets and basic safety and precautionary measures during emergencies that can happen while they are at sea

C. Free Medicine Program

The Free Medicine Program is a new part of the CSR initiatives of JDVC with the goal of giving a free access to basic medicines needed by the host and neighboring communities. The said communities are in the coastal part of Cagayan which makes it difficult to avail medical services that includes free medicines. Thus, it is an immediate need that must be addressed to ensure the health and welfare of the communities.

JDVC has executed a Memorandum of Agreement (MOA) with Elaine's Pharmacy, located in the said municipality, for the provision of free medicines with a maximum of Php 500.00/claimant per month provided that the following requirements are submitted:

1. Purchase Order signed by any of the JDVC authorized representatives;
2. Valid ID/Barangay Certification; and
3. Medical Prescription.

The Company has allocated Php 150,000.00 per month for this program to ensure the health and welfare of the host community. The program was initially launched last March 2019.

5.3 Information, Education, and Communication (IEC) Framework

The Information, Education, and Communication (IEC) framework is meant to bridge the proponent and the host communities through various media. The basic objective is to promote awareness and understanding among the residents of host communities on the different programs JDVC Resources Corporation is doing for their benefit. This will build confidence and will promote better understanding and harmony between the host communities and the proponent.

The Information, Education, and Communication Plan of the company shall focus on the project information dissemination, predicted impacts of mining activities to the environment particularly to the people and their inherent resources, the benefits that the communities and its people may derived from such operation, and the cost and benefit analysis of the mining operations with regard to the environmental protection, and the future of local folks after the abandonment of the project.

The IEC will focus on the following: employment, sea water quality, noise, emergency response procedures, and the ECC conditions. The program will be handled by a Community Organizer. He or she will organize local meetings and reach out the community to convey JDVC Resources Corporation's programs for the community.

Table 5-3: Information, Education and Communication Framework

Target Sector Needing IEC Project	Major Topics of Concern in Relation to Project	IEC Scheme / Strategies / Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
Provincial Information Office; Municipality of Aparri, Municipality of Buguey, Municipality of Gonzaga, and their respective affected coastal communities	• The EIA process • Increase in extraction rate and operations of the Magnetite Off-shore Mining • The remuneration for identified areas to be used by the mining operation • The consequential impacts on the residents of the communities; and • The benefits of the Project on their Socio-cultural/economic and bio-physical environment of the affected residents as they address the major issues of air and water Pollution using Information, Communication and Information process. • Awareness of laws and regulations on illegal fishing and overfishing and	• Primer / Brochure / (print media in tarpaulin) • Consultations with Barangay Leaders and Multi-sectoral Representatives • Posters, wall comics, and signages in strategic area of the Barangays • Cellphone Patch Consultation • Community Forum and Phone Patch-Up • Coordination with LGUs, government agencies, and law enforcement on the conduct of awareness on laws and regulations on illegal fishing.	1. Primer / Brochure / (print media in tarpaulin) This strategy is effective in explaining in detail the subject matter, done in a simplified manner and in the language of the people. This strategy, likewise, uses illustrations to further classify the processes that is to be done. A. The EIA Process illustrated and simplified in the language of the affected community written in Ilokano. B. The increase in extraction rate of the Mining Project . This shall contain: • The project description, project timeframe, project facilities, management of Social and Environmental impacts, potential project benefits, a graphic illustration about the process of offshore magnetite mining operation and mitigating measures; • The process of Environmental Performance and Management Plan (EPRMP), roles and responsibilities of the stakeholders; • The Social Development and Management Plan: - Gender Responsive: Livelihood and Credit Facilities - Education and Recreation - Health and Safety - Environment and Sanitation - Infrastructure - Peace and Order	During the project implementation and project operations	Part of the Project Cost

Target Sector Needing IEC Project	Major Topics of Concern in Relation to Project	IEC Scheme / Strategies / Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
			- Spiritual • On the residents who will be affected by the mining activities showing their right to complain about violations of ECC Conditions. C. Information program raising awareness on the problems of illegal, unreported, and unregulated fishing. 2. Consultations with Barangay Leaders and Multi-sectoral representatives (These are face to face encounters where participants and facilitator of knowledge and skills develop strategies to respond to the needs of the communities in the context of what is appropriate for their capabilities and resources) • Using the interpersonal approach, JDVC will maintain a regular consultation with the barangays for an open dialogue on the issues, problems and concerns related to the implementation and sustainability of the project this approach shall compliment the Multi-partite Monitoring Team in terms of monitoring the compliance of the proponent to the conditions of the ECC. This will also serve as an avenue for stakeholders to register feedbacks, concerns, and issues related to the operation of the project. An indicative procedure for addressing stakeholder concerns is summarized below:		

Target Sector Needing IEC Project	Major Topics of Concern in Relation to Project	IEC Scheme / Strategies / Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
			- Through the Community Relations Office (CRO), stakeholders may register their concerns - The CRO shall acknowledge receipt of the stakeholder concern and provide a tag/reference number for tracking stakeholders concerns. May vary depending on the scale of the concerns at hand. - Review and investigation. For the mechanism to work, all concerns should be handled as promptly as possible. Depending on the nature of the matter, some concerns may be easily resolved while other concerns can be quite complex. In these cases, management, contractors and even external experts may become involved in the investigation. In circumstances where the resolution process takes time, the mechanism must ensure that the stakeholder is informed of the progress. - Formulation of resolution options, response/s and close-out – like the process itself, resolutions may vary in complexity. More complex and controversial issues, especially those raised by large groups of people, usually involve overlapping issues with no obvious solutions. Resolution of these may benefit from access to independent bodies that can provide the credibility that comes		

Target Sector Needing IEC Project	Major Topics of Concern in Relation to Project	IEC Scheme / Strategies / Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
			within partially. Such independent bodies can foster dialogue and collaboration between companies and affected communities as they undertake the often-lengthy process of exploring resolution options. Regardless of the outcome, all concerns should receive a response. - Monitoring, Reporting, and Evaluation – Monitoring will also help the proponent track recurring concerns, which may entail or result to evaluation of policies or enhancement of operating procedures. This will also enable the proponent establish baseline information which they can report back to the community. • Group discussion of the sectoral groups which will be affected in the mining activities, the legal processes with the application of priority job placement, and other benefits • Workshop on the Mining Law of 1985 and Solid Waste Management R.A. 9003 and preparation of IEC Materials • Workshop on community Disaster Risk Reduction Management 3. Posters, Wall Comics, and Signages in Strategic area of the Barangays • A graphic illustration of information regarding the offshore mining operations and the rationale of the		

Target Sector Needing IEC Project	Major Topics of Concern in Relation to Project	IEC Scheme / Strategies / Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
			project in the context of their goal and experiences in relation to offshore mining written in Ilokano. • Community-based Solid Waste Management and information about R.A. 9003 4. Cellphone Patch Consultation Using the cellphone feedback mechanism through the information booths in the project affected Municipalities and Barangays. 5. Community Forum and Phone Patch-Up This strategy enables the proponent to discuss the progress of the project with keypersons of the company/resource persons weekly. This also encourages multi-sectoral interest groups to ask questions though phone patches.		

6. ENVIRONMENTAL COMPLIANCE MONITORING

6.1 Self-Monitoring Plan

The Environmental Monitoring Plan describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

The primary purpose of self-monitoring plan is to ensure the identified project impacts will be addressed by the proposed management measures and will remain compliant to the relevant regulatory requirements. In the ECC issued to JDVC Resources Corporation last 2016, DENR-EMB required the project proponent to submit a Compliance Monitoring Report (CMR).

A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. **Table 6-1** shows the summary matrix for environmental monitoring per phase while **Table 6-2** presents the proponent's compliance to the conditions set forth in its ECC commitments.

6.2 Multi-Sectoral Monitoring Framework

JDVC Resources Corporation is committed to follow the ECC conditions to be imposed by the DENR, especially on the forming of multisectoral monitoring team of the multipartite monitoring team (MMT) in pursuant to DAO 2017-15 and DAO 2018-18.

The MMT shall conduct quarterly ocular site visit to validate JDVC's compliance with the ECC conditions and the Environmental Management and Monitoring Plan. The MMT shall prepare and submit its report to EMBCO and EMBRO concerned and institute an environmental emergency and complaints receiving and management mechanism, which shall include systems for transmitting recommendations for necessary regulatory action to EMB in a timely manner to prevent adverse environmental impacts.

Table 6-3 shows the composition of the MMT on the basis provided thereto.

6.3 Contingent Liability and Rehabilitation Fund (CLRF)

The Contingent Liability and Rehabilitation Fund (CLRF) prescribed by the Mining act will cover the for the monitoring and rehabilitation expenses of the project.

The Proponent, JDVC Resources Corporation, have been granted the Certificate of Approval to the Environmental Protection and Enhancement Program (EPEP) and Final Mine Rehabilitation and/or Decommissioning Plan (FMRDP) by the Contingent Liability and Rehabilitation Fund Steering Committee (CLRFSC) in accordance to the pertinent provisions of DENR Administrative Order No. 2010-21, the Consolidated DENR Administrative Order (DAO) for the Implementing Rules and Regulations of Republic Act (RA) No. 7942 or the Philippine Mining Act of 1995. See **Annex J.1.**

Mine Rehabilitation Fund (MRF)

The Monitoring Trust Fund (MTF) amounting to Php 600,000.00 per year is allotted for the operational expenses of the Multipartite Monitoring Team (MMT). The Rehabilitation Cash Fund (RCF) is established to ensure compliance with the approved rehabilitation activities. The RCF is equivalent to 10% of the total EPEP cost or Php 5 million whichever is lower. For this project, 10% of its EPEP cost is Php 3,230,000.00. Hence, the RCF is initially set at this amount. The Environmental Trust Fund (ETF) is established to pay for mining related compensable damages other than those caused by mine waste

and mill tailing. It is contained in the MOA entered by and among the stakeholders. ETF is pegged at a minimum of PHP 50,000.00.

The approved amount of the Company's Final Mine Rehabilitation and Decommissioning Fund is Php 17,735,475.00 as stated in their Certificate of Approval **(Annex J.1).**

Table 6-1: Summary Matrix of the Environmental Monitoring Plan

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
Operational Phase													
Water	Degradation of water quality in the mining area	- pH - TSS - Color - Oil and Grease	Grab sampling	Quarterly	Identified water quality and control stations within and near the mine operational area	Pollution Control Officer or Environmental Officer	Included in the project cost	pH level (6.5-8.0) Increase in TSS levels by 15mg/L com-pared to baseline value. Change in the apparent color (PCU) of the surface water. Increase in Oil and Grease levels by 2 mg/L com-pared to baseline value.	pH level (6.2-8.3) Increase in TSS levels by 20mg/L com-pared to baseline value. Change in the apparent color (PCU) of the surface water. Increase in Oil and Grease levels by 2.5 mg/L com-pared to baseline value.	pH level (6.0-8.5) Increase in TSS levels by 25mg/L com-pared to baseline value. Change in the apparent color (PCU) of the surface water. Increase in Oil and Grease levels by 3 mg/L com-pared to baseline value.	Investigate possible cause of pollution.	Investigate cause of pollution in parameters monitored and coordinate with MMT the possible causes of pollution.	Investigate cause of decline in parameters monitored; Increase frequency in monitoring parameters to be measured; Coordinate with MMT the possible causes of pollution.
Water	Disturbance to marine and coastal organisms and/or ecosystem	- Planktons - Fish catch - Conditions of coastal habitats	Grab sampling, visual inspection, fish catch monitoring in fish landing stations	Semi-annually for the first year and will be adjusted as necessary for the succeeding years	Within the primary and secondary impact areas (identified stations for planktons, etc.)	Pollution Control Officer or Environmental Officer / third party consultant	Included in the project cost	Decline (~25%) in the abundance, frequency, and distribution.	Evident decline (≥30%) in the abundance, frequency, and distribution.	Highly evident decline (≥50%) in the abundance, frequency, and distribution.	Investigate possible cause of decline in the parameters measured	Investigate cause of decline in parameters monitored and coordinate with MMT the possible causes of decline;	Investigate cause of decline in parameters monitored; Check success rate of rehabilitation programs;

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
												Check success rate of rehabilitation.	Increase frequency in monitoring parameters to be measured; Coordinate with MMT the possible causes of pollution
Water	Domestic wastewater discharges	- Total Coliforms (MPN/100mL) - BOD 5	Grab sampling and Multiple Tube Fermentation Technique (MTFT) (analysis)	Monthly or as deem necessary	Inside the vessel	Pollution Control Officer or Environmental Officer	Included in the project cost	2,000 ** no standard limit set for BOD 5 in Class SC water*	2,500	3,000	Report actual status on a periodic basis, document results. Investigate possible cause of pollution.	Prepare statistical report highlighting the findings. Investigate cause of pollution in parameters monitored and coordinate with MMT and the management the possible causes of pollution. Increase the frequency of effluent monitoring.	Investigate cause of pollution in parameters monitored and coordinate with MMT and the management the possible causes of pollution. Check the efficiency of the STP / holding tanks / marine sanitation device. Implement good house-keeping practices / measures in the vessel.
Water	Generation of hazardous wastes from the operations (e.g. used oil)	Volume of wastes	Inspection	Daily	Inside the vessel	Pollution Control Officer or Environmental Officer	Included in the project cost	3 tons	5 tons	7 tons	Provision of a temporary container within the vessel.	Strict implementation of proper housekeep-ping and waste	Strict implementation of proper housekeep-ping and waste management

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
											Strict implementation of proper housekeep-ping and waste management measures as stated in RA 6969.	management measures as stated in RA 6969. Coordinate with PCG on the proposal disposal of hazardous wastes.	measures as stated in RA 6969. Coordinate with PCG on the proposal disposal of hazardous wastes.
Water	Generation of solid wastes from the workers	Volume of wastes	Inspection	Daily	Inside the vessels and project site	Pollution Control Officer or Environmental Officer	Included in the project cost	300 kg	400 kg	500 kg	Strict implementation of proper housekeep-ping and waste management measures.		
Air	Increased in noise level from naval mining operations and in the community	Noise level, dB	Direct reading / sound level meter	Quarterly	Inside the vessel Identified sampling stations during baseline sampling.	Safety Officer	Included in the project cost	70	73	75	Immediately fix broken equipment or machine, as necessary. Regularly maintain equipment to keep these working at their optimum and minimize noise generation. Continue noise level monitoring and increase frequency	Investigate cause of complaint, determine and address the root cause.	Conduct vessel-wide noise audit of equipment and machineries.

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
											as necessary		
Air	Possible degradation of ambient air quality in the area due to source emission from generator sets	CO, mg/Ncm	Instrumental Analyzer Method	Semi-annually for the first year and will be adjusted as necessary for the succeeding years.	Exhaust pipes of generator sets	Pollution Control Officer or Environmental Officer	Included in the project cost	40	45	50	Regular maintenance of generator sets. Report actual status on a periodic basis, document results. Regular maintenance of the generator sets.	Prepare statistical report highlighting the findings, for the information of Management. Provide recommend-dations if necessary.	Prepare statistical report highlighting the findings, for the information of Management. Provide recommend-dations if necessary.
		NO_2, mg/Ncm	Griess – Saltzman Reaction Method					130	140	150			
		PM, mg/Ncm	High Volume Sampler – Gravimetric Method					130	140	150			
		SO_2, mg/Ncm	Pararosanilin e Method					160	170	180			
People	Potential accidents and adverse impacts on the health and safety of employees, contractors and the communities.	Safe man-hours	Incident reporting, regular monitoring integrated in the Health and Safety Plan of the proponent	Daily inspection of work conditions, PPEs and compliance to proponent's Health and Safety Plan	Project site	Safety Officer	Part of operation cost	Negative feedback to the Proponent by the communities and workers	Formal complaint lodged by the communities and workers	Multiple complaints feed to local media organizations	Proponent to investigate/ inspect subject of negative feedback; Improvement of health and safety measures to address negative feedback	Investigate reason for complaint and address complaint immediately through consultations with employers, contractors or affected stakeholders; Improvement of health and safety measures to address	Immediately conduct consultations or dialogues with complainants and affected stakeholders to determine reason for complaints. Address the complaints and document the responses and actions that will be done; Release an

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
												negative feedback	official statement to media to clarify the issue; Make improvements on health and safety plan to reflect the actions that were conducted so a repeat of the incident or complaints will not happen.
People	Condition of the affected communities vis-à-vis the project operations Community benefits from the project due to taxes, employment, and social development and management plan (SDMP) Complaints management	SDMP programs, employment generation and tax revenues Number of beneficiaries and other parameters required under SDMP reporting by MGB	Coordination with the affected barangays	Quarterly	Affected barangays	Proponent / third party consultant	Included in the SDPMP fund	Negative feedback to the Proponent	Formal complaint lodged by the communities	Multiple complaints feed to local media organizations	Proponent to investigate/ inspect subject of negative feedback; Coordinate with the barangay and MMT	Investigate the subject of negative feedback; Coordinate with the concerned municipalities and MMT	Regular consultations with the concerned stakeholders; Release an official statement to clarify the issue; Coordinate with MMT
People	(Naval) Traffic congestion	Flow and number of vessels passing	Coordination with the PCG, affected LGUs and	Daily	Project site and vicinity	Proponent	Included in the project cost	Negative feedback to the Proponent	Formal complaint lodged by the	Multiple complaints feed to local media	Implement a naval traffic scheme	Investigate the subject of negative feedback;	Prepare statistical report highlighting the

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
		through the project site and its vicinity	other concerned government agencies						communities	organizations	Coordinate with the concerned municipalities, MMT and government agencies	Coordinate with the concerned municipalities, MMT and government agencies	findings, for the information of Management. Provide recommendations if necessary. Coordinate with MMT.

Table 6-2: Environmental Compliance Commitment (ECC-CO-1409-0021)

No.	ECC Conditions	Status		Remarks
		Yes	No	
Environmental Management				
I.1	Conduct an effective Information, Education and Communication (IEC) Program to inform and educate all stakeholders, especially its contractors, workers and local residents about the mitigating measures embodied in its EIS, the conditions stipulated in this ECC and the environmental and human safety features of the Project for greater awareness, understanding and sustained acceptance of the Project. An annual detailed IEC program shall be implemented, and proof of continuing compliance shall be submitted semi-annually as part of the Project's Compliance Monitoring Report (CMR) to the EMB Central Office (CO), copy furnished the EMB Region II;	✓		The Community Relations Unit of the Company have conducted various public consultation activities and programs. Attached as Annex are the documentations of the public consultations.
I.2	The proponent shall enter into an agreement with the DENR Regional Office regarding the National Greening Program and/or carbon sink management program in line with DENR's thrust for GHG emissions reduction within six (6) months prior to project operation;			Coordinated with DENR-CENRO Aparri for the identification of NGP Area in the Municipality of Gonzaga prior to the preparation of MOA.
I.3	The extraction method shall be by dredging and magnetic separation. Blasting shall be strictly prohibited;	✓		The extraction of magnetite sand thru siphoning activity.
I.4	A Coastal Geohazard Assessment as required under the Mines and Geosciences Bureau (MGB) Memorandum Circular No. 2016-05 regarding the Guidelines on Offshore Mining shall be submitted to the MGB for evaluation and approval copy furnished this Office;			For implementation
General Conditions				
I.5	The mining operations shall conform with the provisions of R.A. No. 6969 (*Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990*), R.A. No. 9003 (*Ecological Solid Waste Management Program Act of 2004*), R.A. No. 9993 (*Philippine Coast Guard Law*) and the MARPOL Convention 73/78;			The Company is on process of securing Hazardous Waste ID with EMB Online Services Company Reference ID: EMBR2-482150-25645.
I.6	The proponent shall comply with the environmental management and protection requirements of the Philippine Mining Act of 1995 (R.A. No. 7942) and its Implementing Rules and Regulations (DAO 2010-11), and Harmonization of the Implementation of the Philippine Environmental Impact Statement System and the Philippine Mining Act of 1995	✓		Complied

No.	ECC Conditions		Status		Remarks
			Yes	No	
	(DAO 2015-02), such as, but not limited to, the following:				
	I.6-a	Submission to the MGB for approval of an Environmental Protection and Enhancement Program (EPEP), including compliance with Section 5.1 of the MGB Memorandum Circular No. 2016-05, copy furnished EMB Central Office;	✓		Attached as **Annex J.1**: Certificate of Approval to the EPEP and FMRDP of JDVC Resources Corporation
	I.6-b	Setting up of a Contingent Liability and Rehabilitation Fund (CLRF) and Environmental Trust Fund (ETF) within sixty (60) days from approval of this Certificate.	✓		Attached as **Annex J.1**: Certificate of Approval to the EPEP and FMRDP of JDVC Resources Corporation
	I.6-c	Establishment of a Multipartite Monitoring Team (MMT) to include Philippine Coast Guard (PCG), Bureau of Fisheries and Aquatic Resources (BFAR), and Maritime Industry Authority (MARINA) representatives;	✓		MMT resolution needed from MGB
	I.6-d	Submission of a Social Development and Management Program (SDMP) within thirty (30) days from receipt of this Certificate to the MGB for approval. The EMB shall be furnished a copy of the SDMP within thirty (30) days from its approval.	✓		Attached as **Annex 4**: Certificate of Approval of SDMP for the Municipality of Gonzaga only
	I.6-e	Creation of Mine Environmental Protection and Enhancement Office (MEPEO) within thirty (30) days from receipt of this Certificate, which shall completely handle all environment-related aspects of the project. In addition to the compliance and monitoring requirements as specified in the EMP/EMoP, the MEPEO shall also monitor the actual project impacts vis-à-vis the predicted impacts and management measures stated in the EIS and submit a Compliance Monitoring Report (CMR) in accordance with the specific format in the Implementing Rules and Regulations (IRR) of the Philippine Environmental Impact Statement System (PEISS);			Mr. Romeo Onte is assigned as the MEPEO cum PCO of this project. Attached as **Annex 12**: Proof of CMR Submission Online
I.7	Secure endorsement/approval of concerned Sangguniang/s prior to project implementation pursuant to the provisions of Section 27 of the Local Government Code. Proof of which shall be submitted to EMB Central Office within sixty (60)		✓		Attached as **Annexes 1, 2, and 3**: Barangay and Municipal Resolutions

No.	ECC Conditions	Status		Remarks
		Yes	No	
	days after issuance thereof by said the concerned Sangguniang/s;			
I.8	The proponent shall ensure that its contractors and subcontractors including all its attending vessels shall properly comply with the relevant conditions of this Certificate.	✓		Attached as **Annex 8**: Agreement between the Subcontractors of the Project
Restrictions				
I.9	The proponent shall implement the project strictly in accordance with the MGB Memorandum Circular No. 2016-05;	✓		In compliance with the MGB Offshore mining guidelines
I.10	Only vessels registered to and/or certified by concerned Government Agencies, such as MARINA and PCG, shall operate in the mining area;	✓		For Compliance
I.11	No other activities shall be undertaken other than what were stipulated in the final EIS document. Any expansion or modification of the Project beyond the project description or any change in the activity shall be subject to a new EIA study; and	✓		The project is under the process of ECC Amendment for expansion of extracted volume.
I.12	Transfer of ownership of this project carries these same conditions and restrictions for which written notification must be made by herein grantee to EMB within fifteen (15) days from such transfer.			The Company have no plans of transferring the ownership of this project
Other Sectoral Requirements				
Recommendations to Concerned Government Agencies				
1	Monitor the project management's provision of rights and privileges for onshore and offshore workers for protection and social security. (Responsible Agency: DOLE – Bureau of Working Conditions)	✓		Attached as **Annex 9**: DOLE Certificate Registration
2	Proponent shall apply for the approval of the following documents: - Notice to Mariners for the operation areas including buffer areas and areas to be occupied by the silt curtains and support vessels; - Oil Spill Contingency Plan, Garbage Management Plan; - Approval of Sewage Treatment Plant; - Approval of Oil Water Separator; - Hazardous Waste Management. (Responsible Agency: Philippine Coast Guard (PCG))			- Attached as **Annex 11**: Notice to Mariners - Other document are in the process of securing.
3	Compliance of the Project with the Sanitation Code.	✓		Attached as **Annex 10**: Sanitary Permit to Operate

No.	ECC Conditions	Status		Remarks
		Yes	No	
	(Responsible Agency: Local Government Unit (LGU))			
Environmental Planning Recommendations				
4	Priority of employment will be given to qualified local residents. Adequate public information for jobs available to local residents in the affected areas will to be provided.	✓		Complied
5	An independent third-party auditor will be commissioned to undertake an environmental audit, including risks and hazards of the Project. An annual report shall be submitted to EMB and the MGB.			For compliance

Table 6-3: Summary of Multi-Sectoral Monitoring Framework

	Stakeholder	Basis for Selection	Specific Organization	Proposed Role in the MMT/ Scope of MMT responsibilities/activities	Strategy in Establishing and Monitoring EQPLs
1	Affected Coastal barangays in the Municipality of Aparri, Buguey, and Gonzaga (Chairmen and Council with Community/Sectoral Leaders and lead health workers)	LGU is a "must" invite due to its direct political jurisdiction over the area	LGU	The Local Government Units shall participate in actual monitoring work. Advise the MMT of any complaints, information or reports from LGUs concerning the project, in order that remedial measures if warranted and feasible can be undertaken.	Report actual status on a periodic basis, document results. Prepare statistical report highlighting the findings, for the information of Management. Provide recommendations if necessary. Always in coordination and regular updating with the LGU and host community.
2	MPDC in the Municipality of Aparri, Buguey, and Gonzaga				
3	MENRO in the Municipality of Aparri, Buguey, and Gonzaga				
4	MHO in the Municipality of Aparri, Buguey, and Gonzaga				
5	MAO in the Municipality of Aparri, Buguey, and Gonzaga				
6	MSWDO in the Municipality of Aparri, Buguey, and Gonzaga				
7	Municipal Fisheries and Aquatic Resources Management Council in the Municipality of Aparri, Buguey, and Gonzaga				
8	Office of the Mayor/SB in the Municipality of Aparri, Buguey, and Gonzaga				

	Stakeholder	Basis for Selection	Specific Organization	Proposed Role in the MMT/ Scope of MMT responsibilities/activities	Strategy in Establishing and Monitoring EQPLs
9	Provincial ENRO of Cagayan Province				
9	POs (fishermen's organizations) / NGOs in the Municipality of Aparri, Buguey, and Gonzaga	Entities that may be directly or indirectly affected by impact resulting from the project's development	Sectoral Representatives	The NGO/PO and other stakeholder groups shall participate in actual monitoring work and concur with and/or sign the monitoring reports or take exception to them as the case may be. The representatives shall advise the MMT of any complaints, information or reports from their respective constituencies concerning the project, in order that remedial measures if warranted and feasible can be undertaken.	
10	PCG, BFAR, and MARINA	DAO 2017-15		The PCG, BFAR, and MARINA shall participate in actual monitoring work. Advise the MMT of any complaints, information or reports concerning the project, in order that remedial measures if warranted and feasible can be undertaken.	
11	Representatives from Government Agencies with related mandate on the project and its impacts during project implementation.	DAO 2015-02 DAO 2017-15 DAO 2018-18	DENR	Responsibilities and specific roles shall be based on the provisions of DAO 2015-02 and DAO 2018-18 Implement specific provisions of DAO 2015-02 and DAO 2018-18	

7. REHABILITATION / ABANDONDMENT / DECOMMISSIONING

The Final Mine Rehabilitation and Decommissioning Plan (FMRDP) of JDVC Resources Corporation was signed last May 21, 2019 and is located in the offshore areas in the Province of Cagayan Valley. The project will siphon within the 4,999.235 hectares out of the approved 14,240 hectares of MPSA No. 338-2010-II-OMR. The siphoning vessel will produce an annual production of 30M Mt (from the previous 1st ECC application of 1.3M Mt) of iron ore concentrate with a minimum grade of 60% Fe.

The objective of the of the mine closure is to bring back the original state of the area prior to any mining activity or if possible, improve the original conditions of the area to become more beneficial to the community. The decommissioning plan was presented and agreed thru consultation of the local communities and local government units. The process of consultation allows the determination of suitable and sustainable development of the mining area after mine life. the company is committed to conduct regular and continuous consultation to achieve the final decommissioning plan of the project. The facilities and services can be donated, transferred, decommissioned, or removed. The plan should be regularly reviewed every two years throughout the mine life.

With the nature of siphoning activity in the offshore areas, the final decommissioning plan in the offshore is quite different compared to the conventional inland location of a project where footprint of the operation us huge and sophisticated. The only inland structure constructed is the admin office and the staff house located in CEZA office. These structures will be decommissioned and removed.

The principal objectives of the rehabilitation and closure planning for the project are:

- Provide an overall framework for closure including rehabilitation and decommissioning strategies that are consistent with Philippine standards and regulatory requirements;
- Set up a clear and agreed criteria that can be used to provide the standard against which the final rehabilitation and post-closure land use can be assessed;
- Reduce and/or eliminate adverse environmental effects once the facility ceases operation;
- Ensure closure is completed in accordance with good industry practice;
- Ensure the closed facility does not pose an unacceptable risk to public health and safety; and
- Provide the local communities with long-term sustainable opportunities following closure.

Closure Planning and Program

Objective of Mine Closure

The project closure occurs when the mineral reserves have been completely exhausted and processed. The mine's decommissioning plan should be included in the operation and rehabilitation/reforestation plan. In this case, there are no rehabilitation to be conducted since the mining is located in offshore areas or at the bottom of the sea. The replenishment of the sand in sea bottom can occur naturally. Factors contribute to the decommissioning or mine closure are:

- depletion of mineral reserves;
- change in metal market value;
- financial viability of the project;
- detrimental environmental mishaps; or
- non-compliance to environmental regulation.

The intention of the mine closure is to revert back to its original condition of the sea bottom and its surrounding environmental to its baseline conditions, if not improved. The planning of the decommissioning together with social plans require the participation of the stakeholders to come up

with a better measures and development. This is to make sure that the decommissioning plan of the project will be sustainable long after the project has come into cessation.

Based on international standards and the Mines and Geosciences Bureau guidelines, the objectives of mine closure are as follows:

1. To develop the local community by establishing cooperatives and association to enable them to efficiently continue and manage sustainability and the livelihood projects and support facilities has implemented.
2. To monitor and do research on the water quality during the mine operations and specifically after the siphoning activities (mine closure) and ensure that the sea water is of good quality or comparable to baseline conditions.
3. To prevent or minimize risks to public health and safety by securely pulling out of drill pipes and the vessels and avoid oil and hazardous contaminants before and during decommissioning implementation.
4. To implement the reforestation projects in the identified areas.

On some occasions, mining operations will have its final closure where the economic or other limits have reached, and resources have been depleted. In other circumstances, temporary cessation may occur, and the project will cease due to economic constraints, or the project is not in conformance with the regulatory requirements.

Final and Planned Closure

Final and planned closure happens when the economic or operations requirements has been reached and ore reserves has been exhausted. The mine will have its closure in accordance with the mine plan. The FMRDP that was crafted and updated throughout the life of the mine should be implemented.

Temporary Closure

Temporary closure will take place when the mining operations temporary stop due to economic and operational issues, where the consumer demands will slow down, or the economic value of metals cannot sustain the operating cost or the chosen design or operations is not suitable to the present operations. Temporary closure is usually planned. Care and maintenance will be implemented until such time that the project addresses the engineering and operational issues or metal prices will become favorable to reopen the mine.

Sudden or Unplanned Closure

Sudden closure occurs when mining and processing or ore cease due to environmental mishaps or non-conformance with regulatory requirements of the government. Immediate preparation and implementation of decommissioning plan based in the existing FMRDP. Rehabilitation of the damage should be done immediately, and operations will only resume if all environmental issues and concerns have been properly addressed.

Stakeholder Engagement

Rehabilitation and closure planning requires input from the community and other relevant stakeholders to ensure that stakeholder issues are addressed in closure strategies, minimize potential adverse impacts of closure, and maximize benefits or opportunities. These include:

- Host and neighboring communities that may be affected by closure as identified during scoping or those part of the MMT;
- Government units involved in the planning, welfare, and economic development; and
- Other interested parties such as environmental, conservation, and industry groups.

The Philippine regulatory framework emphasizes the importance of local community input to the planning of rehabilitation and closure activities. This involvement includes the establishment of a multi-partite monitoring team (MMT) for the project.

Consultation

The primary purpose of involving the stakeholders in the formulation of the plans is to make sure that the interests and concerns of the community are considered during the preparation of the rehabilitation and closure plan. Public consultation is required from the very first step of any mining project, from mining application to development and operations up to the closure of a mining project. The stakeholders play a big role in the success of any mining project. The stakeholders have been consulted for the final plan/land use of the mine of the FMRDP.

Prior to the actual decommissioning procedures, a closure mining program will be formulated 2 years prior to the planned closure activities. This is to make sure that the closure criteria is attainable thru data collected throughout the closure phase to ensure that closure performance criteria will be attained, that the environmental impacts and risks have been properly addressed and any area requiring remedial works are identified.

Community Development and Community Relations Plan

The Community Relations (Comrel) Plan on mine closure includes three (3) years leading to it, which aim to prepare the local people and other stakeholders in the host communities of the eventual phase-down of the offshore mining operations, including associated activities such as indirect businesses that will flourish in the areas of the barangays. The Comrel Plan in coordination with the Information, Education and Community Plan will set out community-based and initiated activities that will psychologically, socially and economically prepare the stakeholders to adjust to the inevitable closure of the mine.

Comrel Plan will be focused to specific stakeholder individuals, groups, and fishermen, especially the most vulnerable. The Comrel Plan will also assist the local government units (Barangays and Municipalities concerned) in adjusting to the slowdown of the business and the displacement of workers in coordination with the Social Plan.

The crafting of the Community Development Plan aims to:

- Identify and implement the basic needs and welfare of the communities as basis for the framework of social development program of the offshore magnetite mining project in the affected barangays within the coverage of the mining area.
- Prepare a sustainable plan based on the Municipal Development Plans or government mandated programs and the mandated Social Responsibility support of JDVC; and
- Establish a harmonized working relation among JDVC and the various community stakeholders with the goal of improving the quality of life of the affected communities by enabling them to become self-reliant and empowered.

The Comrel Plan will be highly participative, adaptable, and owning by the community. The company will act as a coordinator and facilitator in plan preparation and implementation.

Information, Education and Communication (IEC) Framework

Information, Education and Communication (IEC) Framework is meant to bridge the proponent and the host communities through various media. The basic objective is to promote awareness and understanding among the residents of host communities on the different programs the company is doing for them. This will build confidence and will promote better understanding and harmony between the two parties.

The IEC program of the company shall focus on the project information dissemination, predicted impacts of mining activities to the environment particularly to the people may derived from such operation, and the cost and benefit analysis of the mining operations regarding environmental protection, and the future of local folks after the abandonment of the project or mine closure. The IEC program shall be implemented at least one (1) year before the start of the implementation of the FMRDP as part of the social preparation of company.

Risk Assessment

During the development of the Abandonment and Decommissioning Plan (ADP), a closure risk assessment may be necessary to be undertaken in order to identify the key risks. The objectives of the closure risk assessment will be to:

- Identify specific risks/hazards associated with closure of the project;
- Establish appropriate rehabilitation and closure strategies to effectively manage these risks;
- Document the monitoring programs that will be undertaken to demonstrate compliance with applicable closure performance criteria; and
- Establish contingency measures that may be applied if a risk situation eventuates.

Decommissioning Plan

Prior to the actual decommissioning procedures, a closure monitoring program will be formulated two years prior to closure activities. One input to the monitoring program is the data collected from the SMR throughout the operation of the plant to ensure that the closure criteria are attainable.

Monitoring will be done continuously throughout the closure phase to demonstrate that the closure performance criteria have been attained, that the environmental impacts and risks have been appropriately addressed and that any areas requiring remedial works are identified. Periodic reviews of monitoring data will be done to assess trends and the efficiency of the closure management activities. Monitoring will also prompt rehabilitation maintenance if necessary.

This is governed by the Mining Act of 1995 in which a detailed decommissioning plan is to be submitted to the Mines and Geosciences Bureau prior to abandonment. A five-year plan is required. The extraction site will be abandoned after the magnetite deposit had been exhausted, possibly after several years in accordance with the approved mine development plan. For offshore operations, there are no equipment or structures that will require dismantling except for the fixed maroon point and pump station. The only building to be decommissioned are the admin building and the staff house building at CEZA, Sta. Ana, Cagayan. The siphoning vessel, handling anchor tug, and drill barge will be properly pulled out offshore. Corresponding clearances from the LGU, the local port authority and the Philippine Coast Guard (PCG) shall be secured prior to vessel and offshore facility decommissioning.

Final Mine Rehabilitation Plan

During offshore operation, mining will be done by sections as per the approved mine development plan. Once a section is mined out, assessment and necessary rehabilitation of that particular section should immediately commence so that there would be a shorter time frame in the abandonment and rehabilitation phase. As necessary, during the rehabilitation of the extraction areas, the beneficiary communities may be involved and organized so that by the end of the abandonment time frame, the stakeholders are ready to handle the responsibility with the local DENR, the LGU and the Environmental Protection unit of the Philippine Coast Guard.

The mining operation is offshore by nature, the company in coordination with concerned government offices shall allocate other areas for greening or reforestation program to identifies areas since rehabilitation is not applicable in offshore mining project. JDVC will conduct reforestation (as offsetting of the offshore area that will be disturbed by commercial operations) initially on a ten (10) hectare land at Gonzaga, Cagayan with some initial seedlings of 50,000 bamboo and *acacia mangium* seedlings per year due to the previous research done on the said species suitable for reforestation and mine rehabilitation.

The company will have a nursery station at Gonzaga, Cagayan as per arrangements with the LGU of Cagayan. JDVC will have a one (1) hectare of land allotted for the nursery facility wherein they will prepare and propagate of seedlings of bamboo and *acacia mangium* until it is ready for distribution and planting at the reforestation areas. The company will also conduct mangrove planting at the identified areas at Gonzaga as part of Carbon Sink Management Program stipulated in the ECC condition of the company.

The detailed Abandonment and Decommissioning Plan (ADP) will be done and submitted to the MMT and EMB Central Office one year before the actual decommissioning activities.

8. INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

In compliance to the requirements of the DENR and other concerned government agencies, JDVC Resources Corporation shall formulate a Mine Environmental Protection and Enhancement Office (MEPEO) as stipulated in DAO 96-46 also known as the Philippine Mining Act of 1995.

The MEPEO shall have the following functions:

- Formulation and conservation of environmental conservation plans;
- Implementation of environmental impact and management procedures;
- Timely submission of Self-Monitoring and related reports;
- Coordination with the Multi-partite Monitoring Team (MMT);
- Community programs during project operation;
- Compliance with all regulations imposed by the DENR, MGB, and other concerned agencies; and
- Implementation of the Final Mine Rehabilitation and Decommissioning Plan (FMRDP).

The MEPEO shall report directly to the operations manager of the company together with the Pollution Control Officer (PCO), Health and Safety Officer (HSO), and the Community Relations Officer (CRO). The MEPEO will be a Mining Engineer or Geologist or Metallurgist Engineer or by an Environmental Engineer with at least 5 years experience in both onshore and offshore mining environment. The MEPEO will be organized also and shall be responsible for the internal monitoring if the environmental impacts and implementation of the environmental management programs as presented in this EIS.

The MEPEO shall implement the following:

- Planning and managing the implementation of the approved EPEP/AEPEP;
- Monitoring and compliance of Contractors in the implementation of provision of EPEP/AEPEP;
- Monitoring and evaluating the effectiveness of the mitigation and enhancement measures;
- Planning, proposing and implementing rehabilitation and abandonment programs;
- Liaise with the Community Relations Officer (CRO) and the Mine Safety Personnel in creating a holistic Safety and Health, Environment and community relation program for the project;
- Implementation of the Environmental Management & Monitoring Team, and other agencies and stakeholders relative to compliance with other environmental regulations that the DENR, MGB and other concerned agencies may impose; and
- Work with the Community Relations Officer in coordinating the activities of the Multi-partite Monitoring Team (MMT).

The Pollution Control Officer (PCO) is tasked to:

- Proper and regular monitoring of water quality, compliance to all permit conditions and all sampling and monitoring activities are done in accordance to the required methodologies;
- Regular submission of compliance reports;
- With the MEPEO, conduct spot and regular audit procedures to ensure implementation of established environmental management protocols and impact management plans, and
- In coordination with the MEPEO, report on the efficiency of environmental management measures and assist the management in implementing corresponding mitigating measures as required.

The Health and Safety Officer (HSO) is tasked to:

- Ensure that comprehensive Health and Safety protocols are in place and implemented. Such policies shall be complied with not only by the proponent but also by all contractors and personnel involved in the project;

- Conduct regular safety trainings and audits similar to environmental audits for all its personnel, directly hired and contracted, and
- Ensure conduct of health examinations for all personnel prior to engagement and on a periodic during the duration of the project.

The CRO on the other hand shall have the following functions:

- Maintain constant communication and establish positive relationship with concerned government agencies (e.g., MGB, DENR, LGU, PCG, etc.) and stakeholder groups to address environmental concerns and implement environment-related programs in coordination with the PCO and the MEPEO, and
- Implement a regular and intensive information, education and communication (IEC) program to promote Corporate Social Responsibility advocacies in environmental protection and other social development programs (SDP).

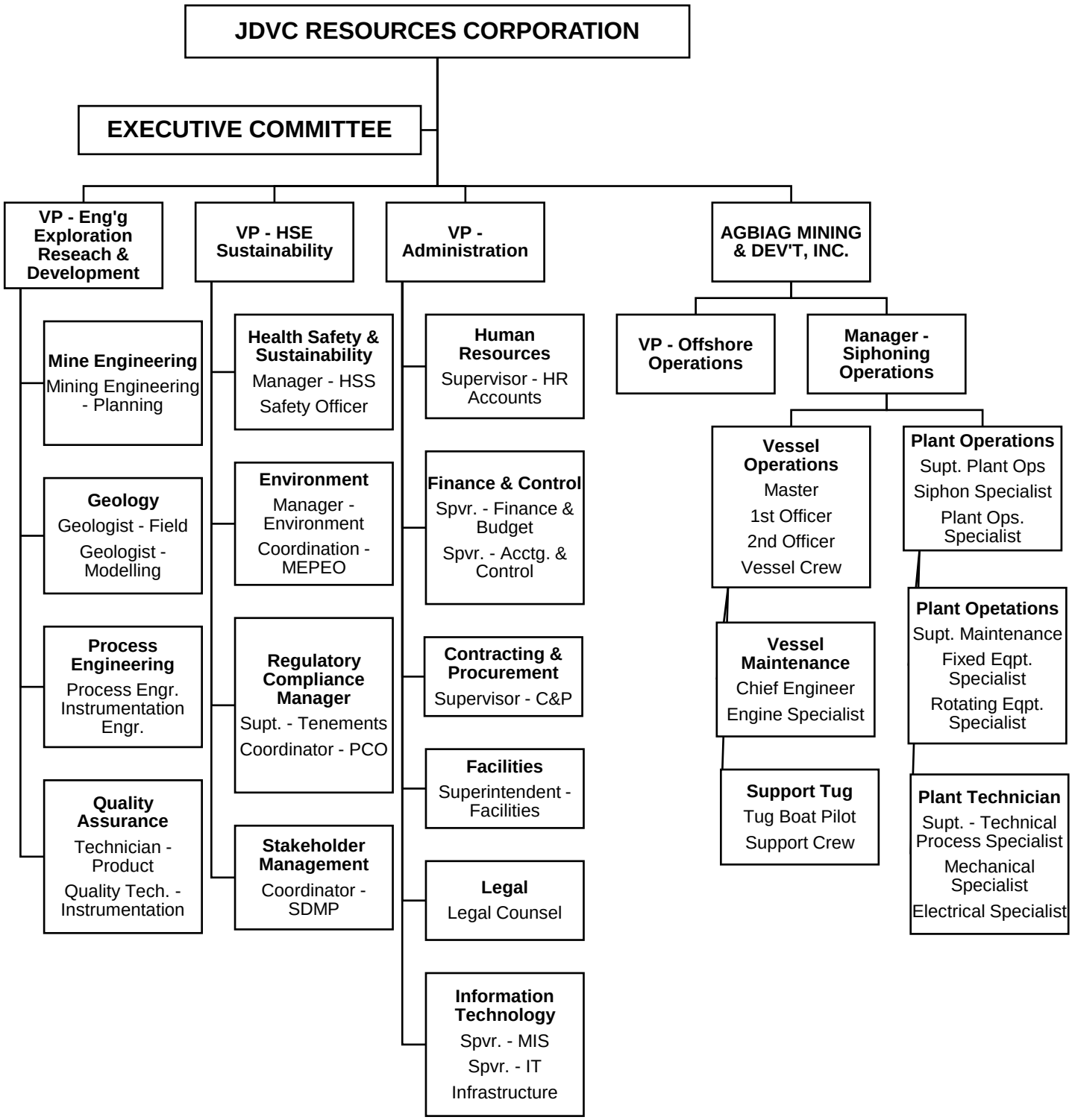


Figure 8-1: JDVC Resources Corporation Organization Chart of the Project

PROJECT ENVIRONMENTAL MONITORING AND AUDIT PRIORITIZATION SCHEME (PEMAPS) QUESTIONNAIRE

Project Name	**Cagayan Offshore Magnetite Mining Project**
Location	**Municipalities of Aparri, Buguey, and Gonzaga, Province of Cagayan**
Project Area	**4,999.2358 hectares**
Nature of Project	**Magnetite Extraction**
Name of Proponent	**JDVC Resources Corporation**
Address	
Contact Details	

I. PROJECT CONSIDERATIONS

1.1 Size and Type

1.1.1 Size based on number of employees

Specify number of employees: 140 employees

1.1.2 Type

ECP (in either ECA or Non-ECA) ___x_____
Non-ECP but in ECA _____
Non-ECP and Non-ECA _____

1.2 Waste Generation and Management

1.2.1 Enumerate Waste Type and Specify Quantity of Wastes generated in your facility. (Identify /Enumerate)

Category	Waste	Type		Quantity
		Hazardous	Non-Hazardous	
	Solid wastes		✓	< 100kg per vessel
	Mud and aggregates		✓	
	Used oil	✓		Based on vessels' preventive maintenance requirements

1.3 Pollution Control System (PCS)

1.3.1 Enumerate PCS or Waste Management Method used in your facility.
(Identify /Enumerate)

Category	PCS/Waste Management Method Used	Remarks
Solid	Will use long tube to return aggregates on the seabed to lessen impact of turbidity on sea water	Resulting from magnetic separation, non-magnetite materials will be returned to the seabed.

II. PATHWAYS

2.1 Prevailing wind towards barrio or city? (mark the corresponding point) Yes _x___ No ____

2.2 Rainfall (impacts surface & groundwater pathways)

2.2.1 Average annual net rainfall:
Specify amount: 1,326.2 mm

2.2.2 Maximum 24-hour rainfall:
Specify amount: 131.4 mm (November 29, 2008)

2.3 Terrain (select one and mark) Flat ___ Steep ___ ***Activity is offshore***

2.4 Is the facility located in a flood-prone area? (select one and mark) Yes __ No __

2.5 Ground Water- Not Applicable

Depth of groundwater table (meter) (select one and mark)

0 to less than 3 _____
3 to 10 _____
Greater than 10 _____

III. RECEIVING MEDIA/RECEPTORS

3.1 Air (Distance to nearest community) (select one and mark)

0 to less than 0.5 km _____
0.5 to 1 km _____
Greater than 1 km ____x_____

3.2 Receiving Surface Water Body ***offshore at Babuyan Channel***

3.2.1 Distance to receiving surface water: (select one and mark)

0 to less than 0.5 km ____x___
0.5 to 1 km _____
Greater than 1 km _____

3.2.2 Size of population using receiving surface water

Specify number: Not Applicable

3.2.3 Fresh Water – Not Applicable

3.2.3.1 Classification of fresh water (select one and mark)

AA _____
A _____
B _____
C _____
D _____

3.2.3.2 Size of fresh water body

Specify size: __(units: km2)

3.2.3.3 Economic value of water use (may select more than one of the criteria below)

Drinking	_____
Domestic	_____
Recreational	x
Fishery	x
Industrial	_____
Agricultural	_____

3.2.4 Salt water

3.2.4.1 Classification of salt water (select one and mark)

SA	_____
SB	x
SC	_____
SD	_____

3.2.4.2 Economic value of water use (may select more than one of the criteria below)

Fishery	x
Tourist zone or park	_____
Recreational	x
Industrial	_____

3.3 Ground Water – Not applicable

3.3.1 Distance to nearest recharge area -NA (select one and mark)

0 to less than 0.5 km	_____
0.5 to 1 km	_____
Greater than 1 km	_____

3.3.2 Distance to nearest well used -NA (select one and mark)

0 to less than 0.5 km	_____
0.5 to 1 km	_____
Greater than 1 km	_____

3.3.3 Groundwater use within the nearest well (may select more than one of the criteria below) NA

Drinking	_____
Industrial	_____
Agricultural	_____

3.4 Land – Not applicable

3.4.1 Indicate current/actual land uses within 0.5 km radius: (may select more than one of the criteria below) ***Offshore NA***

Residential	_____
Commercial/Institutional	_____
Industrial	_____
Agricultural/Recreational	_____
Protected Area	_____

3.4.2 Potential/proposed land uses within 0.5 km (may select more than one of the criteria below)
Offshore NA

Residential _____
Commercial/Institutional _____
Industrial _____
Agricultural/Recreational _____
Protected Area _____

3.4.3 Number of affected Environmentally Critical Areas within 1 km:

Specify number: _____None_____

3.4.4 Distance to nearest ECA (select one and mark)

0 to less than 0.5km _____
0.5 to 1 km _____
Greater than 1 km ___x_____

IV. ENVIRONMENTAL PERFORMANCE (FOR EXISTING PROJECTS FOR EXPANSION)

3.5 Compliance (pls. take note that this will be double-checked with PCD files)

Law	Violation (check if any)	Type (pls. specify number of times committed) STANDARD				Type of Admin Violation	Additional Remarks/Status of Compliance
		Emission/Effluent/ Discharge	Ambient	Human Impact	Admin/ ECC		
RA 8749	Not Applicable						
RA 9275	Not Applicable						
RA 6969	Not Applicable						
PD 1586	Not Applicable						
RA 9003	Not Applicable						

3.6 Number of Valid Complaints

3.6.1 Citizen and NGOs

Specify number: __none_____

3.6.2 Others (other Govt. Agencies, Private Institutions)

Specify number: __none_____

_____

(To be filled up by EMB Personnel)

RECOMMENDATION/S:

_____
_____
_____

Assessed By:

_____

Noted By: _____