REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

ROAD NETWORK DEVELOPMENT PROJECT IN CONFLICT – AFFECTED AREAS IN MINDANAO

(PARANG EAST DIVERSION ROAD)

INITIAL ENVIRONMENTAL EXAMINATION (IEE) DRAFT REPORT

CTI ENGINEERING INTERNATIONAL CO., LTD.

in association with

KRC Environmental Services

PROJECT FACT SHEETS

NAME OF PROJECT	**ROAD NETWORK DEVELOPMENT PROJECT IN CONFLICT – AFFECTED AREAS IN MINDANAO** **Parang East Diversion Road**
PROJECT LOCATION	**Municipality of Parang, Maguindanao**
ROAD WIDTH	**6.7 meters**
ROAD LENGTH (TOTAL)	**6.963 kilometers**
NAME OF PROPONENT	**Department of Public Works and Highways-Unified Project Management Office (DPWH-UPMO)** **HON. EMIL K. SADAIN, CESO I** **Undersecretary for UPMO Operations and Technical Services** **In Partnership with:** **CTI Engineering International Co. Ltd.**
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Project Background

Within Mindanao, the ARMM remains the poorest region with poverty incidence of 55.8% in 2012. Likewise, the region's GRDP in 2015 accounts for only 0.7% of the Philippines' GDP with annual average growth in the last five years of merely 1.13% which is the smallest among the regions. Similarly, economic structure of the region reflects its position as less developed where agriculture accounts for more than half (59.1%) of the GRDP with industry accounts only for 2.7% and services accounts for 38.2%.

Recognizing the above, the GOP through DPWH has made a request to the Government of Japan to undertake feasibility study of 7 priority roads identified in the 2016 JICA assisted Bangsamoro Development Plan – II. Part of the tasks is to study the possibility of utilizing Yen loan as of the possible sources of fund to implement the identified projects. The Preparatory Survey started in August 2017 and is expected to complete in May 2018

The Road Network Development Project in Conflict Affected Areas in Mindanao is a Japan International Cooperation (JICA) assisted study in the Republic of the Philippines. The said study is awarded to CTI Engineering International Co. Ltd. in joint venture with Oriental Consultants Global Co., Ltd., and IC-Net Ltd. referred to as JICA Study Team.

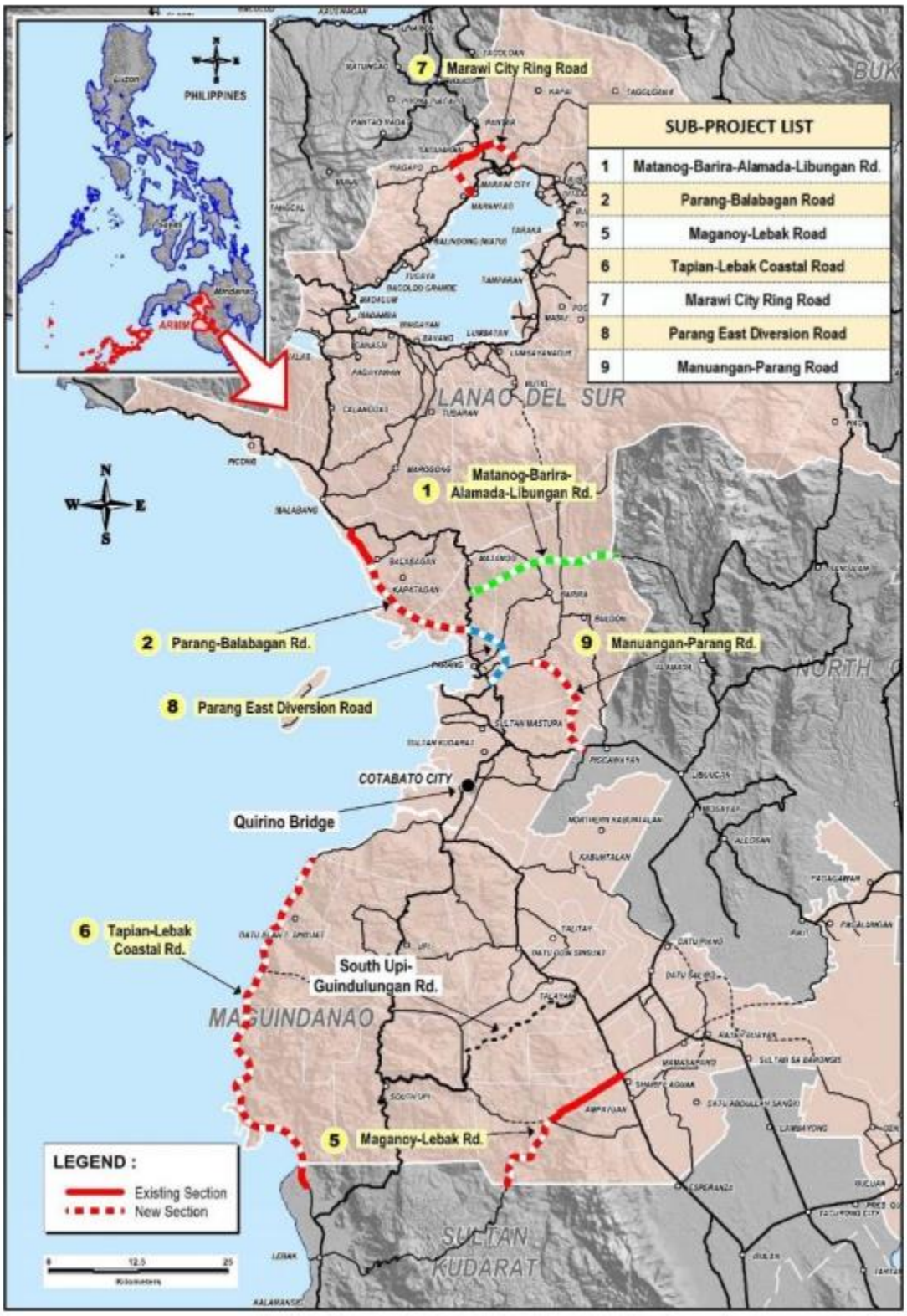
The project area has favorable natural conditions for agriculture –i.e. high temperature, plenty of rainfalls distributed throughout a year, dominant fertile soil and outside of the typhoon belt.

Infrastructure supply is also limited – ARMM for instance needs 800 km of new road to close the gap with other regions in Mindanao.

One of the reasons for delay of development is the presence of protracted armed conflict between the government and different armed groups (particularly MILF).

In recent years, efforts towards securing peace is gaining momentum, FAB (Framework on the Bangsamoro) was signed in 2014; BBL was submitted to Congress this August 2017.

For the region to recover, there's a need to complement the progress of the peace process by way of addressing the shortage of infrastructure supply in the region. Figure 1 presents the Road Network Development Projects in Mindanao.



Source: JICA Study Team

Figure 1. Proposed Road Network Development Projects in Mindanao

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Acronyms and Abbreviations

AASHTO	:	American Association of State Highway and Transportation Officials
AFP	:	Armed Forces of the Philippines
AO	:	Administrative Order
APHA	:	American Public Health Association
ARMM	:	Autonomous Region in Muslim Mindanao
ASTI	:	Academy of Science and Technology Institute
AWWA	:	American Water Works Association
BBL	:	Bangsamoro Basic Law
BOD	:	Biochemical Oxygen Demand
BWC	:	Bureau of Working Conditions
CCC	:	Climate Change Commission
CENRO	:	Community Environment and Natural Resources Office
CLUP	:	Comprehensive Land Use Plan
CPDC	:	City Planning and Development Coordinator
CPDO	:	City Planning and Development Office
CTII	:	CTI Engineering International Co., Ltd.
DA	:	Department of Agriculture
DBM	:	Department of Budget and Management
DENR	:	Department of Environment and Natural Resources
DED	:	Detailed Engineering Design
DEO	:	District Engineering Office
DGCS	:	Design Guidelines, Criteria and Standards
DILG	:	Department of the Interior and Local Government
DND	:	Department of National Defense
DO	:	Department Order
DO	:	Dissolved Oxygen
DOH	:	Department of Health
DOLE	:	Department of Labor and Employment
DOST	:	Department of Science and Technology
DOTR	:	Department of Transportation
DPWH	:	Department of Public Works and Highways
DRM	:	Disaster Risk Management
DRRMC	:	Disaster Risk Reduction and Management Council
ECC	:	Environmental Compliance Certificate
EMB	:	Environmental Management Bureau
ESSD	:	Environmental and Social Safeguards Division
FGD	:	Focal Group Discussions
JICA	:	Japan International Cooperation Agency
JST	:	JICA Study Team
HSP	:	Health and Safety Plan
IEE	:	Initial Environmental Examination
IUCN	:	International Union for Conservation of Nature
LGU	:	Local Government Unit
LWUA	:	Local Water Utilities Administration
MGB	:	Mines and Geosciences Bureau

Acronyms and Abbreviations

MILF	:	Moro Islamic Liberation Front
MPDO	:	Municipal Planning and Development Office
NAAQGV	:	National Ambient Air Quality Guideline Values
NAMRIA	:	National Mapping and Resource Information Authority
NPCC	:	National Pollution Control Commission
NWRB	:	National Water Resources Board
OSHS	:	Occupational Safety and Health Standards
PAGASA	:	Philippines Atmospheric Geophysical and Astronomical Services Administration
PCO	:	Pollution Control Officer
PHIVOLCS	:	Philippine Institute of Volcanology and Seismology
PENRO	:	Provincial Environment and Natural Resources Office
PM_{10}	:	Particulate Matter at 10 microns (μ)
PNRC	:	Philippine National Red Cross
PPE	:	Personal Protective Equipment
RAP	:	Resettlement Action Plan
TSP	:	Total Suspended Particulate Matter
TSS	:	Total Suspended Solids
UPMO	:	Unified Project Management Office

EXECUTIVE SUMMARY

Project Fact Sheet

Project Type	**Road and Bridge Construction**
Project Name	**Road Network Development Project in Conflict Affected Areas in Mindanao** **Parang East Diversion Road**
Project Location	**Municipality of Parang, Maguindanao**
Project Size	**Width: 6.7 meters** **Length: 6.963 kilometers**
Project Component	Road with total length of 6.963km (Road length: 6,718m; Bridge length: 245m) 3 Bridges: Bridge No.1: L=160m, Sta. 3+140- 3+300 Bridge No.2: L=60m, Sta. 3+560- 3+620 Bridge No.3: L=25m, Sta. 6+360- 6+385 Farm-to-market road Drainage & slope protection: RCPC (610mmR 1places): 32m RCPC (910mmR 20places) 403m Stone masonry: 600m^3 Miscellaneous: Guardrail: 4,505m Chevron Signs: 411ea Road markings: 1,741m^2 Coco-net: 29,261m^2 Temporary Camp & facilities
Project Cost	**Mil PhP 729.70**
Man Power	**1,037 man-month (skilled)** **2,275 man-month (unskilled)**

Proponent Profile

Proponent	**Department of Public Works and Highways-Unified Project Management Office (DPWH-UPMO)** **Hon. Emil K. Sadain, CESO I** **Undersecretary for UPMO Operations and Technical Services**
In partnership with **Represented by** **Email**	**CTI Engineering International Co. Ltd.** Mr. Mitsuo Kiuchi Team Leader kiuchi.mitsuo67@gmail.com; kiuchi@ctii.co.jp

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DESCRIPTION OF THE PROJECT'S EIA PROCESS

The environmental impact assessment was undertaken based on the Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) for the proposed project. The resulting study was documented in the form of an Initial Environmental Examination Report (IEER). Minimum required by DENR-EMB for the issuance of an Environmental Compliance Certificate (ECC) will be in the form of IEE checklist.

The IEER as outlined in the revised procedural manual was used as basis in the conduct of this study.

The result of the IEER shall be used by the proponent as a tool in the formulation of appropriate environmental management plan for the proposed project.

IEE TEAM

KRC Environmental Services is composed of multi-disciplinary specialists with expertise in the conduct of Environmental Impact Assessment, IEE and other environmental studies. The following are the team composition.

Ricardo A. Capule	-	President / Air & Noise Quality Specialist
Marilou P. Avenido	-	Team Leader
Maria Carmela Q. Capule	-	Project Manager/Environmental Scientist
Milagrosa P. Asuncion	-	Sociologist
Abelardo H. Angadol Jr.	-	Terrestrial Specialist
Pablito C. Argamosa	-	Geologist
Virgilio M. Garcia	-	Hydrologist

IEE STUDY SCHEDULE

The team was assigned to conduct the IEE study from November 2017 to March 2018. Public Consultations with Municipalities and Barangay Scopings were held on December 2017 and January 2018 respectively. 2nd Public consultations with Municipality was held on February 2018.

Ocular inspection of the area to determine the exact location of the project site, to establish the primary and secondary impact areas, the existing land uses, the receiving body of water, ecological characteristics, geophysical feature, etc.

Both primary and secondary were collected and used in the environmental examination and assessment of impacts of the project. Different methods were used in gathering primary and secondary data:

- Meeting with the proponent and extensive discussion on the description of the project
- Gathering and review of secondary data from proponent, private and concern government offices.
- Actual site investigation, focus group discussion and consultative meetings
- Mapping using GPS, compass, topographic and google maps
- Actual flora and fauna survey
- Actual investigation of socio economic profile and gathering and review of secondary data

IEE STUDY AREA

The scope of the study focuses on the probable adverse impact that may occur during the operation phase of the project on water, air, soil, health, people and the environment in general. The impact prediction is based on similar, past actual eventuality and perceptions based on the present physical condition of the environment

Based on the predicted impacts, the enhancement and mitigating measures were formulated to prevent the occurrence of such adverse impact. However, the limitation of the study is that it was only predictable based on the available primary and secondary physical and scientific data. The study area is within the direct impact which are Barangays Nituan, Gumagadong Calawag, Making and Manion where the road alignment and right of way are situated while the indirect impacts are the surrounding barangays, the hosts and surrounding municipalities and provinces.

IEE METHODOLOGY

Scoping with DENR is usually done to define the range of actions, alternatives, and impacts that are to be examined. The project falls under **Minor Roads and Bridges Item C.4.b (Roads, new construction, widening including RO-RO facilities)** with a total length of 5.9 kilometers having no critical scopes covered. The presented outline prepared by DENR in the Revised Procedural Manual for DAO 03-30 was used as basis to determine the actual scope of this study. **Table 1** presents the different components and methodologies of the project.

Table 1: Components and Methodologies of the Project

COMPONENT	METHODOLOGY
Project Description	Meetings with the proponent and actual site investigation
Baseline Environmental Condition	Secondary data gathered from the proponent, concern government offices and institution, actual gathering of flora and fauna, transect method in the identification of trees ,actual social-economic investigation.
Delineation of Impact areas	Annex 2-2 of Rev Procedural Manual DAO 2003-30
Impact Assessment	Qualitative assessment and expert opinion
Environmental Management and monitoring Plan	Template on Annex 2-17,2-18,2-19, 2-20 of the Rev. Procedural Manual of DAO2003-30
Secondary Data	Research, gathering and review of data from LGUs concern, PHIVOLCS, PAGASA, EMB, DPWH, CTI, LGUs

Summary of Baseline Characterization, Key Environmental Impacts and Management and Monitoring Plan

COMPONENTS/ SUBCOMPONENTS	KEY BASELINE FINDINGS
LAND	
Geology	The Project Area is dominated by volcanic plain or volcanic piedmont deposits, chiefly pyroclastics and/or volcanic debris usually found at the foot of volcanoes. Plateau basalt in Pagadian and Lanao regions, and non-active cones (generally pyroxene andesite) are also present. The most recent deposit is the Quaternary Alluvium composed of alluvium, fluviatile, lacustrine and beach deposits, raised coral reefs, and beachrock. Thick, extensive, transgressive mixed shelf marine deposits, largely wackes, shales and reef limestone are also present.
Topography	In general, Maguindanao for its part has 45 percent plain and 55 percent sloping areas. Its southwestern part consists of mountain cluster of the Binica and Blit Mountains. The biggest and longest river is the Rio Grande de Mindanao which flows through Liguasan Marsh before emptying into the Moro Gulf.
Geomorphology	The mountainous areas in the region consist chiefly of basement and Tertiary volcanic rocks; while Tertiary sedimentary rocks predominate in lowland areas. A cluster of inactive volcanoes with associated volcanic lakes in Lanao del Norte and Lanao del Sur.is collectively called the Lanao Volcanic Complex. The volcanoes include Mt. Gadungan, Dos Hermanos Peaks, Mt. Cabugao, Mt. Iniaoan, Lake Nunungan, Mt. Catmon, Mt. Sagada, Mt. Puerai and Gurain Mountains.
Terrestrial	
Flora	Survey on terrestrial fauna was undertaken within the proposed road alignment in the municipality of Parang. The five (5) observation sites for faunal species are situated in 3 barangays in Parang, namely; Nituan, Gumagandong Calawag, and Making. Observation sites are mostly situated within and along the alignment which land cover are dominantly agricultural primarily coconut plantations. Elevations of selected observation sites are in between 100 to 200 meters above sea level which topography is from gently sloping to rolling. Relative to the plant category, the majority of the plant species belong to trees (54.35%); seconded by herb (15.22%), followed by vine (13.04%); shrub (8.70%); grass (6.52%) and; the remaining 2.17% are palm trees. On the other hand, 83% of the recorded species are naturally growing and the remaining 17% are planted species.
Fauna	The overall result of **fauna** survey in the proposed project site shows the presence of 19 species of Aves belonging to 16 families with a total abundance of 92 accounted within the 5 observation sites. Dominant species belonging to Columbidae and Laniidae represented by 3 species of Dove and 2 species of Shrike, respectively. In terms of species endemicity, only 3 species of avifauna and 2 herpetofauna are found to be endemic in the country and the rest of the recorded species are native/non-endemic species. With regard to species conservation with reference to the International Union for Conservation of Nature (IUCN) (2017) showed that there are no Critically endangered nor endangered species in the category. Majority of the species are under least concern in the category, the rest are not evaluated

WATER	
Hydrology/Hydrogeology	The river systems that affect the proposed road alignment are tributaries of the Nituan and Simuay Rivers. During the conduct of field investigation, no ground water wells or springs were found that may be affected by the project and also based on the data from the National Water Resources Board (NWRB) and Local Water Utilities Administration (LWUA). In general, the proposed alignment has a low susceptibility to flooding.
Surface Water Quality	Surface water samples were sampled on December 5, 2017 on a sunny weather. Surface water samples were collected at Nituan River and Nituan irrigation. Based on the results, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), pH and TSS meet the criteria guidelines of the DENR Administrative Order No. 2016-08, Water Quality Guidelines and General Effluent Standards of 2016. It should be noted that DENR does not have regulatory standard for Turbidity.
AIR	
Climate	The area belongs to Type III climate according to the Modified Coronas Classification from which seasons are not very pronounced, relatively dry from November to April and wet during the rest of the year.
Rainfall	The nearest PAGASA synoptic station is in Cotabato City. Based on the data from this station the average annual rainfall from a 30-year record is 2487.8 millimeters. The rainiest months are from May to October.
Temperature and Humidity	The annual mean temperature is 27.8ºC with high temperature of 28.6ºC in April and low temperature of 27.3ºC in July. The lowest recorded temperature of 18.9ºC occurred on 26 January 2014 while the highest recorded temperature was 37.7ºC which occurred on 28 March 1997. The average wind speed is 2 meters per second distributed over the whole year at NNW direction. Relative humidity averages from 73% to 76% and vapor pressure averages from 28.4 millibars to 29 millibars. Mean sea level atmospheric pressure varies from 1012.6 millibars to 1011.2 millibars, with higher value in February then lower in October.
Ambient Air Quality	Air Samples were collected on December 7-9, 2017 at Purok Dulangan I, Brgy. Nituan, Parang and Brgy. Making, Parang, Maguindanao. Total Suspended Particulates, Particulate Matter at 10 micron, Sulfur Dioxide and Nitrogen Dioxide were measured. Results of air quality for all parameters measured at two (2) sites are compared with National Ambient Air Quality Guideline Values (NAAQGV) of Republic Act 8749 or known as Philippine Clean Air Act. All parameters tested are within the allowable limits.
Noise	Noise measured during morning and daytime are within the DENR standard limits of National Pollution Control Commission (NPCC) for residential areas. Ambient noise levels around the project sites during evening and nighttime are slightly higher than the standards. Sources of noise may came from animals sounds such as barking from dogs, rooster's crow, goats' bleat, sounds from insects such as crickets etc. which may have impacted the increase in sound measurement. Activities from residents near the sampling area also influenced the sound measurements during morning time.
PEOPLE	
Population	As of 2015, Parang has a total population of 89, 194 (PSA Census, 2015). Out of the 25 barangays of Parang, four (4) barangays are along the proposed road alignment. These includes Nituan, Gumagadong Calawag, Making and Manion. Among the barangays covered by SP 8, Barangay Making has the highest population of 5,989 which comprised 6.71% of the municipality's total population while the Gumagadong Calawag has the lowest population of 1,513 (1.70%).

Ethnicity	In terms of ethnicity based on the Municipal Profile of Parang (2015), Iranun is the most dominant ethnic group with almost 30% of the total population. Maguindanaon and Cebuano are the next dominant both comprising 20% of the population. Other ethnic group are Ilocano (10%), Maranao (9.96%), other Visayan language (7.20%), and Tagalog (2%). Based on the Indigenous people (IP) study conducted by CFSI, forty (40) families of migrant IP accounted in barangay Making, Parang Municipality. In terms of economy, their primary source of livelihood is farming. Their other sources of income are driving motorcycles to ferry people, and working as laborers from the construction projects. Majority of the farmers still practice slash-and-burn methods of farming. Thus, the average income of the Migrant IP communities in the three sitios in Parang (at P3,541) is still much lower than the average income of a Filipino family at P22,000 plus. With an average monthly expenditure of P3,450, the typical Migrant IP family barely has any money left to save. The IP survey team conducted interview at least ten (10) for migrant IPs on November 2017; A Key Informants interview (KII) was conducted from November 14 to 15, 2017 to discuss the following matters. This is to provide background on the proposed project and know the current situation of the IP communities; The Environmental and Social survey team conducted a random socio-economic/perception surveys from February 12 to 16, 2018 at the affected barangays to determine if there will be affected structures and properties along the alignment of the proposed project; and the study Team found that the affected project area is no Ancestral Domain application and claim.
Public Participation	The four (4) public consultation meetings were held in Parang Municipality on 7 December 2017 and 27 February 2018. Vital concerns were stressed by the panel who participated in the consultation process. These meetings were attended by a total of 199 participants (Male – 111 and Female – 20). Among the concerns raised are the affected owners of the private properties should be compensated prior to the road implementation. In case that the owner cannot present the proof of ownership, the barangay chairman committed to intervene for any form of negotiations and settlement; Prioritized work force from the affected community; and affected irrigation canal along the road alignment. Over-all, the proposed project is a welcome development as signified by the participants. The community is currently experiencing problem in the transportations that has significant effect on their way of life. Road development is anticipated by the affected community and other neighborhood barangays.

A total of 6 stakeholders' meetings were held for SP 8 from December 2017 to March 2018. The stakeholders' meetings/ public consultations conducted (1st Public Consultations, Barangay Scoping and 2nd Public Consultations) are the Information, Education and Communication (IEC) based on the Philippine EIA guidelines held in the municipal conference of Parang with the affected stakeholders, barangay and municipal officials, and concerned LGU offices such as Assessors, MPDC. Public consultations were attended by a total of 199 participants (Male – 111 and Female – 20) while barangay scoping's were attended by 46 male and 21 female.

Summary of the salient issues and concerns raised, as well as comments and suggestions made are summarized in the table below. Responses to queries are also included in the Table.

Queries/Concerns/Suggestions/Comments	Response to Queries
Project affected without land title	Based on the discussion with JICA during our meeting in Manila last November 2017, DPWH will compensate the affected land owner. In absence of land/lot title and other supporting documents will not be compensated from DPWH. Land owners should secure proper documents. For affected without land titles, we will compensate the cost of the properties affected. The government thru DPWH will be fare for those affected with and without land titles. We will include this in our study and the estimated cost of the affected properties.
Land within military reservation	There are government policies that we follow if under public lands such as the military. The affected properties, trees and displacement of habitat will be included in the computations but not the payment of the land. The alignment of the project is not yet final. We will provide a copy of the results of the inventory per Barangay level for their information and confirmation.
To avoid muslim cemetery	We will always consider and respect the heritage area for the benefit of the culture of the affected community. We need your cooperation during the survey in your community. All affected will be listed and be reported to JICA for consideration in the finalization of the project design
Realignment of the proposed road in Parang (from Sitio Nabunturan, Making to Brgy. Gumagadong Calawag.)	Suggestion will be noted and included in the report. This should also raise during the Steering Committee so that JICA/DPWH will consider the concern in finalizing the project design
If the design of the road PWD friendly	The road will follow the design road guidelines of DPWH. It includes the signage and pedestrians especially for schools. We will consider the needs of PWD particularly in pedestrians
Alignment of the proposed project	(Presented the alignment of the Project) This however might be changed in the detailed engineering
If who will pay the compensation of affected land, house, trees and crops	DPWH will be the implementing agency and will pay the acquisition of all affected land,

	structures after the inventory of RAP team considering the rules and regulation adopted by DPWH
If all the affected people's land will be acquired	You will be compensated and provided assistance (i.e livelihood)
If trees are included for compensation	Yes, it will be compensated as long as included in the inventory conducted by RAP team. DPWH will pay based on their guidelines.
Needed documents to be compensated	Certificate of land title or tax declaration certified by LGU. For the cost that wanted by the owners, we will negotiate that to DPWH based on their guidelines and by what is present cost of the said land, structures for compensation. Also, we will coordinate to the municipal assessor.
Prioritization of Local in hiring	This will be recommended to the proponent considering that they are qualified for the job.
Get the trees that will be cut	This depends to DENR. They have processes regarding tree cutting.

Photo 1: Abdul M. Ariman- quiry on land without titles (Parang)

Photo 2: Ramil Mama – Chairman, PDAO (PWD) stated if the road is accessible fir all, with signage and PWD friendly (Parang)

Photo 3: Rudy A. Cabahug – Fisher folk, MFARMC Brgy. Macasandag quoted, "We need this project for our children and to the next generation. We need to support for the development in our community. We are thankful to JICA and DPWH for their continuous support" (Parang)

Photo 4: Brgy. Chairman Reynaldo of Brgy. Making, Parang inquires for the possiblity of the realignment of the proposed road

Photo 5: Mr. Lito Ariman of Brgy. Macasandag, Parang asking to they can get those trees to be cut during the construction

Photo 6: During consultation meeting with LGU officials and PAPs of Municipality of Parang

SUMMARY OF KEY IMPACTS AND MITIGATING MEASURES

It has been determined that most of the negative impacts will be during construction phase In terms of environmental impacts, the main components that need to be managed are: compensation and relocation of displace residence and structures, dust and noise suppression, traffic management. Positive Impacts is expected during Operation Phase.

Environmental Component Likely to be Affected	Impacts	Duration and Types of Impacts	Intensity of Impacts	Mitigation/Enhancement Measures
Pre-Construction and Construction Phases				
The Land				
Geology	Ground Shaking: - The proximity of active faults to the proposed road alignment makes it susceptible to moderately strong to strong ground shaking.	Long-term, negative	High	• Conduct a site specific Probabilistic Seismic Hazard Assessment (PSHA) to quantify the rate (or probability) of exceeding various ground-motion levels. • Determine the Design Basis earthquake (DBE) and Maximum Credible Earthquake (MCE) to define the Peak Ground Acceleration (PGA) resulting from the movement of specific earthquake generator. • The ground acceleration within the study area is estimated to be 0.21g for bedrock and about 0.60g for

				soft soils, which should be considered in determining the seismic coefficient during the design of foundation of the proposed road project.
Slope	Destabilization of slope	Short-term, negative	High	• Set-up temporary fence around the construction area • Conduct slope stability analysis and construct silt trap and spoils disposal area
Terrestrial Ecology	Removal of vegetation and habitat disturbance	Long-term, negative	High	• Cutting Permit will be secured if there are trees that will be affected during construction • Limit land clearing in designated sites only. • Establishment of a small nursery as source of planting materials using the endemic species and fruit-bearing trees found onsite for the replacement of trees to be cut or removed • Gradual clearing and removal of vegetation to provide sufficient time for wildlife species to transfer to the nearby habitat. Planting of naturally-grown species in the designated areas might encourage the wildlife species to return in the future.
	Loss of planted trees, agroindustry trees such as coconut, and high-value commercial crops/trees such as banana, mango,	Long-term, negative	High	
The Water				
Water Quality	Increase in coliform level due to improper management of domestic and solid wastes	Short-term, negative	Medium	• Provision of temporary sanitation facilities such as portalets and trash bins to properly manage solid and domestic wastes to be generated by the at construction workers, particularly near the waterways; • Strict implementation of proper waste segregation scheme; • Strict implementation of daily inspection of the areas provided with temporary sanitation facilities to ensure proper waste management • Site clearing will be limited to areas needed and restricted to acceptable weather conditions
	Generation of wastewater from cleaning of construction equipment, vehicles and regular watering activities	Short-term, negative	Medium	
	Contamination of surface water with oil and grease	Short-term, negative	Medium	

				• No clearance or establishment works will be undertaken along the riverbanks during high rainfall conditions to reduce the risk of sediment loss to the environment • Set up adequate toilet facilities; ensure sufficient washrooms for workers • Installation of silt traps to contain inflow of muddy waters • Installation of oil traps and proper storage of used oil
The Air				
Air Quality	Possible increase the TSP levels of due to resuspension of dust particulates	Short-term, negative	High	• Exposed and cleared construction areas will be regularly sprayed with water to minimize dust re-suspension; • Temporary stockpiles of excavated materials and construction spoils must be covered with tarpaulin or sack materials to prevent resuspension of particulate matters; • Construction spoils will be regularly hauled and disposed to areas duly-approved by the DENR/LGUs
	Possible increase in the ambient concentration levels of NO2 and SO2 due to operation of various construction vehicles, equipment, and machineries	Short-term, negative	High	• Periodic Maintenance Service (PMS) of construction vehicles, heavy equipment and machineries must be regularly conducted to ensure these are in good working condition; and • Daily routine check-up of construction vehicles, equipment, and machineries must be strictly complied with
Noise Level	Possible increase in the noise level in the area due to operation of various construction equipment and machineries	Short-term, negative	High	• Bored piles using a special boring equipment will be adopted during foundation works instead of pile driving; • Noise suppressors will be installed to maintain noise generated by various

				heavy equipment and construction machineries at permissible limit; • High noise generating activities will be done during the daytime to minimize noise disturbance to adjacent residential areas; and • Temporary noise barriers will be installed at noise sensitive areas such as residential, schools, and places of worships to maintain noise level at permissible limit
The People				
Communities along the Alignment	During pre-construction phase, significant impact identified is the apprehension of locals towards project development. This may attribute to the loss of their land, crops and other properties that might possibly be affected by the implementation of the proposed project.	Short term, negative	High	• Information dissemination in the community about the project through coordination with LGU's, PO's, NGO's, barangay officials and other concerned community groups should be conducted. This program will introduce the proposed project in the area and avert negative perception of people towards the project. • Consultation with landowners, farmers, tenants with regards to the development of an acceptable land acquisition and compensation package.
Assets and Properties	Loss of private lands, settlements	Long term, negative	High	• Determine conditions of the affected people and tagging of existing structures as control measures. • Provide food, transport and livelihood assistance, and orderly dismantling of structures • Determine exact legal status of these displaced individuals and implement measures to compensate and restore/ improve their standard of living • Involve these affected individuals in the planning of their relocation to secure

				their commitment and sense of ownership of the program • Create a grievance committee that will arbitrate, address matters of claims and disputes with regards to compensation or benefits • Acquisition of private properties will be limited to the required 30 m RROW • Prompt payment of compensation at fair market values for land (DPWH R.A. 10752). Compensation and relocation concerns should be closely coordinated with the LGUs, barangay and affected community. A detailed Resettlement Action Plan will be prepared to properly and completely document and inventory all the project affected people, lands, and other properties for possible compensation and relocation. Intensive consultation with the affected people during this period will be undertaken to avoid misunderstanding and opposition against the project.
Employment	Generation of temporary employment	Short-term, positive	High	Qualified skilled workers and laborers in the Direct Impact Areas (DIA) duly endorsed by the Brgy. Captains will be given priority in hiring during implementation of the project. This will reduce numbers of migrant workers
Public health	Possible spread of communicable diseases due to solid and domestic wastes generated by the construction personnel	Short-term, negative	Medium	• Temporary sanitation facilities such as garbage bins and portable toilets must be provided by the Contractor at the construction area; • Regular disposal of the solid and domestic wastes to the designated disposal areas duly-approved by the host and affected

				LGUs must be strictly complied with • Weekly inspection of the work sites must be undertaken to ensure proper management of the solid and domestic wastes generated
Occupational health	Construction personnel, particularly operators of heavy equipment and machineries may experience upper respiratory ailments and may likewise experience temporary hearing problems	Short-term, negative	Medium	• Construction personnel will be provided with Personal Protective Equipment (PPE) such as protective masks, ear muffs, and hard hats, and related gears • First aid stations supervised by the Environment and Safety Health Officer (ESHO) of the Contractor will be located within the construction site
Temporary Employment and Small-scale Business Opportunities	Availability of temporary employment during construction period. Female members of the community, particularly wives of tenant farmers can engage in small scale business enterprises such as eateries, and supply of other goods and services	Short-term, Positive	High	• Qualified skilled workers and laborers in the DIA will be given first priority in hiring during construction period • Applicant workers will be required to secure certification from their respective barangays to confirm residency status in the area; • Strict screening of female members of the community to ensure that those who will be given priority in the business concessions to be created are the directly affected persons
Traffic	Traffic congestion during transport of construction materials and in the construction area	Short-term, negative	Medium	• Approved Traffic management Plan (TMP) and re-routing schemes will be strictly implemented to minimize traffic congestion on said road junctions; • Parking time of idle construction vehicles and equipment along the major roads will be limited, especially during rush hours; • Transport of fabricated construction materials will be done during nighttime;

Operation Phase				
The People				
Basic Services	The new road will provide easier transport of products from Farm to Market	Long term, positive	High	Care and proper maintenance of the road to lengthen the benefits of the communities
Abandonment Phase				
Land	Land degradation	Long-term	High	• Preparation and implementation of comprehensive abandonment management plan • Proper clean-up and decontamination of affected site • Proper demolition of temporary construction yard and facilities • Disposal of hazardous waste

Summary of Compliance Monitoring

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling & Measurement Plan			Lead Person
			METHOD	FREQUENCY	LOCATION	
CONSTRUCTION PHASE						
Environmental Aspect	Fresh Surface Water Quality Stations: Major river tributaries River sediments	Surface Water Total Suspended Solids (TSS), pH, BOD, DO, Oil & Grease, Color, turbidity -Heavy metals (As, Ba, Cd, Cr, Cu, Pb, Hg,Se,F)	Grab Sampling RA 9275 RA 6969	Monthly Semi-annual	Upstream; midstream and downstream Sampling point to be monitored should be within the project site Same stations with fresh surface water quality	PCO
	Air Quality Proposed site locations upwind and downwind	Total Suspended Particulates (TSP)	1-hr Sampling per RA 8749	Monthly	Upwind; downwind; NSEW direction	PCO
	Noise Quality Same as air station	Ambient Noise (especially during drilling activities)	Grab sampling	Monthly/ Weekly during drilling	Upwind; downwind; NSEW direction	PCO

	Solid Wastes	Construction debris, papers, plastics, biodegradable waste		Daily	Construction site / SW storage area	PCO
	Wastewater (domestic)	TSS, BOD, pH, Oil & Grease (canteen)	Grab Sampling RA 9275	As necessary	Common septic tanks for toilets & canteens	PCO
	Chemicals & Hazardous Wastes	Used oil, busted lamps Used paints, spent solvents	Individual segregation & collection		Storage Area/ Motorpool	PCO
	Socio-economic	Displacement of informal settlers; relocation Recruitment/ hiring for manual labor & other skills available within the Host Barangay & nearby communities			Project location	CRO
	Terrestrial Flora & fauna Impacts	Flora- species dominance within quadrants in terms of total cover, relative ground cover, absolute density, absolute frequency, relative density and relative frequency of individual species Fauna – species diversity index, dominance index, and evenness index Soil Nutrients, Plant Tissue Nutrients	Line transect/ quadrat / trap	Annual	Within project vicinity and its affected barangays	PCO
ABANDONMENT PHASE (IMMEDIATE AFTER CONSTRUCTION PHASE)						
Environmental Aspect Land	Clearing of construction debris; removal of construction equipment	-Heavy metals (As, Ba, Cd, Cr, Cu, Pb, Hg,Se,F)	Systematic sampling: Several Grab and composite Sampling	As prescribed	Contaminated sites	PCO

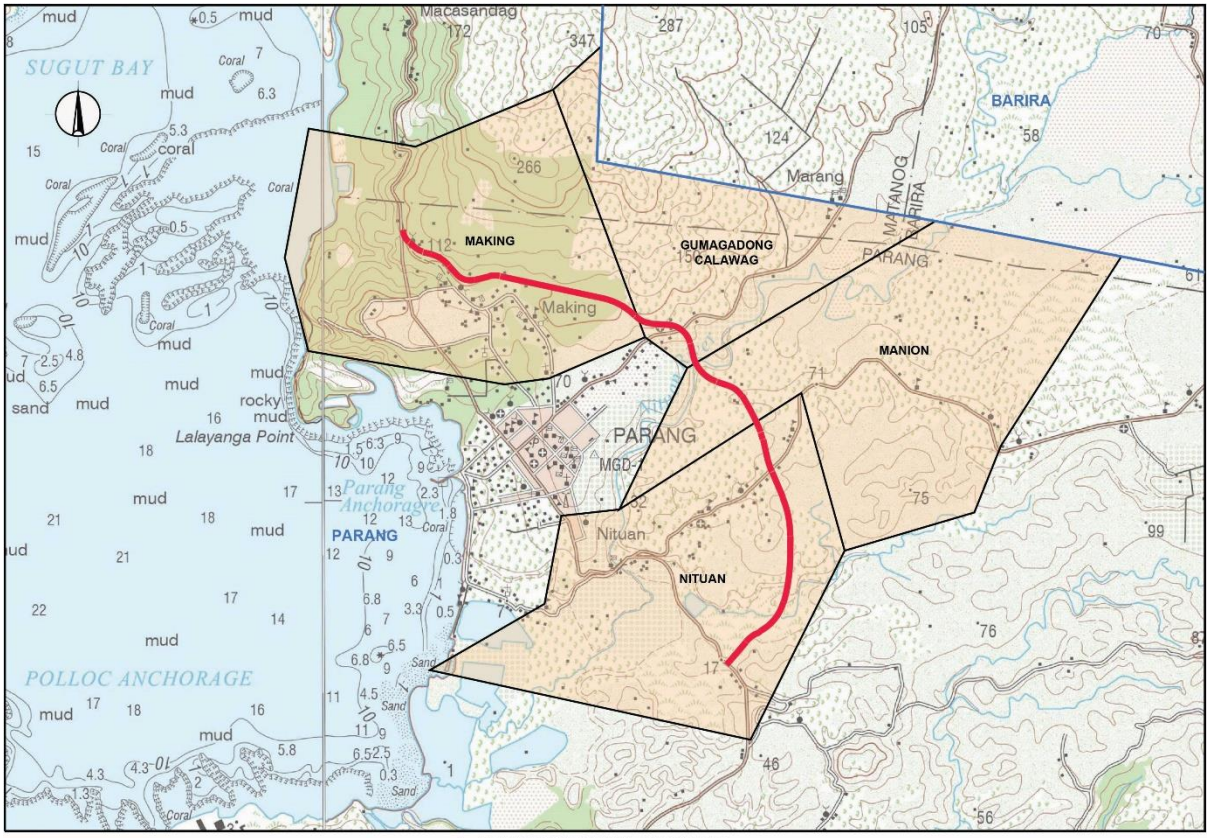
Section 1

PROJECT DESCRIPTION

1.1 PROJECT DESCRIPTION

1.1.1 PROJECT LOCATION AND AREA

The proposed road alignment will traverse the Municipality of Parang, Maguindanao. **Figure 1** shows the location map of the study area. **Table 1** shows the list of Municipalities and affected barangays.

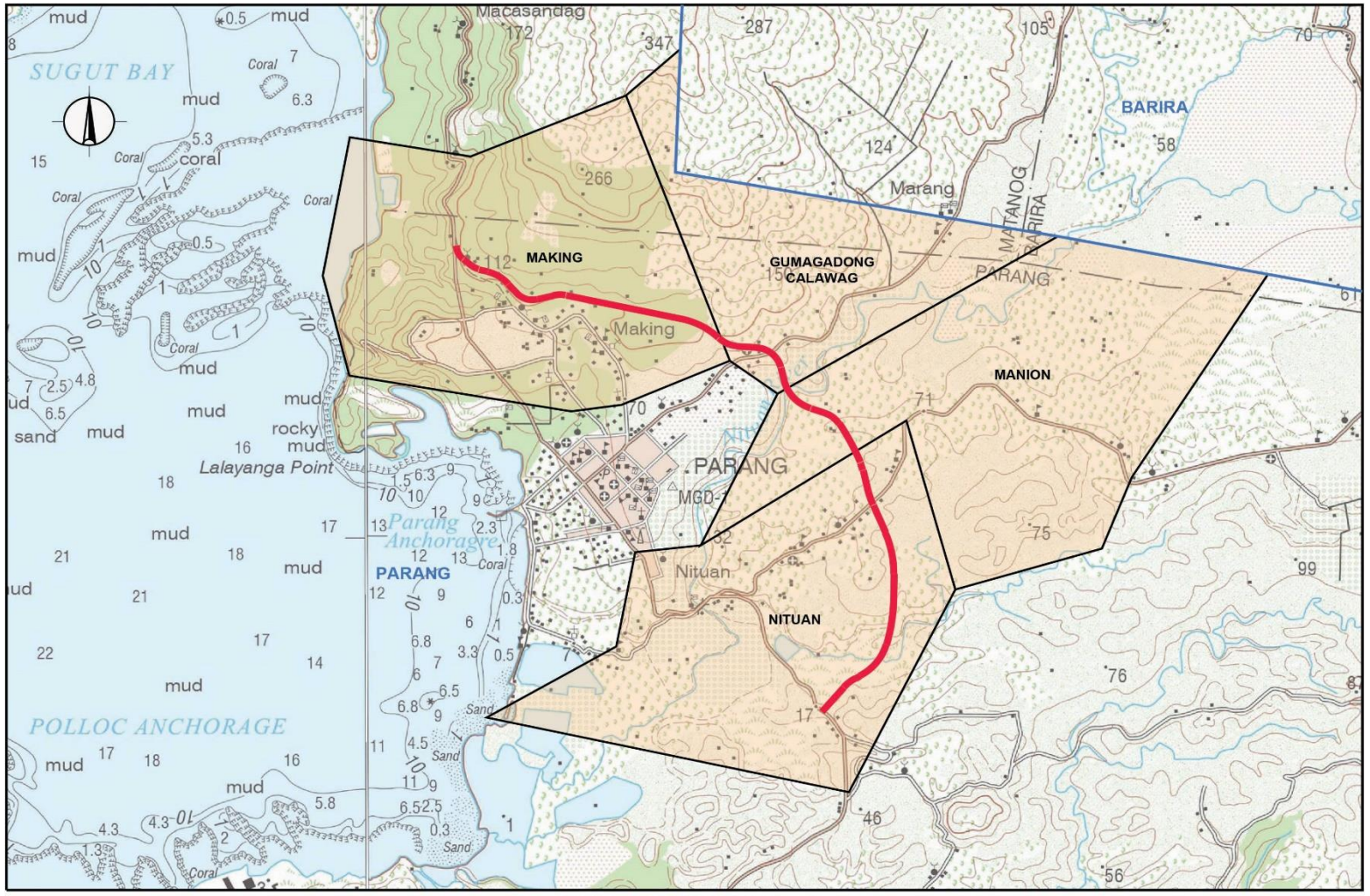


Source: JICA Study Team
Figure 1. Location Map Showing the study area

Table 1: **Parang East Diversion Road**

Municipality	Name of Barangay
Parang	Nituan
	Gumagadong Calawag
	Making
	Manion

Figure 2 shows the map of affected Barangays traversing the road alignment along the Municipality of Parang, Maguindanao.



Source: JICA Study Team

Figure 2. Map Showing the Affected Barangays at Sub-Project 8

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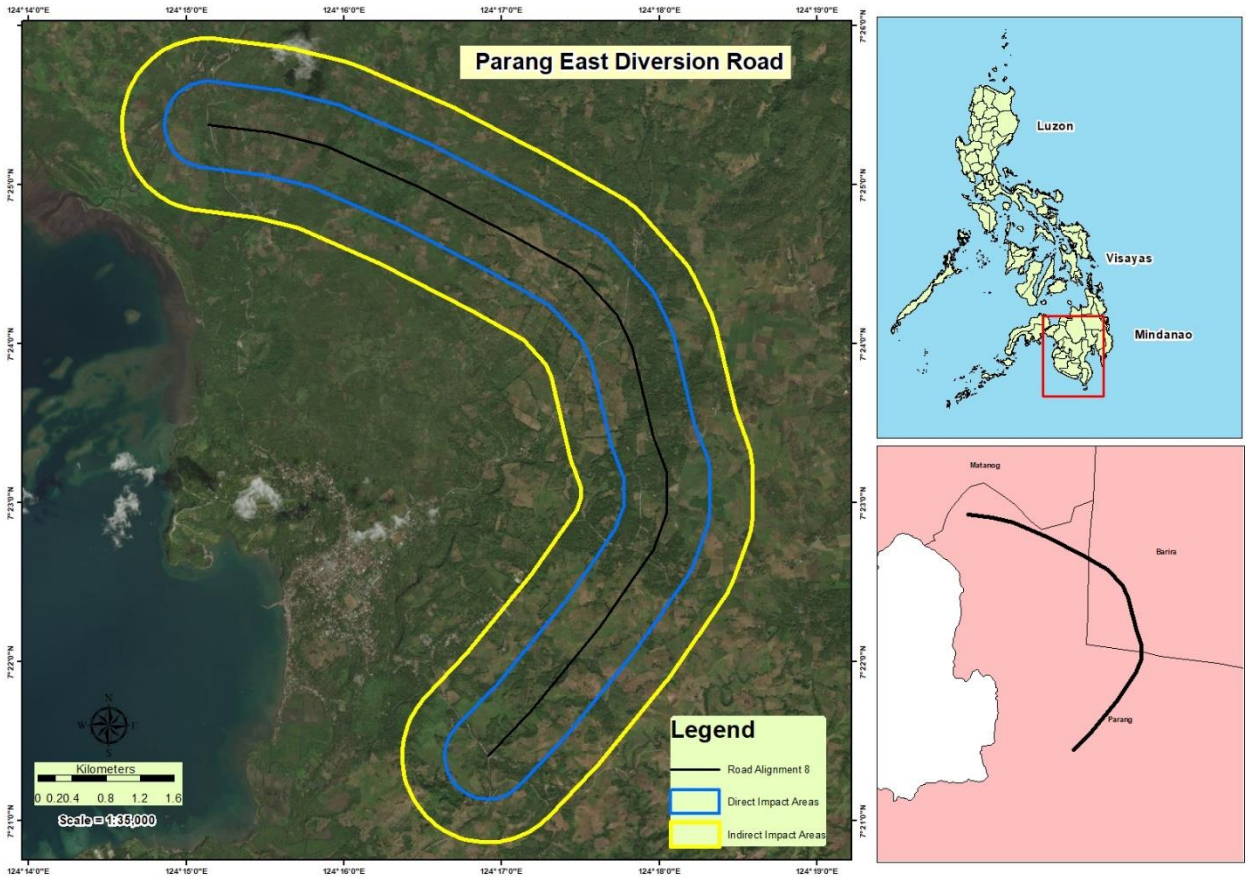
1.1.2 Primary and Secondary Impact Areas

As per DENR Administrative Order 2003-30 the direct impact of the project will be the areas of the whole alignment of the road or the proposed construction area. With the implementation of the proposed project, some aggregates of residential area and agriculture lands will be will be affected by the project. **Figure 3** shows the map of direct and indirect impact of the study area at 1 km radius. impact area- 100 meters from the center line in both sides (total of 200 meters) width. This covers the total width of the road intended for construction and immediate vicinity which will be impacted during construction activities.

Indirect impact- width is about 500 meters in both sides (total of 1km. width). This covers areas that will experience certain disturbance/enhancement of environment brought by the project activities. i.e. dust, noise, traffic adversity, peace and order issues due to possible temporary migration of workers in the project site etc. while, positive impact will be increased in goods/supply demand due to presence of workers which local economy will somehow be enhance during the construction phase.

During the pre-construction phase, there are certain populations, house structures, improvements, crops and private lands directly affected by the project due to the acquisition of Right of Way (RoW) for the construction and improvements of proposed road.



Source: Google Earth

Figure 3. Impact Map the study area

1.2 PROJECT RATIONALE

The project area has favorable natural conditions for agriculture –i.e. high temperature, plenty of rainfalls distributed throughout a year, dominant fertile soil and outside of the typhoon belt. Infrastructure supply is also limited – ARMM for instance needs 800 km of new road to close the gap with other regions in Mindanao.

One of the reasons for delay of development is the presence of protracted armed conflict between the government and different armed groups (particularly MILF).

In recent years, efforts towards securing peace is gaining momentum, FAB (Framework on the Bangsamoro) was signed in 2014; BBL was submitted to Congress this August 2017.

For the region to recover, there's a need to complement the progress of the peace process by way of addressing the shortage of infrastructure supply in the region.

Within Mindanao, the ARMM remains the poorest region with poverty incidence of 55.8% in 2012. Likewise, the region's GRDP in 2015 accounts for only 0.7% of the Philippines' GDP with annual average growth in the last five years of merely 1.13% which is the smallest among the regions. Similarly, economic structure of the region reflects its position as less developed where agriculture accounts for more than half (59.1%) of the GRDP with industry accounts only for 2.7% and services accounts for 38.2%.

The road infrastructure of ARMM is less developed as well compared to other regions. While the country and Mindanao has an average road density of 0.25 and 0.17 respectively, ARMM has only 0.10. This means that for the ARMM to close the gap and reach the Mindanao average, at least 800 km of new roads should be constructed. The signing of the Comprehensive Agreement on Bangsamoro (CAB) between the government and the Moro Islamic Liberation Front (MILF) in March 2014 however is expected to provide extra push for social and economic development of ARMM.

Recognizing the above, the Government of the Philippines through DPWH has made a request to the Government of Japan to undertake feasibility study of 7 priority roads identified in the 2016 JICA assisted Bangsamoro Development Plan – II. Part of the tasks is to study the possibility of utilizing Yen loan as of the possible sources of fund to implement the identified projects. The Preparatory Survey started in August 2017 and is expected to complete in May 2018.

The Road Network Development Project in Conflict Affected Areas in Mindanao is a Japan International Cooperation (JICA) assisted study in the Republic of the Philippines. The said study is awarded to CTI Engineering International Co. Ltd. in joint venture with Oriental Consultants Global Co., Ltd., and IC-Net Ltd. referred to as JICA Study Team.

National level

The project is in line with the trust of the government to encourage economic development, reduce poverty and contribute in the government effort to peace development in the conflict-affected area in Mindanao. As shown below its objectives.

- To contribute in economic development;
- To contribute in poverty reduction;

- To contribute in peace building in the conflict-affected areas through improvement and construction of roads and bridges which would facilitate smoother commodity flow, more active economic activities and improved accessibilities and linkages to other regions in Mindanao.

Regional level

For Sub-Project 8, Parang East Diversion Road, the following are the specific objectives:

- Increase flexibility of the network by linking two primary inter-city roads (Cotabato-Pagadian Road and Cotabato-Davao Road)
- Support small farmers by providing reliable access road that would result to reduced transport cost of their products.
- Promote development of agri-industry such as banana plantation by provision of high capacity road.
- Support peace building by improving access to MILF camps and other areas without stable road connection due to long-protracted armed conflicts.
- Provide access to the areas with high poverty incidence (56.53%) to help them access social services and sell their products to urban centers with minimal transportation cost.

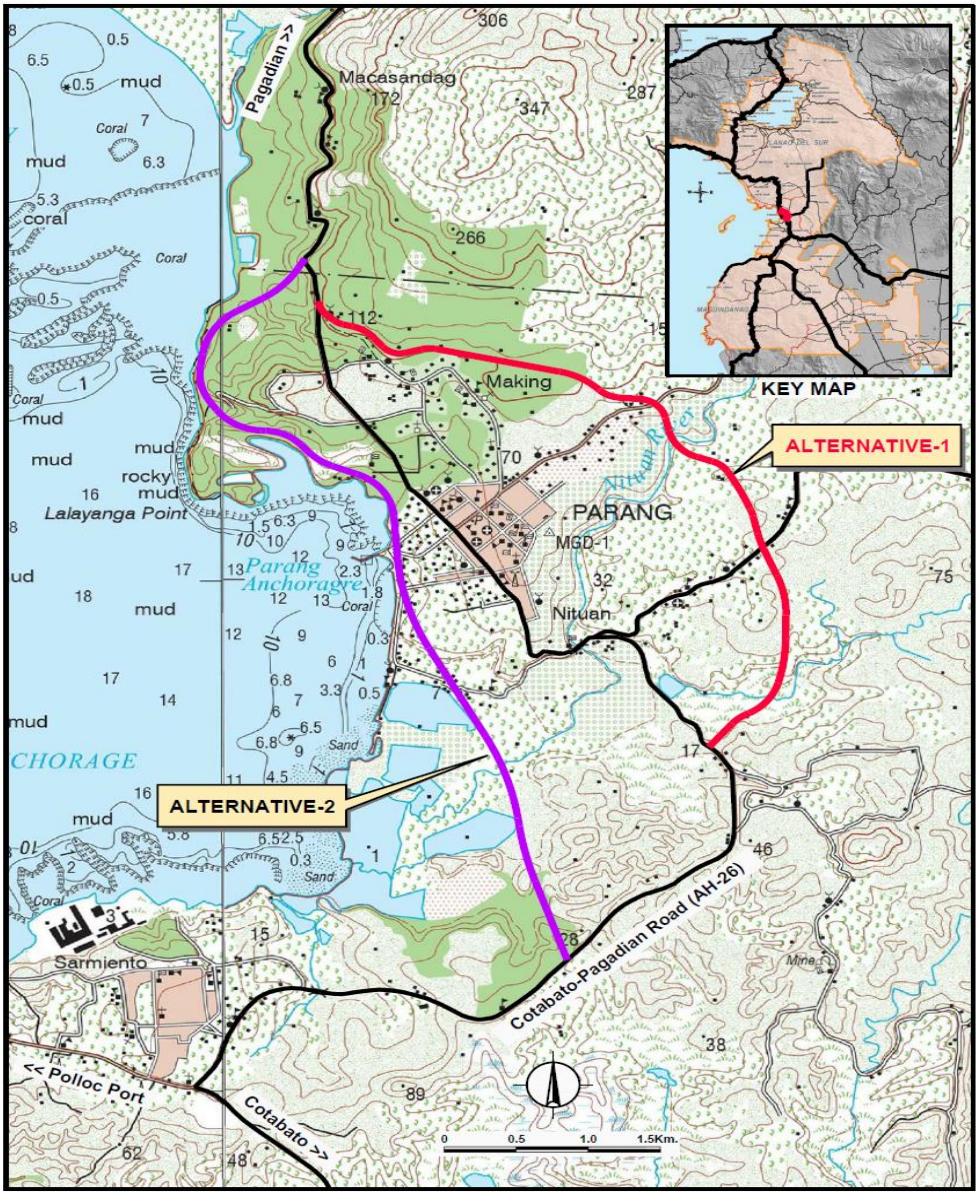
1.3 Project Alternatives

1.3.1 Design Criteria and Standards

1.3.2 Alignment Study

Project alternative here would mean the different alignment that were considered. At least two (2) alignment were studied. And based on the bases of studies shown below and the evaluation made as shown in **Table 2**, Alternative 1 was the choice.

Figure 4 shows the alternative alignments for Sub-Project No. 8.



Source: JICA Study Team

Figure 4. Alternative Alignments for Parang East Road

The following were the bases on evaluating alternative alignments.

- Best Alternative:
  Evaluated to be “Good” ○
- Within 10% difference from the Best Alternative:
  Also evaluated to be “Good” ○
- Within the 10% to 20% Difference from the Best Alternative:
  Also evaluated to be “Medium” △
- More than 20% Difference from the Best Alternative:
  Evaluated as “Bad” X

Table 2 presents the evaluation on alternative alignments.

Table 2. Evaluation on Alternative Alignments

Indicators	Items		Unit	ALT-1		ALT-2	
Cost, Consruction Period	Total Road Length		km	5.9	○	7.0	△
	Utilization of Existing Road/Trail		km	0.0	×	0.4	○
	New construction road length		km	5.9	-	6.6	–
	No. of bridges		nos	2	-	3	-
	Total length of bridges		m	460	○	850	×
	No. of box culverts		nos	1	-	2	-
Economic Impact	No. of Direct Beneficiaries		persons	19,174	×	41,170	○
	Agricultural land areas to be served		km	0.45	○	0.00	×
Environmental Impact	High-filling section length (H= 10m or more)		m	700	○	709	○
	High-cutting section length (H= 10m or more)		m	400	○	865	×
	Number of houses/buildings affected		nos	14	○	178	×
Technical Features	Alignment	Total no. of curves	nos	5	-	10	-
		No. of curve radius < 300m	nos	0	○	0	○
		Length of vertical grade ≧ 5%	m	1,500	×	1,014	○
	Suitability in view of road network		-	Expected to induce the urban areas to the suburbs	○	Since facing the sea, the expansion of urban areas is	×
Evaluation				○ = 8 △ = 0 × = 3		○ = 5 △ = 1 × = 5	
Recommendation				Recommended		-	

Source: JICA Study Team

1.4 PROJECT COMPONENTS

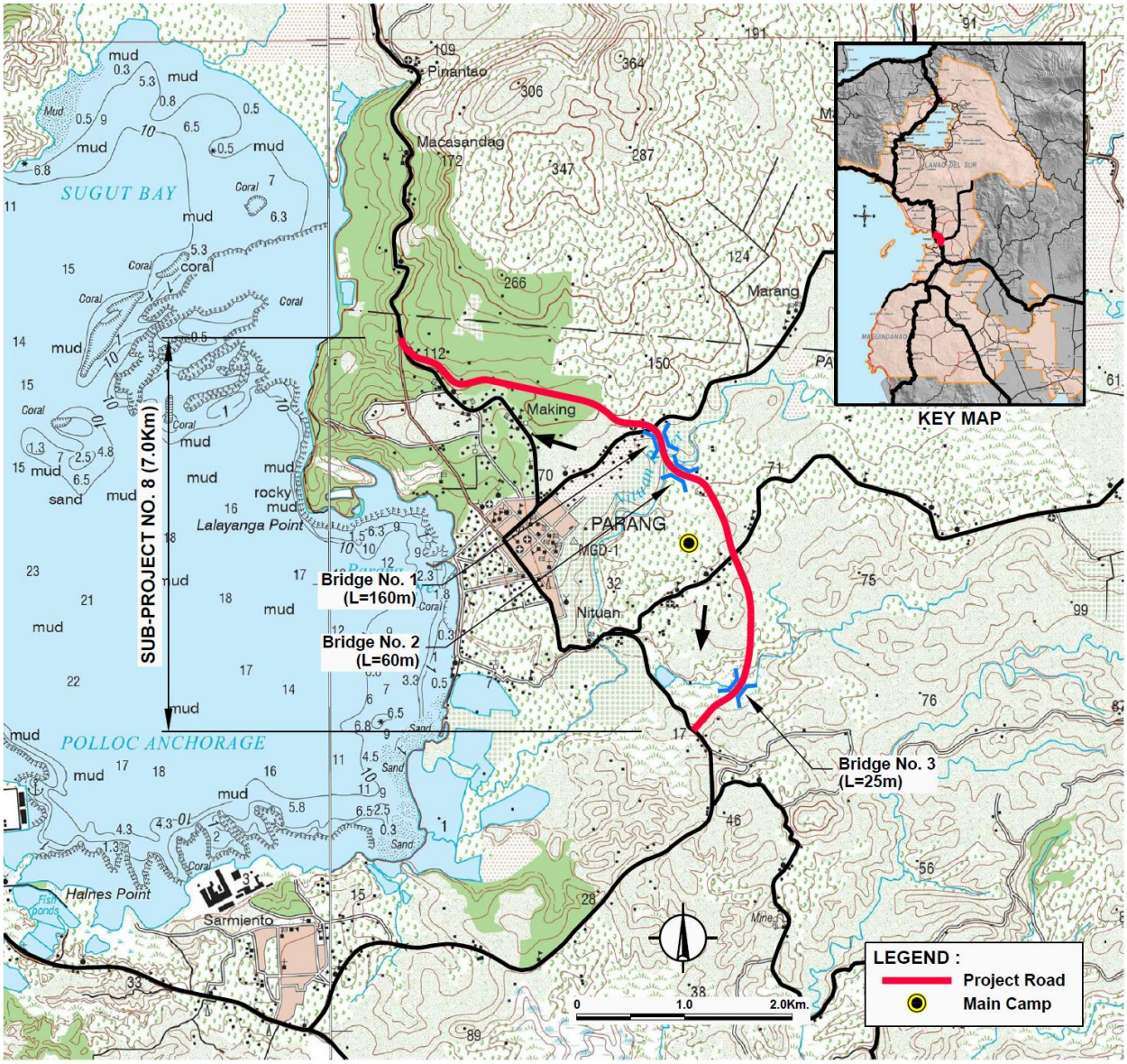
The project is to construct a bypass road of Parang Municipality Center and passes through rolling to mountainous terrain. **Figure 5** shows the construction plan.

Table 3 presents the proposed Subproject 8 project components.

Table 3. Components of the Construction Plan

Item	Contents
Road length	6.963km (Road length: 6,718m; Bridge length: 245m)
Earth work	Clearing: 18.4ha Roadway Excavation: 37,000m^3 Embankment from Roadway: 121,000m^3
Pavement work	PCCP (280mm): 52,995m^2
Road shoulder work	PCCP shoulder (150mm): 19,312m^2 Gravel surface shoulder: 2,641m^3
Bridge	Bridge No.1: L=160m, Sta. 3+140- 3+300 Bridge No.2: L=60m, Sta. 3+560- 3+620 Bridge No.3: L=25m, Sta. 6+360- 6+385
Drainage & slope protection work	RCPC (610mmR 1places): 32m RCPC (910mmR 20places) 403m Stone masonry: 600m^3
Miscellaneous work	Guardrail: 4,505m Chevron Signs: 411ea Road markings: 1,741m^2 Coco-net: 29,261m^2

Source: JICA Study Team



Source: JICA Study Team

Figure 5. Construction Site and Packages

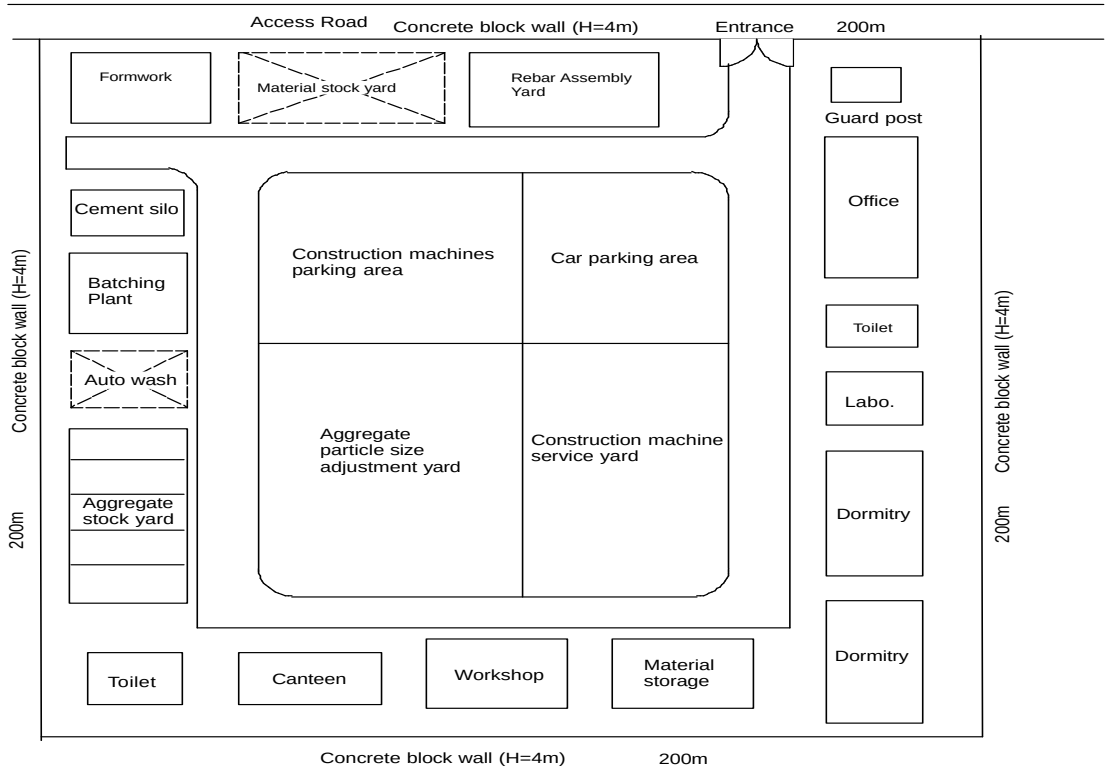
Farm-to-Market Road

During the series of public consultations at barangay level under this Study, the subject of farm-to-market roads (FMR) was always raised by the communities to extend the influence of sub-project road to their productive lands (farms). The road should be planned in a way that it supports the said industry comprehensively. This can be done by including FMRs in the sub-projects. Length of each farm-to-market road may extend from 2 km to 5 km depending on the productivity level of target productive land.

Main Camp

The selection of construction yard is definitely important. Appropriate locations of main temporary camp for construction should be identified. Although the construction yard is only a temporary site, however, large volume of concrete materials through the concrete batching plant shall be required, hence, an appropriate area for this yard is needed in the east segment. The selection of temporary yard for construction will be decided during the detailed design stage,

and the contractor will select the proper location of the construction site and its area size during tender procedure. Proposed Main Camp Location and size is shown in **Figure 6**.



Source: JICA Study Team
Figure 6. Proposed Main Camp

1.4.1 Design Criteria and Standards

In order to achieve the objectives of the project, the roads, bridges and other structures shall be designed in consideration of providing a high grade road as national highway which would facilitate smoother commodity flow, more active economic activities and improve accessibilities and linkage to other regions.

The preliminary design of the road, bridges, and other structures will be executed mainly in accordance with "Design Guideline, Criteria and Standards published by the Department of Public Works and Highway (DPWH-DGCS)" and Japanese standard will be applied to the design as a supplement.

The proposed Subproject 1 is a 14-kilometer road with 6.7 meters long and a Road Right-of-Way at 30 meters. The number of lanes required is set at two-lanes initially. Projected increase in number of lanes from 2-lanes to 4-lanes will be after 2035 depending on traffic demand.

1.4.2 Road Design

1.4.2.1 Geometric Design Standards

a) National Road Classification for Subproject 8

The road classification for subproject 8 – Parang East Diversion Road is tertiary located in rural area.

b) Road Design Criteria for Subproject

i. Applied Design Criteria in relation with Road Classification

Highway design standard of DPWH in Philippines basically defines the standard in accordance with traffic volume. However, National Tertiary Road is not indicated in Highway Design Standard of DPWH. On the other hand, Expressway is treated as one of functional classification. In AASHTO, an expressway (a freeway) is not a functional class in itself but is normally classified as a principal arterial. In reference with the former highway design standard of DPWH, it is recommended to apply the road classification as follows:

	ADT Range
• National Primary Road	More than 2,000
• National Secondary Road	1,000 – 2,000
• National Tertiary Road	400 – 1,000

ii. Design Target Year for Number of Lanes

In a practical sense, the design volume should be a value than can be estimated with reasonable accuracy and it is believed the maximum design period is in the range of 15 to 24 years. Therefore, a period of 20 years is widely used as a basis for design year from planning stage. Traffic cannot usually be forecast accurately beyond this period on a specific facility. For the subprojects, design year for number of lanes is proposed year 2035.

iii. Geometric Design Criteria for Subprojects

The proposed design criteria is tabulated in **Table 4**.

iv. Maximum Superelevation

The subproject roads not only strengthen the highway network, but also contribute to the enhancement of agro-fishery business. The trucks for this business in ARMM are generally old and over-loaded. When such trucks stop on the curve with high superelevation, it may roll over. Also, for slow-moving vehicles such as agriculture vehicles, pedestrian and bicyclists, high superelevation is uncomfortable, dangerous and may causes accidents.

Table 4. Summary of Geometric Design Standards for Subprojects

Road Classification	National Tertiary	National Secondary	National Primary
Average Daily Traffic (ADT)	400-1,000	1,000-2,000	More than 2,000
	Design Speed (km/h)		
Flat Topography	70	80	95
Rolling Topography	60	60	80
Mountainous Topography	40	50	60
	Min. Horizontal Radius (m)		
Flat Topography	160	220	320
Rolling Topography	120	120	220
Mountainous Topography	50	80	120
	Max. Horizontal Radius for Use of a Spiral Curve Transition (m)		
Flat Topography	290	379	592
Rolling Topography	213	213	379
Mountainous Topography	95	148	213
	Max. Vertical Grade (%)		
Flat Topography	5.0	4.0	3.0
Rolling Topography	6.0	5.0	5.0
Mountainous Topography	8.0	7.0	6.0
	Min. Crest Vertical Curve Based on SSD (K-value)		
Flat Topography	17	26	52
Rolling Topography	11	11	26
Mountainous Topography	4	7	11
	Min. Vertical Curve on Sag (K-value)		
Flat Topography	23	30	45
Rolling Topography	18	18	30
Mountainous Topography	9	13	18
	Typical Cross Section (m)		
Cross-fall for Pavement (%)	1.5	1.5	1.5
Cross-fall for Shoulder (%)	3.0	3.0	3.0
Carriageway Width (m)	3.35	3.35	3.35
Shoulder Width (m)	1.50	2.50	3.00
Right of Way Width (m)	30	30	30
Superelevation (%)	6.0 (max.)	6.0 (max.)	6.0 (max.)
	Non Passing (Stopping) Sight Distance (m)		
Flat Topography	90	115	150
Rolling Topography	70	70	115
Mountainous Topography	40	60	70
	Passing Sight Distance (m)		
Flat Topography	490	560	645
Rolling Topography	420	420	560
Mountainous Topography	270	360	420
	Surface		
Surface Type	Portland Cement Concrete	Portland Cement Concrete	Portland Cement Concrete

Source: JICA Study Team

Where there is a tendency to drive slowly, it is common practice to utilize a lower maximum rate of superelevation, usually 4 to 6%. The terrain of subproject areas is mountainous. Therefore, the maximum superelevation is recommended to apply 6.0%.

v. Superelevation Rates

When the maximum value of superelevation is applied 6%, the superelevation rates are shown in **Table 5**.

Table 5. Minimum Radii for Design Superelevation Rates, Design Speeds and e_{max} = 6%

	Design Speed (kph)	20	30	40	50	60	70	80	90	100	110	120	130
e (%)	NC	194	421	738	1050	1440	1910	2360	2880	3510	4060	4770	5240
	RC	138	299	525	750	1030	1380	1710	2090	2560	2970	3510	3880
	2.2	122	265	465	668	919	1230	1530	1880	2300	2670	3160	3500
	2.4	109	236	415	599	825	1110	1380	1700	2080	2420	2870	3190
	2.6	97	212	372	540	746	1000	1260	1540	1890	2210	2630	2930
	2.8	87	190	334	488	676	910	1150	1410	1730	2020	2420	2700
	3.0	78	170	300	443	615	831	1050	1290	1590	1870	2240	2510
	3.2	70	152	269	402	561	761	959	1190	1470	1730	2080	2330
	3.4	61	133	239	364	511	697	882	1100	1360	1600	1940	2180
	3.6	51	113	206	329	465	640	813	1020	1260	1490	1810	2050
	3.8	42	96	177	294	422	586	749	939	1170	1390	1700	1930
	4.0	36	82	155	261	380	535	690	870	1090	1300	1590	1820
	4.2	31	72	136	234	343	488	635	806	1010	1220	1500	1720
	4.4	27	63	121	210	311	446	584	746	938	1140	1410	1630
	4.6	24	56	108	190	283	408	538	692	873	1070	1330	1540
	4.8	21	50	97	172	258	374	496	641	812	997	1260	1470
	5.0	19	45	88	156	235	343	457	594	755	933	1190	1400
	5.2	17	40	79	142	214	315	421	549	701	871	1120	1330
	5.4	15	36	71	128	195	287	386	506	648	810	1060	1260
	5.6	13	32	63	115	176	260	351	463	594	747	980	1190
	5.8	11	28	56	102	156	232	315	416	537	679	900	1110
	6.0	8	21	43	79	123	184	252	336	437	560	756	951

Source: JICA Study Team

vi. Traveled-Way Widening on Horizontal Curves

According to the equation in AASHTO, proposed traveled-way widening on horizontal curves are listed in **Table 6**.

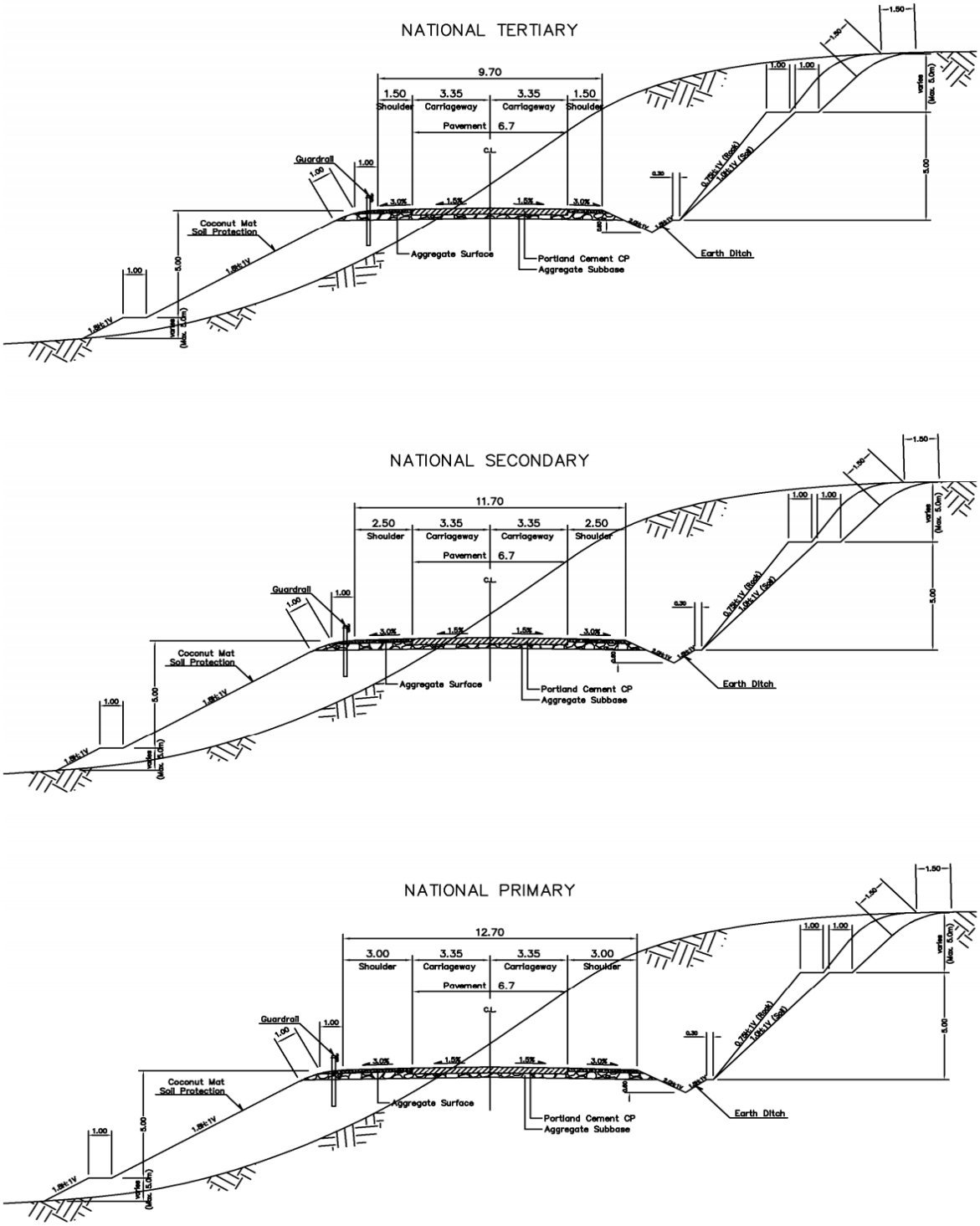
Table 6. Summary of Geometric Design Standards for Subprojects

No. of lanes		2			2			2		
Traveled-way width (m)		6.7			6.7			6.7		
Design Speed (kph)		40	60	70	50	60	80	60	80	95
Radius of curve (m)	1,000	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.5
	900	0.3	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5
	800	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.5	0.6
	700	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.6
	600	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.7
	500	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.8
	400	0.7	0.8	0.8	0.7	0.8	0.9	0.8	0.9	1.0
	300	0.9	1.0	1.0	0.9	1.0	1.1	1.0	1.1	1.2
	250	1.0	1.2	1.2	1.1	1.2	1.3	1.2	1.3	
	200	1.3	1.4	1.5	1.3	1.4	1.5	1.4	1.5	
	150	1.6	1.8	1.9	1.7	1.8		1.8		
	140	1.7	1.9		1.8	1.9		1.9		
	130	1.9	2.0		2.0	2.0		2.0		
	120	2.0	2.2		2.1	2.2		2.2		
	110	2.2			2.3			2.4		
	100	2.4			2.5			2.6		
	90	2.6			2.7					
	80	2.9			3.0					
	70	3.3								
	60	3.9								
	50	4.6								

Source: JICA Study Team

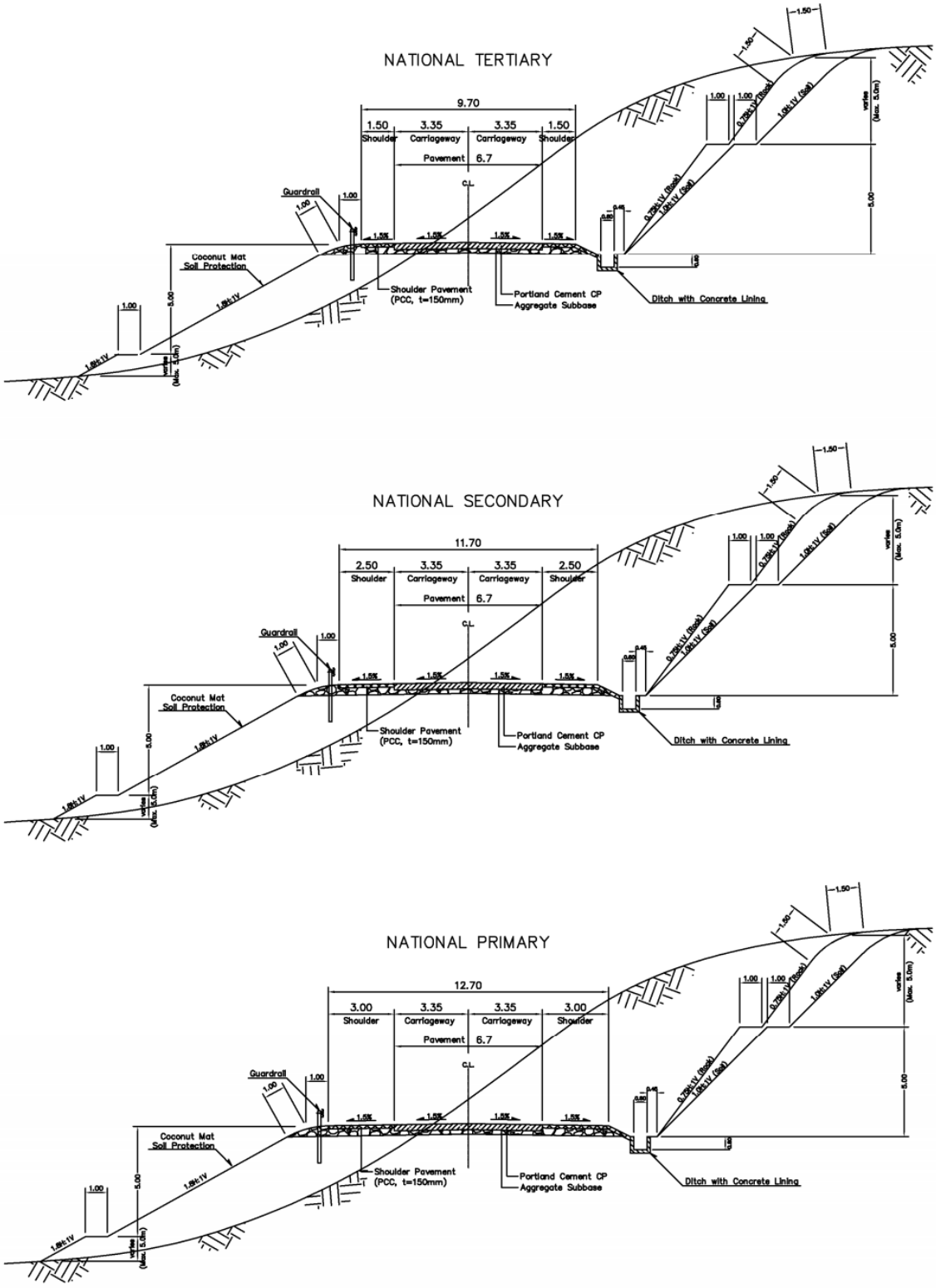
1.4.2.2 Typical Cross Sections

Typical cross sections by class of road are shown in **Figure 7 and Figure 8.**



Source: JICA Study Team

Figure 7. Typical Cross Sections for Subproject Roads (Vertical Grade Less Than 4%)



Source: JICA Study Team

Figure 8. Typical Cross Sections for Subproject Roads (Vertical Grade 4% and More)

1.4.3 Bridge and Structural Design

1.4.3.1 Specifications

Bridge design standards to be applied in this project shall be set in accordance with the following specifications

- Design Guidelines, Criteria & Standards Volume 5 Bridge Design 2015 (DGCS)
- DPWH Guide Specifications LRFD Bridge Seismic Design Specifications 1st Edition 2013

1.4.3.2 Load

1) General

The load types that shall be considered for the design bridge structure and other structures in this project are mainly as follow.

a) Dead load
b) Live load includes impact or dynamic effect of the live load and pedestrians load
c) Earth pressure
d) Seismic load

2) Dead load

Dead loads include all loads that are relatively constant over time, including the weight of the bridge itself and there are three primary types of dead load

- Down drag force (DD)
- Dead load of non-structural attachment (DC), and
- Dead load of wearing surfaces and utilities, designated as DW

The dead loads shall be the volumes of the member of the structural elements computed based on unit weights of materials. The following unit weights as shown in **Table 7** shall be used for dead load

Table 7. Unit Self-Weight of the Materials

Materials		Unit self-weight (kg/m3)
Aluminium Alloys		2,800
Bituminous waring Surface		2,250
Cast Iron		7,200
Compacted Sand, Silt or Clay		1,925
Concrete	Normal w/ f'c ≦35MPa	2,400
	Normal w/ 35< f'c≦105	2,250+2.29f'c
Loose Sand, Silt or Gravel and Soft Clay		1,600
Rolled Gravel, Macadam, or Ballast		2,250
Steels		7,850
Stone Masonry		2,725
Wood	Hard	960
	Soft	800

Source: JICA Study Team

3) Live Load

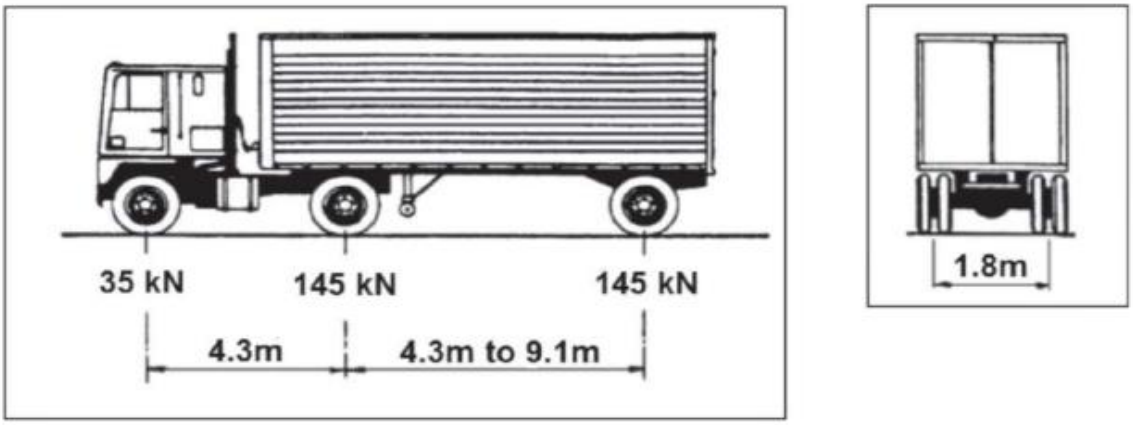
Design live loads of the bridges shall consist of:

a) The vehicle live load (LL)

Vehicular live loading on the road ways of bridges or incidental structures, designated HL-93 and shall consist of combination of the design truck and design lane load.

The weights and spacing of axials and wheels for the design truck shall be in accordance as shown in **Figure 9.**

The design lane load shall consist of a load of 9.34 kN/m, uniformly distributed in the longitudinal direction. Transversely, the design lane load shall be assumed to be uniformly distributed over 3.0m width. The force effects from the design lane load shall not be subject to a dynamic lane allowance.



Source: JICA Study Team
Figure 9. Characteristics of the Design Truck

b) Vehicular dynamic load allowance (IM)

The static effects of design truck, other than centrifugal and braking forces, shall be increased by the percentage specified in **Table 8** for dynamic load allowance in accordance with DPWH Design Guidelines, Criteria and Standards (DGCS).

Table 8. Dynamic Load Allowance (IM)

Component	Limit States	IM
Deck Joints	All Limit States	75%
All Other Components	Fatigue and Fracture	15%
	All Other Limit States	33%

Source: JICA Study Team

Dynamic load allowance need not be applied to:

- Retaining walls not subject to vertical reactions from the super structure
- Foundation components that are entirely below ground level

c) Dynamic Load Allowance (IM) for Culverts and Other Buried Structures

The factor to be applied to the static load shall be taken as:

$IM = 33(1.0 – 0.125D_E) \geq 0\%$

Where:

D_E = the minimum depth of earth cover above the structure (mm)

d) Multiple Presence Factors

Multiple presence factors shall be based on **Table 9**.

Table 9. Multiple Presence Factors

Number of Loaded Lanes	Multiple Presence Factors
1	1.2
2	1.0
3	0.85
>3	0.65

Source: JICA Study Team

e) Pedestrians Load

A pedestrian load of 3.6kPa shall be applied to all sidewalks wider than 600mm and consider simultaneously with the vehicular design live load in the vehicle lane.

f) Live load for Box Culvert

Live load applied for Box Culvert design shall be estimated in accordance with Article 11.3.2.10 of DPWH Design Guidelines, Criteria and Standards Volume 5.

4) Earth Pressure

Earth Pressure shall be determined in accordance with Chapter 10.15 of DPWH Design Guidelines, Criteria & Standards Volume 5.

5) Seismic Load

Earthquake effects shall be determined in accordance with DPWH Guide Specifications LRFD Bridge Seismic Design Specifications 1st Edition 2013.

a) Condition of seismic design

- Earthquake Ground Motion: Level 1, Level 2
- Bridge Operation Classification: OC-III

b) Design Response Spectrum

1.4.3.3 Materials

1) Concrete Strength

The strength of the concrete use for the bridges and other structures design shall be in accordance with **Table 10.**

Table 10. Concrete Strength of Concrete Elements

Description		Fc'(min) (MPa)
Superstructure	PSC I -girder	38
	Deck Slabs, Cross beam	28
Substructure	Abutment walls, footings	28
	RC Pier coping, columns, footings	28
	PSC Pier coping, Rotating pier head	38
	Bored piles	28
Earth covered RC Box structure		28
Other concrete (normal use)		21
Lean concrete (for leveling)		17
Non Shrink grout		41

Source: JICA Study Team

2) Reinforcing Steel

Reinforcing steel used for the design of bridge and other structure shall follow

- ASTM GRADE 40, fy=278 Mpa
- ASTM GRADE 60, fy=415 Mpa

3) Prestressing

Ultimate stress of prestressing steel shall be: fs' = 1860 MPa

4) Structural Steel

Structural Steel shall follow in accordance with DPWH DGCS Volume 5.

- Steel plate and rolled shapes: ASTM A36
- Bolts: AASHTO M164 (ASTM A325)
- Welds: AWSD1.1 – 183, E70XX series

1.4.3.4 Concrete Cover for Reinforcing Steel

Concrete cover for reinforcing steel shall follow **Table 11.**

Table 11. Concrete Cover

Situation	Cover (mm)
Direct exposure to salt water	100
Cast against earth	75
Coastal	75
Exposure to deicing salts	60
Deck surfaces subject to tire stud or chain wear	60
Exterior other than above	50
Interior other than above • Up to No. 36 bar • No. 43 and No. 57 bars	 40 50
Bottom of cast-in-place slabs • Up to No. 36 bar • No. 43 and No. 57 bars	 25 50
Precast soffit form panels	20
Precast reinforced piles • Noncorrosive environments • Corrosive environments	 50 75
Precast prestressed piles	50
Cast-in-place piles • Noncorrosive environments • Corrosive environments - General - Protected • Shells • Auger-cast, tremie concrete, or slurry construction	 50 75 75 50 75

Source: JICA Study Team

1.4.3.5 Superstructure Arrangements

1) Vertical Clearance of Bridge Superstructure

The vertical clearance between the Design Flood Level (DFL) and the lowest member of the bridge superstructure shall not be less than 1.5m for reverse carrying debris in accordance with DPWH DGCS.

Since all roads of this project are National Road, applied flood frequency shall as in accordance to **Table 12.**

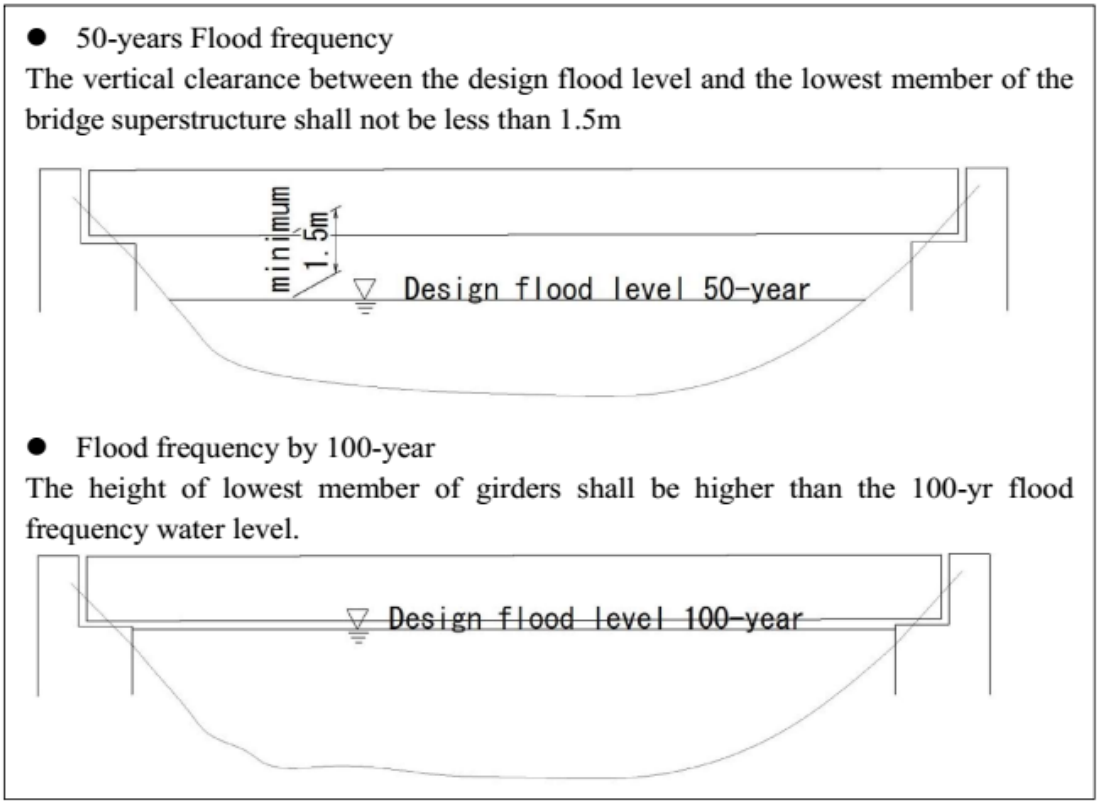
- 50 years flood frequency shall be applied for the estimation of flood level (DFL)
- 100 years flood shall be used for check vertical clearance of the bridge superstructure

Table 12. Design Flood Frequency for Bridges

Road Classification	River				Bridge Drainage	
	Structure		Hydraulic Scour			
	Design Flood	Check Flood	Design Flood	Check Flood	Design Flood	Check Flood
Expressway	100 yr	200 yr	*100 yr	*500 yr	25 yr	50 yr
National Road	50 yr	100 yr	*100 yr	*500 yr	10 yr	25 yr
Other Roads	25 yr	50 yr	50 yr	100 yr	5 yr	10 yr

Source: JICA Study Team

From mentioned above, when 100 years flood level is more than 1.5m higher than 50 years flood level, the lowest level of the bridge superstructure shall be kept to be higher than the 100 years flood level as shown in **Figure 10.**



Source: JICA Study Team

Figure 10. Vertical Clearance of Bridge Superstructure

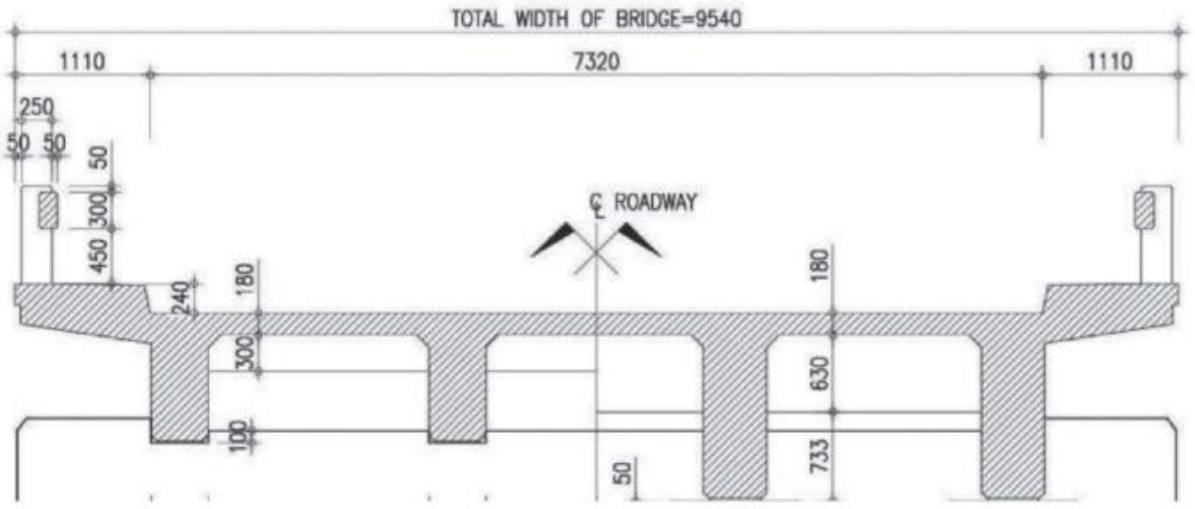
Discharge of river will be estimated in accordance with DPWH DGCS Volume 3 and 4. The Criteria for hydrological analysis are described in separate report of JICA Study Team.

2) Bridge Span Length

Minimum bridge span length shall be determined in accordance with Article 4.2 of DPWH DGCS Volume 5 using 50 years frequency flood discharge.

3) Width of Roadway

The minimum width of bridge for 2 lanes shall be 7.32m and the minimum width of the pedestrian sidewalk shall be 750mm, in accordance with DPWH DGCS Volume 5. Typical cross section of the bridge is shown in **Figure 11.**



Source: JICA Study Team

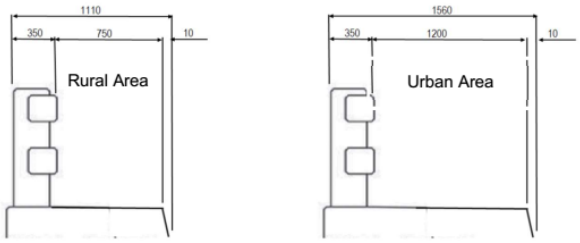
Figure 11. Typical Cross Section of Bridge

4) Width of Sidewalk

According to DPWH DGCS Volume 5, the minimum width of pedestrian sidewalk is specified as follow:

- In rural area: minimum pedestrian width is 750mm
- In urban area: minimum pedestrian width is 1200mm

Width of sidewalk is shown in **Figure 12**.



Source: JICA Study Team

Figure 12. Width of Sidewalk

1.4.3.6 Substructure Arrangements

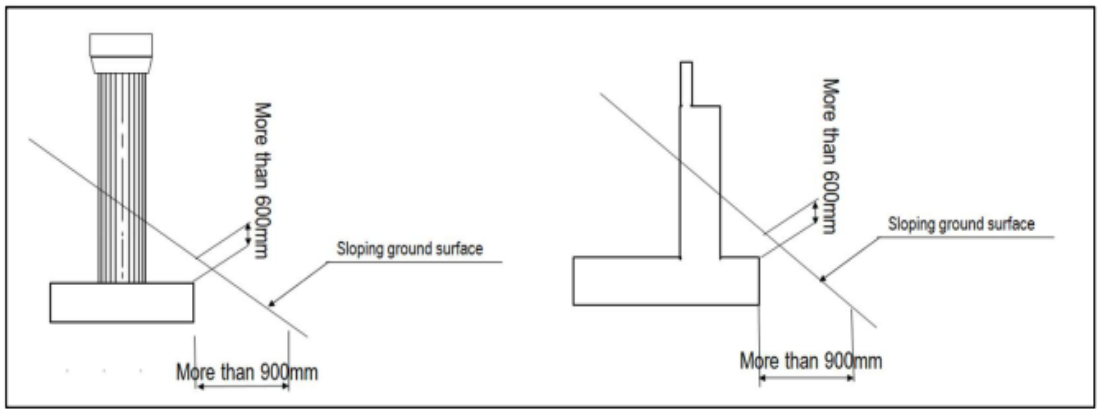
1) Seat Length

DPWH Guide Specifications LRFD Bridge Seismic Design Specifications 1st Edition 2013 will be followed.

2) Depth of Footing

a) Minimum embedment and bench depth (except in water way)

- Adequate bearing capacity shall be maintain
- 900 mm of the bottom of the footing
- 600 mm cover over the footing
- When the spread footing located on a slope, the minimum distance from the lower edge of the footing to the sloping ground surface should be 900 mm as shown in **Figure 13.**
- Maximum height of abutment is 15.0m.



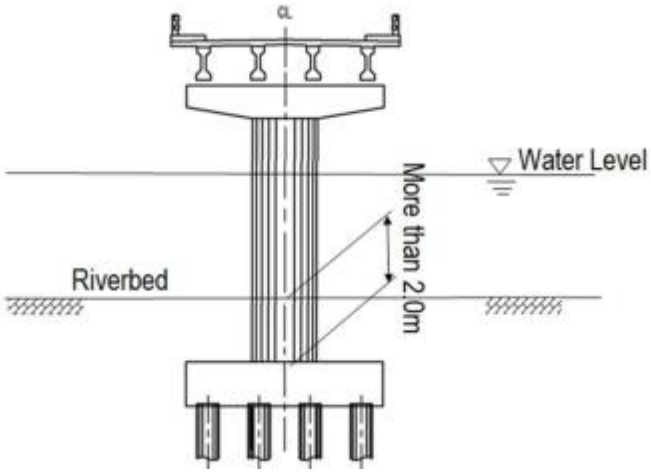
Source: JICA Study Team
Figure 13. Footing Position on Slope

b) In Water Way

According to DPWH DGCS Volume 5, the depth of pier footing in water way is specified as follow.

- On soil: top of footing must be located below the scour depth
- On rock: the bottom of footing must be embedded in non-erodible rock

Therefore, in this project, the cover of the top of the foundation from riverbed shall be kept greater than 2.0 m based on Japanese Standards as shown in **Figure 14**.

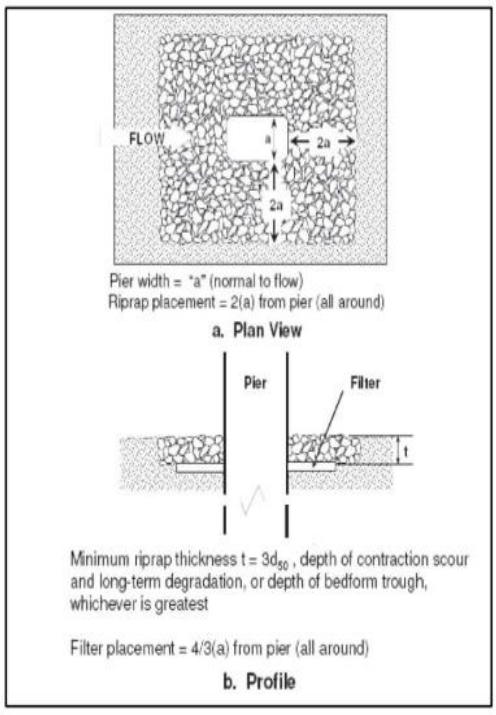


Source: JICA Study Team
Figure 14. Depth of Pier Footing in Water Way

1.4.3.7 River Protection

1) Pier Foundation

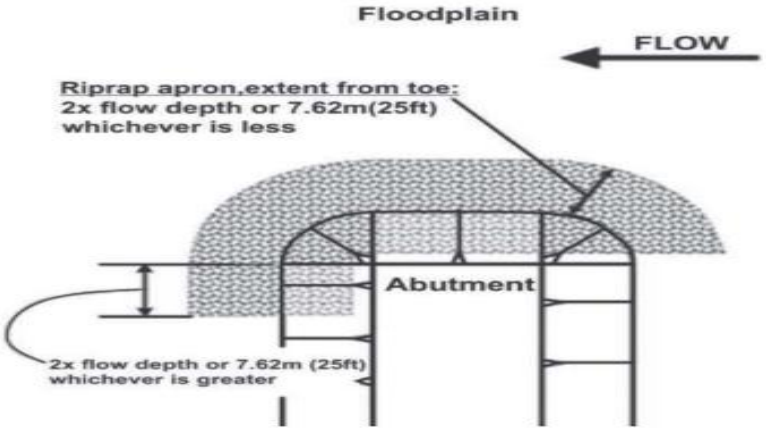
The pier footing shall be protected against a scouring of river bed by loose bolder apron, gabions, precast concrete blocks and grout-filled or sand/cement-filled bags. The example of the riverbed protection measure at the pier is shown in **Figure 15**.



Source: JICA Study Team
Figure 15. Example of Riverbed Protection (Typical Bolder Apron Layout)

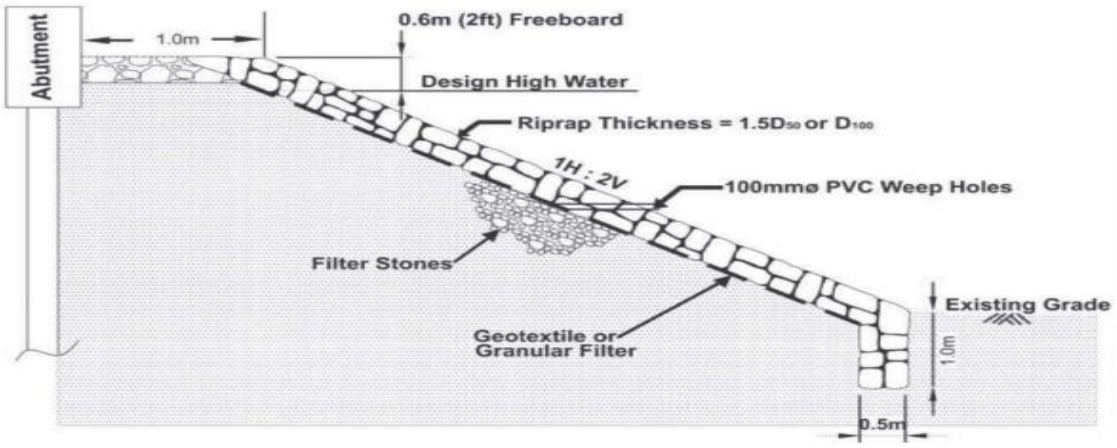
2) Abutment

The plan of abutment protection and typical cross section of the revetment front of abutment is shown in **Figure 16 and Figure 17**.



a) The plan of abutment protection

Source: JICA Study Team
Figure 16. Example of Protection for Abutment



b) Typical cross section of the revetment

Source: JICA Study Team
Figure 17. Typical Cross Section of the Revetment

1.4.4 Pavement Design Standards

The following standard is basically applied for this project.
Chapter 6 Pavement Design, DGCS Volume 4 Highway Design 2015, BoD, DPWH

1) Design Life for Pavement

In estimating the design volume, the minimum life is commonly assumed to be 20 years for a rigid pavement. The pubic opening is assumed to be year 2022. Therefore, design life for pavement design is proposed between year 2022 and year 2042.

2) Type of Pavement

In Mindanao Island, the Portland Cement Concrete Pavement (PCCP) is widely used because the cement is plenty produced. In consideration with the road maintenance, the PCCP is applied for this project.

3) Minimum Thickness of PCCP Slab

In accordance with Department Order (DO), the minimum thickness of PCCP slab for new construction is adopted 280 mm, if the cumulative equivalent single axle load (CESAL) is more than 7.0×10^6.

4) Minimum Width of PCCP

In accordance with DO, the minimum width of PCCP on National Highways for new construction adopted is 6.70 meters.

1.4.5 Drainage Design Standards

1.4.5.1 Road Surface Drainage

The following standard is basically applied for this project.

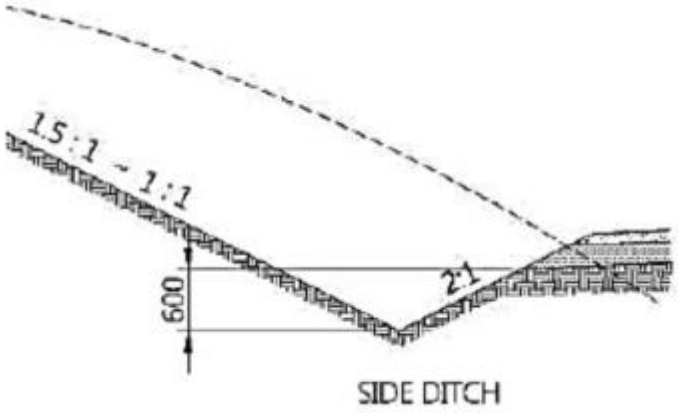
- Chapter 5 Highway Drainage DGCS Volume 4 Highway Design 2015, BoD, DPWH
- Guidelines for drainage work; Japan Road Association

1) Type of Roadside Channel

Between the roadway and cutting slope, the open earth gutters will be provided where the vertical grade is less than 4 percent. Where the vertical grade is 4 percent and more, the open concrete ditches will be installed. Also, shoulder shall be paved by PCCP with 150mm in thickness, and a part between edge of paved shoulder and ditch should be lined by concrete.

2) Minimum Depth of Roadside Channel

The minimum depth of roadside channel is applied 600mm from the bottom of pavement as shown in **Figure 18.**



Source: JICA Study Team
Figure 18. Minimum Depth of Ditch

1.4.5.2 Culverts

The following standard is basically applied for this project.

- DPWH DGCS Volume 3 Water Engineering Projects 2015
- Chapter 5 Highway Drainage Design of DPWH DGCS Volume 4 Highway Design 2015
- Standard Drawings for Roads and Bridges

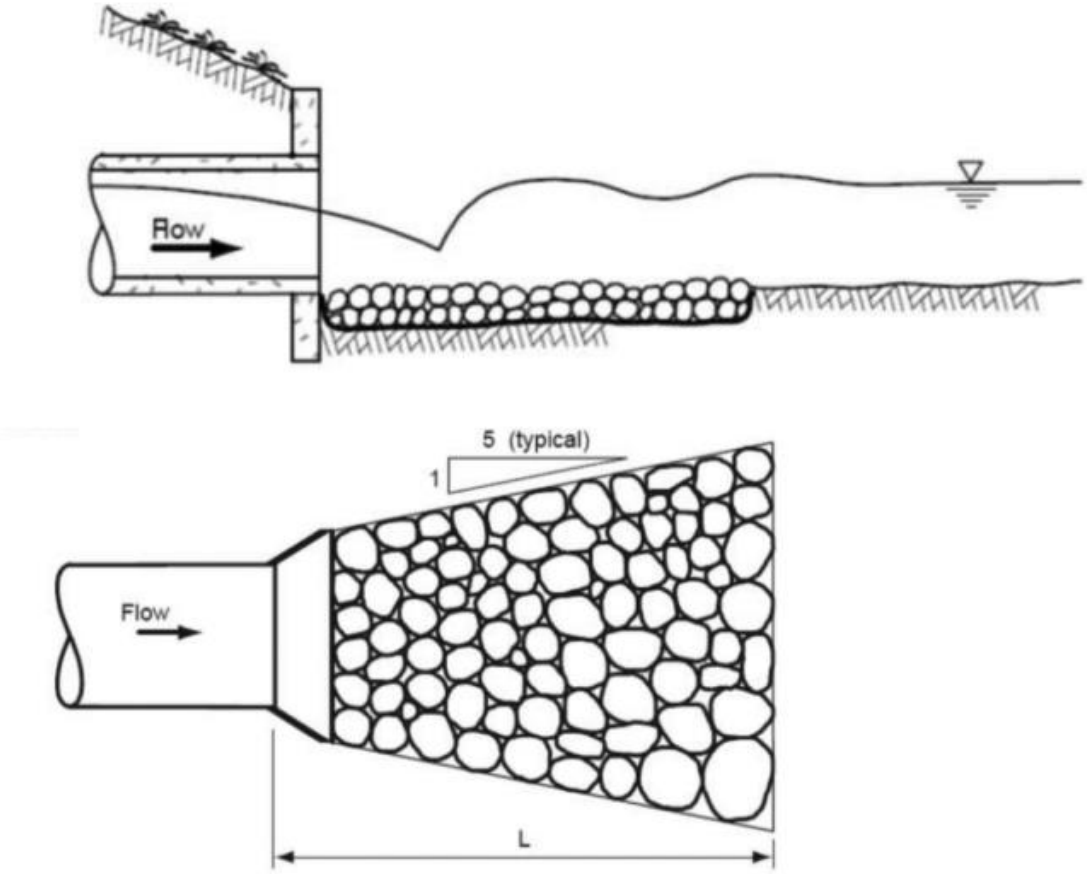
1) Discharge (Hydrologic Analysis)
2) Hydraulic and Structural Design of Culvert

Hydraulic design of culverts will be done in accordance with Chapter 5.8 of DPWH DGCS Volume 4 Highway Design 2015

Criteria for structural design of culvert are discussed on separate report.

The culvert shall be designed in consideration of the items below.

- Minimum cover: 0.6 m
- Size of culvert (minimum internal width and clear depth): 0.910 m
- Minimum velocity: 0.8m/sec
- Maximum velocity: 5m/sec
- Outlet scour control – refer to **Figure 19**.



Source: JICA Study Team

Figure 19. Typical Layout of Outlet Scour Control

1.4.6 Slope Design Standards

The following standard is basically applied for this project.

- Chapter 7 Earthworks, DGCS Volume 4 Highway Design 2015, BoD, DPWH
- Guidelines for road earthwork; Japan Road Association
- Manual for Slope Protection, Highway Earthwork Series; Japan Road Association

1) Filling Slope

Based on **Table 13**, the height, berm and slope ration for filling slope are applied as follows:

- Max. Height (1 step): 5.0 m
- Width of Berm: 1.0 m
- Slope Ratio: 1.8H:1V

The slope protection is adopted the coconut mat soil protection because it is widely used in the Philippines and is economical.

Table 13. Stability of Cut and Fill Slopes for Different Material Types

Filling Material*	Nature of Material	Height of Cut/ Fill (m)	Slope Ratio (H:V)***	Remarks
Well graded sand (SW)	Soil	Less than 5	1.5:1 to 2.0:1	Applied to fills with sufficient bearing capacity at foundation ground, which are not affected by inundation (assumed drained and unsaturated). Consistency assumed to be medium dense (non-cohesive) or stiff (cohesive) or better.
Gravel with Silt (GM)				
Gravel with Clay (GC)				
Well Graded Gravel (GW) Poorly Graded Gravel (GP)		5 to 15	1.8:1 to 2.5:1	
Poorly Graded Sand (SP)		Less than 10	1.8:1 to 2.5:1	
Silty Sand (SM)		Less than 5	1.5:1 to 2.0:1	
Clayey Sand (SC)				
Hard clayey soils and clay of alluvium, loam (CL)		5 to 10	2.0:1 to 2.5:1	
Soft Clay of high plasticity (CH), Silts (ML, MH)		0 to 5	2.5:1 to 3.0:1	
Medium to High Strength Rock, Slightly Weathered to Fresh	Rock**	Less than 10	0.5:1 to 1:1	Assess all rock slopes in cut in accordance with Section 7.3.
		10 to 15	0.75:1 to 1.2:1	
Very Low to Medium Strength Rock, Extremely to Distinctly Weathered		Less than 5	0.75:1 to 1.2:1	
		5 to 10	1.0:1 to 1.5:1	
Residual Soil to Extremely Low Strength Rock, Extremely Weathered		Less than 5	1.0:1 to 1.5:1	
		5 to 10	1.5:1 to 2:1	

2) Cutting Slope
3)

Based on **Table 13**, the height, berm and slope ration for filling slope are applied as follows:

- Max. Height (1 step): 5.0 m
- Width of Berm: 1.0 m
- Slope Ratio: 1.00H:1V
- Slope Ratio (Soft Rock): 0.75H:1V

1.4.6.1 Slope Protection for Bank of River / Drainage System

Slope and foot protection works for river/drainage system passing across road alignment shall be planned and designed in accordance with DGCS 2015. All considerations as design criteria are described in “(2) Slope and Foot Protection Works or Revetments”.

1.5 TECHNOLOGY OPTIONS

1.5.1 Design Criteria and Standards

In order to achieve the objectives of the project, the roads, bridges and other structures shall be designed in consideration of providing a high grade road as national highway which would facilitate smoother commodity flow, more active economic activities and improve accessibilities and linkage to other regions.

The preliminary design of the road, bridges, and other structures will be executed mainly in accordance with "Design Guideline, Criteria and Standards published by the Department of Public Works and Highway (DPWH-DGCS)" and Japanese standard will be applied to the design as a supplement.

The following standard is basically applied for this project.

- Design Guidelines, Criteria and Standards Volume 4 Highway Design 2015, BoD, DPWH

  Also, the following standards are referred to:

- Policy on Geometric Design of Highways and Streets, AASHTO 2011, 6th Edition

- Japan Road Association, Road Structure Ordinance, 2015

1.6 PROJECT SIZE

The total length of the road project is 6.963 km with 3 bridges at a total length of 245m.

1.7 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES AND CORRESPONDING TIMEFRAMES

1.7.1 Pre Construction Phase

- This will involve the acquisition of Environmental Compliance Certificate and other permits and clearances
- Proponent to iron out details of the projects, finalized the detailed engineering design (DED)
- Preparation and implementation of Relocation Action Plan for the affected communities
- Acquisition of right of way and right to use land

1.7.2 Construction Phase

1.7.2.1 Preparation Works

- Mobilization
- Clearing and earthworks for the preparation of construction works, stripping, grubbing
- Construction of the temporary yard and facilities (workers' camp, field offices, facilities yard)
- Provision of power, water and sanitary facilities
- Mobilization of major construction equipment and tools

- Established main site logistics and transport requirements
- Delivery of construction materials

1.7.2.2 Construction Works

- Dredging
- Pile Foundation
  1. Excavation
  2. Installation of steel cage
  3. Concrete pouring by tremie pipe
  4. Extraction of casing and tremie pipe
  5. Completion of bored pile

- Construction of substructures
  1. Construction of cofferdam
  2. Drying inside of cofferdam
  3. Conduct of substructure
- Superstructures

1.7.2.3 Health, Safety and other services for the workforce, refer to Section 9 – Emergency Response Policy and Generic guidelines for details

1.7.2.4 Environmental Aspects/waste generation and built in measures

During this phase generation of waste is expected. **Table 14** shows the type and built-in measures.

Table 14. Type of Waste and Built-in measures

Type of waste	Management measures
Domestic Wastewater	Provision for Portalet (portable toilet) Proper wastewater treatment of domestic wastewater either through an accredited Treatment, Storage and Disposal Facility (TSD) or an accredited septic tank hauler and treater Provision of oil and water separator should be included in the wastewater treatment for oil spills, vehicle and construction cleaning etc.
Solid waste	Practice 3R (Reduce Reuse and recycle Carton, wood, steel, bottle sent to recyclers Use of Materials Recovery Facility (MRF) and sanitary landfill through respective LGUs involve
Used oil and batteries	Sent to Treatment Storage and Disposal facility
Air emission	-Periodic maintenance of construction equipment and vehicle -For batching plants, use of insulation board to prevent the spread of dust and to reduce the noise pollution at work, cement dust filter is also needed
Dust	Administrative control: Regular sprinklers Engineering control: For dust removal of cement silo, it is a general practice to install the dust collector on the top of the cement warehouse in order to reduce the dust pollution

1.7.3 Demobilization/Decommissioning Phase

Demobilization/Decommissioning phase pertains to activities that will be undertaken immediately after the completion of road and bridge constructions. The Contractor/DPWH must ensure that the following decommissioning/demobilization activities are complied with.

- Complete closure and restoration of all temporary construction facilities and structures such as bunkhouses, field offices, facilities yard etc.
- Complete dismantling of portable sanitation facilities such as portalets provided in the construction sites;
- All construction sites are cleared of residual solid and domestic wastes generated from temporary sanitation facilities;
- All disconnected / disrupted basic social service facilities such as water and power supplies, and communication lines are fully restored to normal functions;
- Affected public structures are reconstructed/restored; and
- All construction sites are cleared of residual construction spoils and debris

1.7.4 Operation Phase

- Operation would mean the opening and utilization of the roads to the public.
- Inspection and monitoring of the whole alignment and maintenance and rehabilitation whenever necessary.

The DPWH District Engineering Office (DPWH-DEO) who has jurisdiction over the newly construction road shall perform periodic inspection and maintenance of the road section, including all appurtenant structures based on DPWH Standard Inspection and Maintenance Manual for Roads and Bridges.

Regular inspection and maintenance of the bridges (crossing river/waterway/and crossing roads) shall be undertaken by the DPWH-DEO concerned to ensure structural integrity of the facilities. Regular de-clogging and de-silting of the culverts shall be maintained to prevent flooding, particularly at low-lying and identified flood-prone areas.

1.8 MANPOWER REQUIREMENTS

Total manpower man-day is approximately 1,037 for skilled and 2,275 for non-skilled workers who shall be employed during construction. This may vary during actual works.

1.9 INDICATIVE PROJECT INVESTMENT COST

The total estimated project cost is **Mil PhP 729.70.** The summary of quantity and total project costs for the road and bridge project are shown in **Table 15**. Details of project cost is provided in **Table 16**.

Table 15. Summary of Estimated Project Cost

Sub Project	Road length (km)	No. of Bridges	Total Brdiges length (m)	No. of contract package	Main road cost (million php)	Farm to Market Road cost (php)	Total cost (million php)	Cost per km of road section (million php)	Cost per m of bridge (million php)	Total cost per km (million php)
No.8	6.963	3	245	1	675.9	53.8	729.7	62.48	1.05	104.8

Source: JICA Study Team

Table 16. Detailed Estimated Project Cost

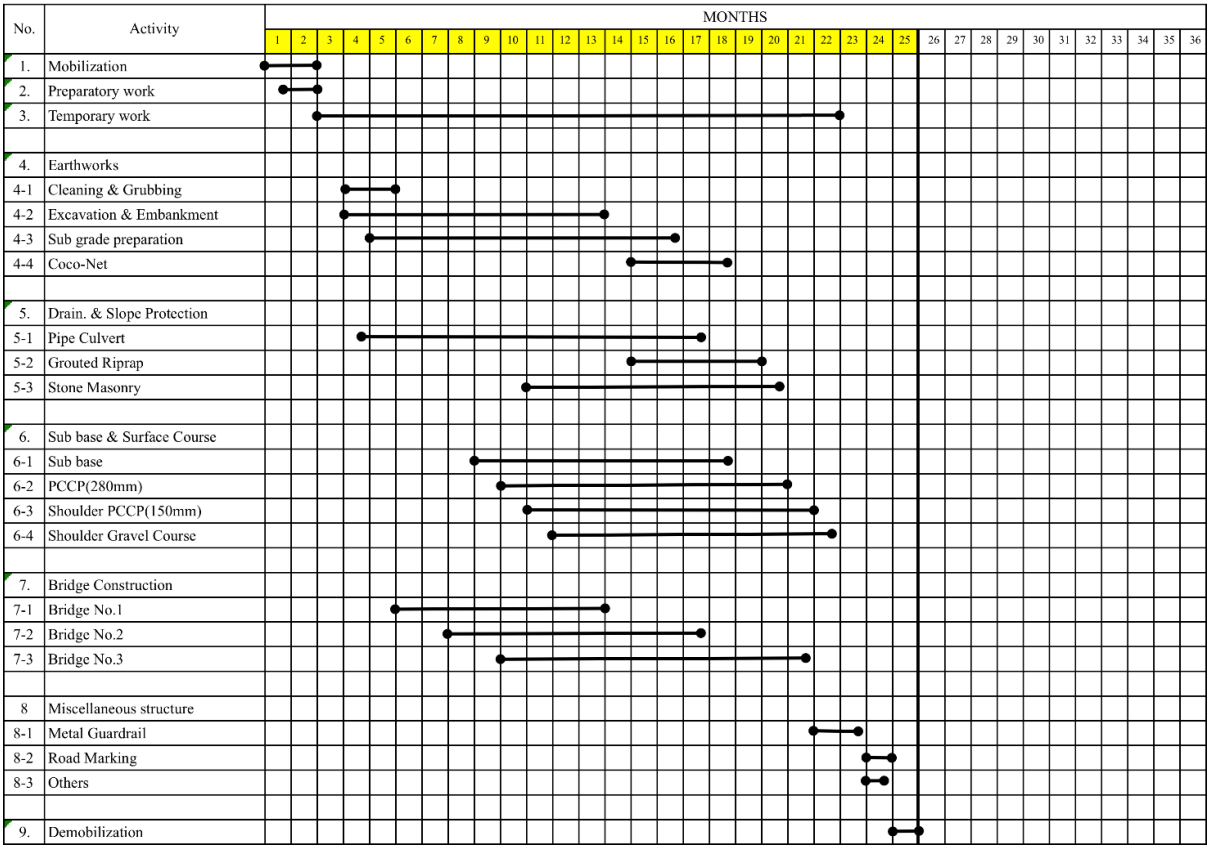
Item	Contents	Q'ty	Cost (mill. php)	Cost per km (mill. Php)	Bridge/m (mill. Php)	Portion (%)
A	Facilities for engineer	1.0	10.377	1.54		1.4%
B	Other general requirement	1.0	27.468	4.09		3.8%
C	Earth work	1.0	109.023	16.23		14.9%
D	Subbase and base course	1.0	56.884	8.47		7.8%
E	Surface course	1.0	138.778	20.66		19.0%
F	Bridge structure (Total)	245m	256.057		1.06	35.1%
	F1	160m	158.441		1.07	21.7%
	F2	60m	61.313		0.89	8.4%
	F3	25m	36.303		1.19	5.0%
G	Drainage and slope protection	1.0	41.129	6.12		5.6%
H	Miscellaneous item	1.0	36.111	5.38		4.9%
I	Farm to Market road	11km	53.828			7.4%
	Grand Total		729.655	62.48		100.0%

Source: JICA Study Team

1.10 Project Duration and Schedule

Estimated construction period is 25 months. **Table 17** shows the project duration and schedule.

Table 17. Project Duration and Schedule



Source: JICA Study Team

Section 2

LEGAL AND ENVIRONMENTAL ASSESSMENT FRAMEWORK

2.0 LEGAL AND ENVIRONMENTAL ASSESSMENT FRAMEWORK

The environmental impact assessment was undertaken based on the Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) for the proposed project. The resulting study was documented in the form of an Initial Environmental Examination Report (IEER). Minimum required by DENR-EMB for the issuance of an Environmental Compliance Certificate (ECC) will be in the form of IEE checklist.

The IEER as outlined in the revised procedural manual was used as basis in the conduct of this study.

The result of the IEER shall be used by the proponent as a tool in the formulation of appropriate environmental management plan for the proposed project.

2.1 National and Local Environmental Assessment, Laws, Regulations and Standards

National and Local laws, regulations and standards are summarized in **Table 18**.

Table 18. Philippine Environmental Laws and Decree by Category

Category	Title	Outline
Natural Resources	Constitution Article 12/Clause 2.	Investigation of natural resources, development use
	Presidential Decree (PD)/No. 1198	Protection of Natural Environment
Protection of wildlife and biodiversity	Republic Decree No. 826	Preservation of Natural Parks and Establishment of Wildlife Protection Committee
	Statement No. 2141	Preservation of wilderness region
	Administrative Order	No. 243 (1970) Prohibition of slaughter for buffalo
Forest resources	Presidential Decree (PD) NO. 209	Encourage of common forest project
	Presidential Decree (PD) No. 277	Encourage of report on offender against forest law
	Presidential Decree (PD) No. 278	Procedural regulation on development application for forest resources and forest land development use
	Presidential Decree (PD) No. 331 (1973)	Sustainable forest development forest resources
	Presidential Decree (PD) No. 389	Regulation on forest recovery
	Presidential Decree (PD) No. 705 (1975)	Amendment of regulation on forest recovery
	Presidential Decree (PD) No. 865	Export of lumber (selective deforestation)
	Presidential Decree (PD) No. 953	Request of forestation
	Presidential Decree (PD) No. 1153	Decree of forestation
	DNR Decree No. 78 (1987)	Regulation on permission range for felling and collection of oak, other hard wood
	DNR Decree No. 79 (1987)	Establishment of foundation of forest regeneration
	DNR memorandum No. 8 (1986)	Full prohibition of log export
	Notification No. 818	Diminution of forest
	Forest Development Bureau Circular No. 13 (1986)	Full prohibition of land possession within mangrove area, river area, preservation area, wilderness area. National park, wildlife reserve, experimental forest etc.
Coastal marine	Presidential Decree (PD) No. 600 (1974)	Prevention of marine pollution
	Presidential Decree (PD) No. 602 (1974)	Establishment for oil pollution management center
	Presidential Decree (PD) No. 979	Prevention of ocean pollution

Ambient air	Republic law No. 3931	Establishment of National air, water pollution control committee, definition of pollution and penalty
	Presidential Decree (PD) No. 1181	Air pollution regulation on incidence origin of traveling
	Presidential Decree (PD) No. 1160	Barangay Captain Community Leader on implementation of law on prevention of public nuisance
	Circulation No. 247	Appointment of highway patrol guard
	Circulation No. 551	Equipment of prevention devices of motor vehicles
Water quality	Republic law No. 3931	Establishment of National Water and Air Pollution Control Commission
	Presidential Decree (PD) No. 600	Establishment of Philippine coastal guard, measure for marine pollution
	Presidential Decree (PD) No. 602	Establishment of National oil pollution management center
	DENR Decree No. 34	Classification of water and use
	DENR Decree No. 35	Regulation on discharge water for industrial and urban drainage
Land use and resettlement	Constitution Article 13	Establishment of human protective committee and their responsibility
	DPWH Department Order No. 65	Land use procedure for public project and expressway project
	DPWH Department Order No. 120 (1988)	Compensation of private land for DPWH project
	DPWH Department Order No. 234 (1990)	Amendment of compensation of private land for DPWH project
	Revised Administrative Code No. 64	Competence of house of justice on private land acquisition by the government
	DPWH Department Order No. 65 (1983)	Guideline for land use and right of way
	Presidential Decree (PD) No. 1517	Designation of reserve area at reorganization of urban land use
	Senate Article No. 328	Decree of temporally prohibition for removal of displaced persons
	Republic Act 7279 (Urban Development and Housing Act of 1992)	An Act to provide a comprehensive and continuing urban development and housing program, establish the mechanism for its implementation, and for other purpose; procedure for removal of habituated peoples.
Land acquisition	Republic Act 6389 (1971); The Agricultural Land Reform Code	The agricultural lessee shall be entitled to disturbance compensation equivalent to five times the average of the gross harvests on his landholding during the last five preceding calendar years
	Executive Order (1985)	Providing the procedures and guidelines for the expeditions acquisition by the government of private real properties or rights thereon for infrastructure and other government development projects
	Republic Act 8974 (2000)	An act to facilitate the acquisition of right-of-way, site or location for national government infrastructure project and for other purposes
	Department Order 34 (2007)	Simplified Guidelines for the validation and Evaluation of Infrastructure Right-of-Way Claims" and the DPWH Land Acquisition, Resettlement, Rehabilitation, and Indigenous Peoples' Policy (LARRIPP), Revised March 2007
	Republic Act 10752 (2016)	The Right-of-Way Act

		An Act facilitating the acquisition of Right-of-Way Site or Location for National Government Infrastructure Projects
Human Rights	Executive Order No. 153 (2002)	Instituting the national drive to suppress and eradicate professional squatting and squatting syndicates; Amending E.O. 178 (1999) and E.O. 128 (1993)
	Indigenous People's Rights Act (IPRA) of 1997	Sets the conditions, requirements, and safeguards for plans, programs and projects affecting Indigenous Peoples (IPs).
	NCIP Administrative Order No. 1, Series of 2006	The procedure for obtaining the "Free and Prior Informed Consent" (FPIC) for affected communities
	DOLE Department Order No. 13, series of 1998	Occupational Safety and Health and DOLE Department Order No. 56, series of 2015, also known as Guidelines Governing Occupational Safety and Health in the Construction Industry
Conservation of historical cultural assets	Republic Decree No. 4365	Responsibility of National historic committee on authorization, restoration and maintenance for historical assets
	Republic Decree No. 4346	Responsibility of protection and propulsion of maintenance for cultural assets within National museum
Environmental Assessment	Presidential Decree (PD) No. 1586	Environmental assessment system and administrative organization
	Presidential Decree (PD) No.2146	3 Industrial sectors with large environmental impacts and 12 environmental critical regions
National integrated protected area system	National Integrated Protected Area System Act (1992)	Review of National Integrated Protected Area

Source: JICA Study Team

2.2 JICA Environmental and Social Requirement

Major laws regarding environment is shown in **Table 19**. Environmental related laws in the Philippines are composed of under the Presidential Decree PD) No. 1151 as environmental policy and PD No. 1152 as environmental regulation in relation to the national policy and regulation.

Table 19. Philippine's Major Environmental Laws

Title	Contents
Presidential Decree (PD) NO. 1151	Environmental policy
Presidential Code (PD) No. 1152	Environmental regulation

Source: JICA Study Team

2.3 Philippine Environmental Impact Assessment System for Roads and Bridges Project

The project falls under **Minor Roads and Bridges item C.4.b (Roads, new construction, widening including RO-RO facilities)** with a total length of 5.9 kilometers with no critical scopes covered. The presented outline prepared by DENR in the Revised Procedural Manual

for DAO 03-30 was used as basis to determine the actual scope of this study. **Table 20** shows the policies, laws, administrative orders and memorandum circulars that are applicable and discussed in the Environmental Impact Study.

Table 20. Laws, Regulations and Administrative Orders Applicable in EIS

Environmental Impact Assessment	Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (Implementing Rules and Regulations of Presidential Decree No. 1586, Establishing the Philippine Environmental Impact Statement System), August 2007.
	Memorandum Circular No. 005, Series of 2014, Revised Guidelines for Coverage Screening and Standardized Requirements Under the Philippine EIS System
	Memorandum Circular No. 005, Series of 2011, Incorporating Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) concerns in the Philippine EIS System
	DENR Administrative Order (AO) No. 37, Series of 1996 – Revising DENR AO No. 21, Series of 1992, to further strengthen the implementation of the Environmental Impact Statement (EIS) System
	DENR Administrative Order No. 2017-15: Guidelines on Public Participation under the Philippine Environmental Impact Statement (EIS) System
Land (Terrestrial Flora and Fauna)	Republic Act 9147, otherwise known as the Wildlife Conservation and Protection Act of 2001
	DENR-AO 2007-01 "Establishing the National List of Threatened Philippine Plant and their Categories
	International Union for Conservation of Nature (IUCN) Red List of Threatened Species 2016
	Memorandum Circular No. 01, Series of 2014. Guidelines for the Implementation of the DPWH-DENR-DSWD Partnership on the Tree Replacement Project
Ambient Water Quality	Philippine Clean Water Act of 2004 or known as Republic Act 9275
	Administrative Order No. 10, Series of 2005, Implementing Rules and Regulations of the Philippine Clean Water Act of 2004
	DENR Administrative Order No. 08, Series of 2016, Water Quality Guidelines and General Effluent Standards of 2016
	DENR Administrative Order No. 34, Revised Water Usage and Classification/Water Quality Criteria Amending Section Nos. 68 and 69, Chapter III of the 197 NPCC Rules and Regulations
Ground Water Quality	Philippine National Standards for Drinking Water 2017
	Philippine National Standards for Drinking Water 2007
	Administrative Order No. 0012 Series of 2007
Ambient Air Quality	Republic Act 8749 or known as Philippine Clean Air Act,
	DENR Administrative Order No. 2000-81
Noise Quality	National Pollution Control Commission (NPCC) Rules and Regulations, Chapter IV, Article 1, Section 78
Solid Wastes	Republic Act 2003, Ecological and Solid Waste Management Act, Series of 2000
	Administrative Order No. 34, Series of 2001. Implementing Rules and Regulations of RA 9003
Hazardous Wastes	Republic Act 6969, Toxic Substances and Hazardous Wastes Act, 1990.
	DENR AO No. 22, Series of 2013 – Revised Procedures and Standards for the Management of Hazardous Wastes (Revising DAO 2004-36)

2.4 Gap Analysis between JICA and Related Regulations in the Philippines

Based on the principles for EIA Reports for Category A projects requested by JICA Guidelines, gaps between the Guideline and the legislation in Philippines reviewed in **Table 21**. Basically, the Philippines legislation deems to meet the policy of JICA's Guideline, this Philppine EIA process is applicable on this project.

Table 21. Gaps Between JICA Guideline and the Philippine Legislation on EIA

JICA Guidelines	Legislation of the Philippines (DENR Administrative Order No. 30 Series of 2003)	Gaps	Policy to fill up gaps in this study
1. When assessment procedures already exist in host countries, and projects are subject to such procedures, project proponents must officially finish those procedures and obtain the approval of the government of the host country	The project is required to prepare the EIA and obtain the environmental compliance certificates (ECCs) in accordance with Philippine laws	No difference	Not required
2. EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them	The order stipulates that EIA shall be written in the local dialect or mixed with the popularly known language of the host communities. In this case, English is recognized a s popularly known language in the project area.	-	Not required
3. EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted	The proponent is required to give copies of the full EIA report to the EMB Regional office host municipalities; copies of executive summary to the host barangays	-	Not required
4. In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared.	The prescript public consultation is held with project affected persons and other relevant agencies at scoping stage and draft EIA stage respectively after sufficient announcement of the meeting(s). Project outline is explained sufficiently prior to public consultation at scoping stage.	-	Not required
5. Consultations with relevant stakeholders, such as local residents should take place if necessary throughout the	The prescript public consultation is held with project affected persons and other relevant agencies at	-	Not required

preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared.	scoping stage and draft EIA stage respectively after sufficient announcement of the meeting (s).		

Source: JICA Study Team

2.5 DESCRIPTION OF THE PROJECT'S EIA PROCESS

The environmental impact assessment was undertaken based on the Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) for the proposed project. The resulting study was documented in the form of an Initial Environmental Examination Report (IEE). Minimum required by DENR-EMB for the issuance of an Environmental Compliance Certificate (ECC) will be an IEE.

The IEE as outlined in the revised procedural manual was used as basis in the conduct of this study.

The result of the IEE shall be used by the proponent as a tool in the formulation of appropriate environmental management plan for the proposed project.

2.5.1 IEE TEAM

KRC Environmental Services is composed of multi-disciplinary specialists with expertise in the conduct of Environmental Impact Assessment, IEE and other environmental studies. The following are the team composition.

Ricardo A. Capule	-	President / Air & Noise Quality Specialist
Marilou P. Avenido	-	Team Leader
Maria Carmela Q. Capule	-	Project Manager/Environmental Scientist
Milagrosa P. Asuncion	-	Sociologist
Abelardo H. Angadol Jr.	-	Terrestrial Specialist
Pablito C. Argamosa	-	Geologist
Virgilio M. Garcia	-	Hydrologist

2.5.2 IEE STUDY SCHEDULE

The team was assigned to conduct the IEE study from November 2017 to March 2018. Public Consultations with Municipalities and Barangay Scopings were held on December 2017 and January 2018 respectively. 2nd Public consultations with Municipality was held on February 2018.

Ocular inspection of the area to determine the exact location of the project site, to establish the primary and secondary impact areas, the existing land uses, the receiving body of water, ecological characteristics, geophysical feature, etc.

Both primary and secondary were collected and used in the environmental examination and assessment of impacts of the project. Different methods were used in gathering primary and secondary data:

- Meeting with the proponent and extensive discussion on the description of the project
- Gathering and review of secondary data from proponent, private and concern government offices.
- Actual site investigation, focus group discussion and consultative meetings
- Mapping using GPS, compass, topographic and google maps

- Actual water, air and noise survey
- Actual flora and fauna survey
- Actual investigation of socio economic profile and gathering and review of secondary data

2.5.3 IEE STUDY AREA

The scope of the study focuses on the probable adverse impact that may occur during the operation phase of the project on water, air, soil, health, people and the environment in general. The impact prediction is based on similar, past actual eventuality and perceptions based on the present physical condition of the environment

Based on the predicted impacts, the enhancement and mitigating measures were formulated to prevent the occurrence of such adverse impact. However, the limitation of the study is that it was only predictable based on the available primary and secondary physical and scientific data. The study area is within the direct impact which are Barangays Nituan, Gumagadong Calawag, Making and Manion where the road alignment and right of way are situated while the indirect impacts are the surrounding barangays, the hosts and surrounding municipalities and provinces.

2.5.4 EIA METHODOLOGY

Scoping with DENR is usually done to define the range of actions, alternatives, and impacts that are to be examined. The project falls under **Minor Roads and Bridges Item C.4.b (Roads, new construction, widening including RO-RO facilities)** with a total length of 5.9 kilometers having no critical scopes covered. The presented outline prepared by DENR in the Revised Procedural Manual for DAO 03-30 was used as basis to determine the actual scope of this study. **Table 22** presents the different components and methodologies of the project.

Table 22. Components and Methodologies of the Project

COMPONENT	METHODOLOGY
Project Description	Meetings with the proponent and actual site investigation
Baseline Environmental Condition	Secondary data gathered from the proponent, concern government offices and institution, actual gathering of flora and fauna, transect method in the identification of trees, actual social-economic investigation.
Delineation of Impact areas	Annex 2-2 of Rev Procedural Manual DAO 2003-30
Impact Assessment	Qualitative assessment and expert opinion
Environmental Management and monitoring Plan	Template on Annex 2-17,2-18,2-19, 2-20 of the Rev. Procedural Manual of DAO2003-30
Secondary Data	Research, gathering and review of data from LGUs concern, PHIVOLCS, PAGASA, EMB, DPWH, CTI, LGUs

Section 3

BASELINE ENVIRONMENTAL CONDITIONS AND ANALYSIS OF KEY ENVIRONMENTAL ASPECTS

This section describes and discusses the existing environmental conditions of the project site.

DESCRIPTION OF EXISTING CONDITIONS

Determinations of environmental conditions were undertaken through extensive research. Furthermore, ocular inspections of the project site as well as its immediate vicinity and contiguous area/community were undertaken to determine any possible impact.

3.1 The Land

3.1.1 Land Use and Classification

The land use along the proposed alignment is classified into agricultural and residential areas. Since no Comprehensive Land Use Plan (CLUP) provided by the Local Government Units (LGUs) from the Municipalities affected to properly identify the delineation of the residential land, the survey team did an estimated delineation using a GPS. **Table 23** shows the land use of affected barangays.

Table 23. Land Use (sq. m)

Municipalities	Barangays	Residential	Military Reserve	Agricultural	All Lands
		Total Area Affected (sq.m)	Total Area Affected (sq.m)	Total Area Affected (sq.m)	Total Area Affected (sq.m)
Parang	Nituan	4,552.04	24,513.15	39,660.80	68,725.99
	Manion	0	22,143.30	0	22,143.35
	Gumagadong Calawag	411.44	0	14,592.92	20,174.91
	Making	3,285.66	50,832.97	13,073.25	67,191.868
Total		**8,249.14**	**102,660.02**	**67,326.97**	**178,236.13**

Source: RAP Survey Team
Note: Classification is based on the Municipal Assessors

3.1.2 Geology and Geomorphology

The Project Area is dominated by volcanic plain or volcanic piedmont deposits, chiefly pyroclastics and/or volcanic debris. The most recent deposits, Quaternary Alluvium, is composed of alluvium, fluviatile, lacustrine and beach deposits, raised coral reefs, and beachrock. Other lithological facies are composed mostly of submarine andesite and basaltic flows intercalated with pyroclastics and clastic sedimentary rocks; and reef limestone lenses largely confined within the axial zones Mindanao.

The study was guided by the Department of Environment and Natural Resources (DENR) Administrative Order No. 2000-28, which requires all land development projects to undertake engineering geological and geohazard evaluation as safeguard from the hazards caused by geological phenomena. The guidelines and checklist in carrying out the study and the preparation of the corresponding report follows Memorandum Circular No. 2000-33 issued by the Mines and Geosciences Bureau (MGB).

The geological and geohazard assessment is a vital component of the Environmental Impact Survey to enable the preparation of an Environmental Assessment (EIA) report. The general procedures in carrying out the activities are described as follows:

a) Bibliographic research and desk studies involving the review of available relevant data from national agencies, local government units, and private entities. These include the MGB, National Mapping and Resource Information Authority (NAMRIA), Philippine Institute of Volcanology and Seismology (PHIVOLCS), and the provincial and municipal government of involved localities. Other pertinent information was obtained from several literatures, published materials, and online sources.

b) The field verification of existing secondary information was guided by the available geological maps from MGB, the quadrangle topographic maps published by NAMRIA, and the index/location maps, pertinent plans and drawings provided by JICA.

c) The extensive areal extent of the project necessitates the use of available aerial photographs, and imageries including available Google Earth maps.

d) The field mapping was done on a base with sufficient and satisfactory horizontal and vertical control, such as a detailed topographic map. The nature and source of the base map used are specifically indicated.
e) Careful attention was given to the lithology, structural elements, and three-dimensional distribution of the earth materials exposed or inferred within the area.
f) Distinction was made between observed and inferred geologic features and relationships. Where three-dimensional relationships are significant but cannot be described satisfactorily in words alone, the report is accompanied by geologic cross sections.

g) The geomorphologic characteristics of the project area were verified including the evaluation of the presence of natural hazards such as erosion, active slope movement, flooding and seismic risk.

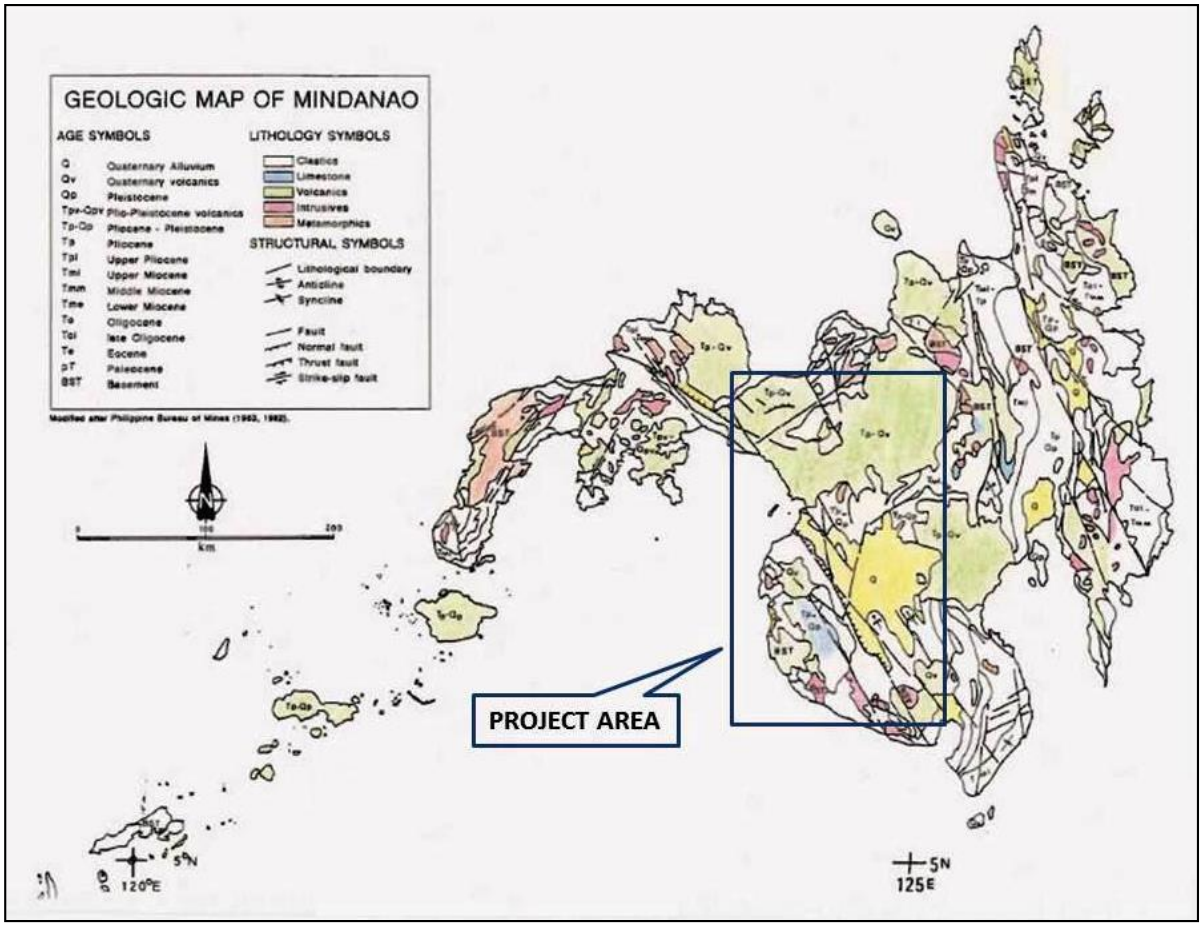
3.1.2.1 Regional Setting

3.1.2.1.1 General Geology

The MGB classified the island of Mindanao into western, central and eastern geologic provinces. Previous geologic studies have identified three (3) main physiographic-structural units in the island, namely a) Pacific Cordillera, Mindanao Central Cordillera and Agusan-Davao Basin; b) Tiruray-Daguma Range and Cotabato Basin; and c) NE-trending Zamboanga Peninsula and Sulu Islands. The subduction zones south of Cotabato and east of Surigao are considered most significant in the geologic development of Maguindanao province.

The province of Maguindanao forms part of the Tiruray-Daguma Range block which forms the southwest margin of the Cotabato Basin. The basement is composed of Cretaceous-Paleogene metamorphosed sediments and volcanics. The northern portion is covered by uplifted Pleistocene reefal limestone and andesite. The southeastern part consists of Pliocene to Pleistocene andesitic pyroclastics and lavas that form Mt Parker. The oldest rocks are the partly metamorphosed Cretaceous to Paleogene tuffaceous mudstone and greywacke which are intercalated with lava flows.

The geologic map of Mindanao is shown in **Figure 20**.



Source: MGB, as cited in Corpuz, 1992

Figure 20. General Geology of Mindanao

3.1.2.1.2 Tectonics

Mindanao Island is a composite of at least two terranes; one with Eurasian affinity (western Mindanao) and the other belonging to the Philippine Mobile Belt (eastern Mindanao) of Philippine Sea plate affinity. The island is surrounded by three subduction zones that have been installed only in the past 4 million years. Prior to this, the two terranes were separated by an ocean that disappeared continuously by subduction of its two edges beneath western and eastern Mindanao. The suturing of the two terranes occurred at ca. 5 Million years. Following this major structural reorganization, abrupt changes are recorded in the old magmatism of the island (Sajona et al., 1994).

The Central Cordillera, Agusan-Davao Basin and Pacific Cordillera are part of the Philippine Arc System. The Central Cordillera is thrust westwards over the Lanao-Bukidnon Highlands. The Pacific Cordillera is thrust westwards over the Agusan Davao Basin. The basin is asymmetrically-shaped with its depocenter located to the east.

3.1.2.1.3 Seismicity

Mindanao Island is prone to seismic events emanating from major earthquake generators in the Philippine Arc System. Active trenches mark out large areas of mainland Mindanao, as well as major fault systems, sub faults and lineaments (PHIVOLCS).

In the ARMM, the active faults within a 100-km radius of the Project Area include the Cotabato Trench and Mindanao Fault as shown in **Figure 21**. By definition, an active fault is one that has moved during the last 10,000 years.

The Philippine Fault located farther east of the Project Area is also included in the discussion due to its significant influence to the seismicity of Mindanao.

a) Cotabato Trench

The Cotabato Trench is a deep depression approximately 4 km deep at the northeastern edge of the Celebes Sea Basin. This geological structure is considered responsible for the Moro Gulf earthquake of August 17, 1976 that registered a computed magnitude of 7.9 in the Richter Scale. The Palimbang earthquake of 2002 with a registered a magnitude of 7.5 was also attributed by PHIVOLCS to subduction along the Cotabato Trench.

A left-lateral strike-slip feature known as the Cotabato Fault that cuts across the Zamboanga Peninsula appears to link the Cotabato Trench with the Negros Trench (Pubellier, et al., 1993).

b) Mindanao Fault

The Mindanao Fault is a trending fault extending from northern Zamboanga Peninsula to eastern Cotabato. The fault is physically traceable to approximately 400 km on the western third of Mindanao Island. It has two distinct segments including that which separates the Daguma Range from the Cotabato Basin corresponding to the Cotabato Fault segment (MGB, 2010). The Sindangan Fault segment, on the other hand, represents the northern continuation of the fault towards Zamboanga. Focal mechanism solutions of earthquakes offshore and narrow shear zones transection recent gravel deposits suggest active sinistral faulting (Pubellier et al., 1991).

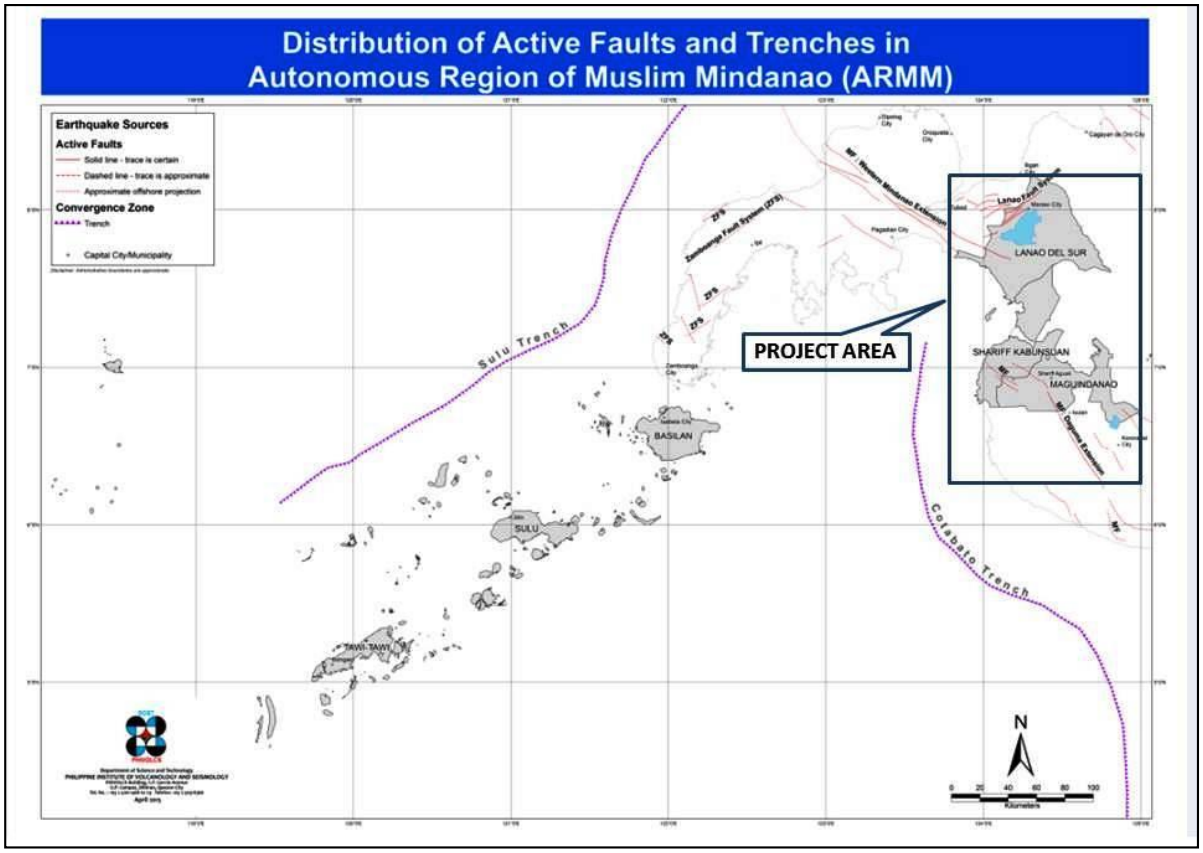
c) Philippine Fault Zone

The Philippine Fault Zone (PFZ) is located farther east within a 300-km radius of the Project Area. The 1,200-km-long PFZ is a major tectonic feature that transects the whole Philippine archipelago from northwestern Luzon to southeastern Mindanao (PHIVOLCS). This arc-parallel, left-lateral strike slip fault is divided into several segments and has been the source of large-magnitude earthquakes in recent years, such as the 1973 Ragay Gulf earthquake (M 7.0), 1990 Luzon earthquake (Mw 7.7), and the 2003 Masbate earthquake (Ms 6.2).

Several subordinate faults are intimately linked to the evolution of the PFZ. In Mindanao, a left-lateral fault zone is comprised by the NW-trending Sindangan-Cotabato-Daguma Lineament This accommodates some of the stress that is not being accommodated by the surrounding trenches in Mindanao (Yumul et al., 2008).

d) Other Earthquake Generators

Moderate earthquakes could be generated by the Sulu Trench, the Zamboanga Fault System, and the Lanao Fault System. The Sulu Trench has been seismically inactive for the last 120 years but PHIVOLCS considers it potentially capable of triggering a major earthquake due to stress build up.



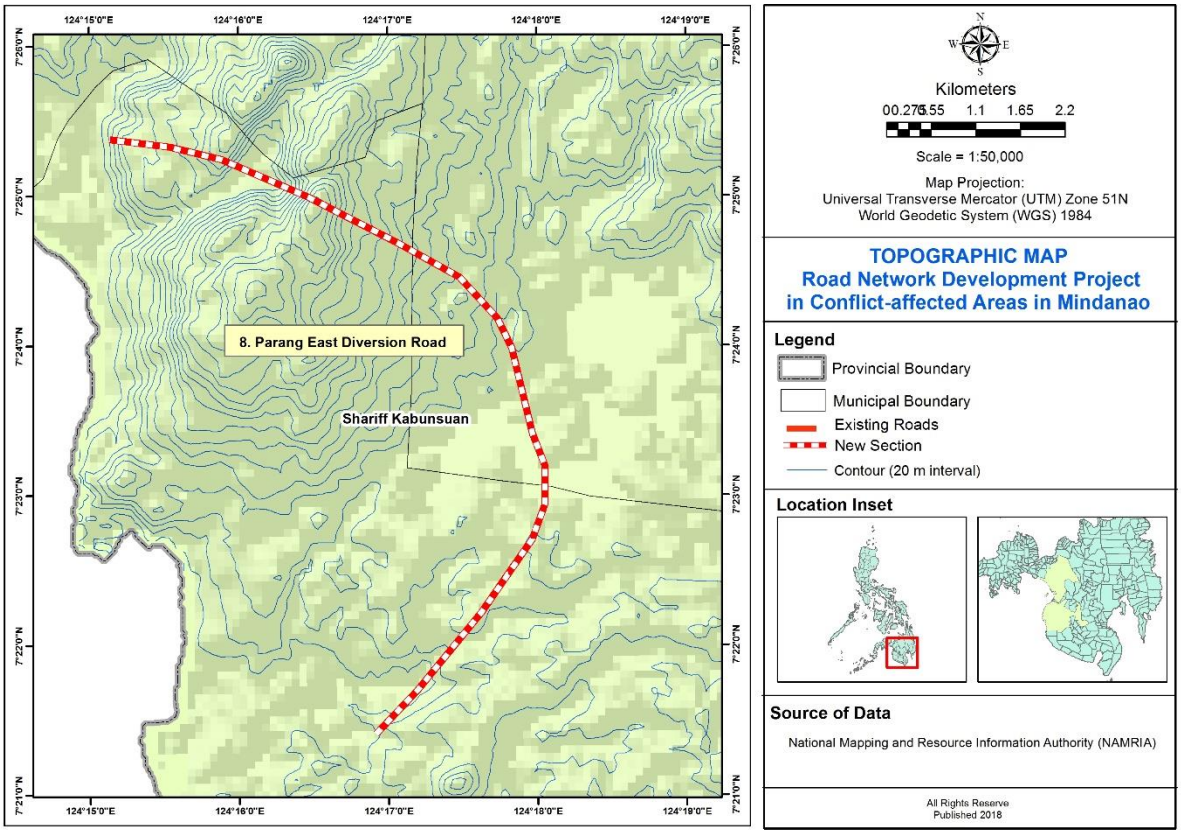
Source: PHIVOLCS

Figure 21. **Distribution of Active Faults and Trenches in ARMM**

3.1.2.2 Project Site Geologic Setting

3.1.2.2.1 Topography

In general, Maguindanao has 45 percent plain and 55 percent sloping areas. Its southwestern part consists of mountain cluster of the Binica and Blit Mountains. The biggest and longest river is the Rio Grande de Mindanao which flows through Liguasan Marsh before emptying into the Moro Gulf (REDPB-ARMM, 2005). **Figure 22** shows the topographic map of the area.



Source: NAMRIA
Figure 22. Topographic Map of the Project Area

The gently sloping to undulating area consists of the coastal and alluvial plains. These areas have nearly flat ground slope of 0 to 8 degree. The topography is characterized by lower elevations that are commonly developed into agricultural lands. The terrain is generally flat to nearly flat and the groundwater table is expected at relatively shallow depth. The area forms the transition between the coastal plain and the undulating to rolling area.

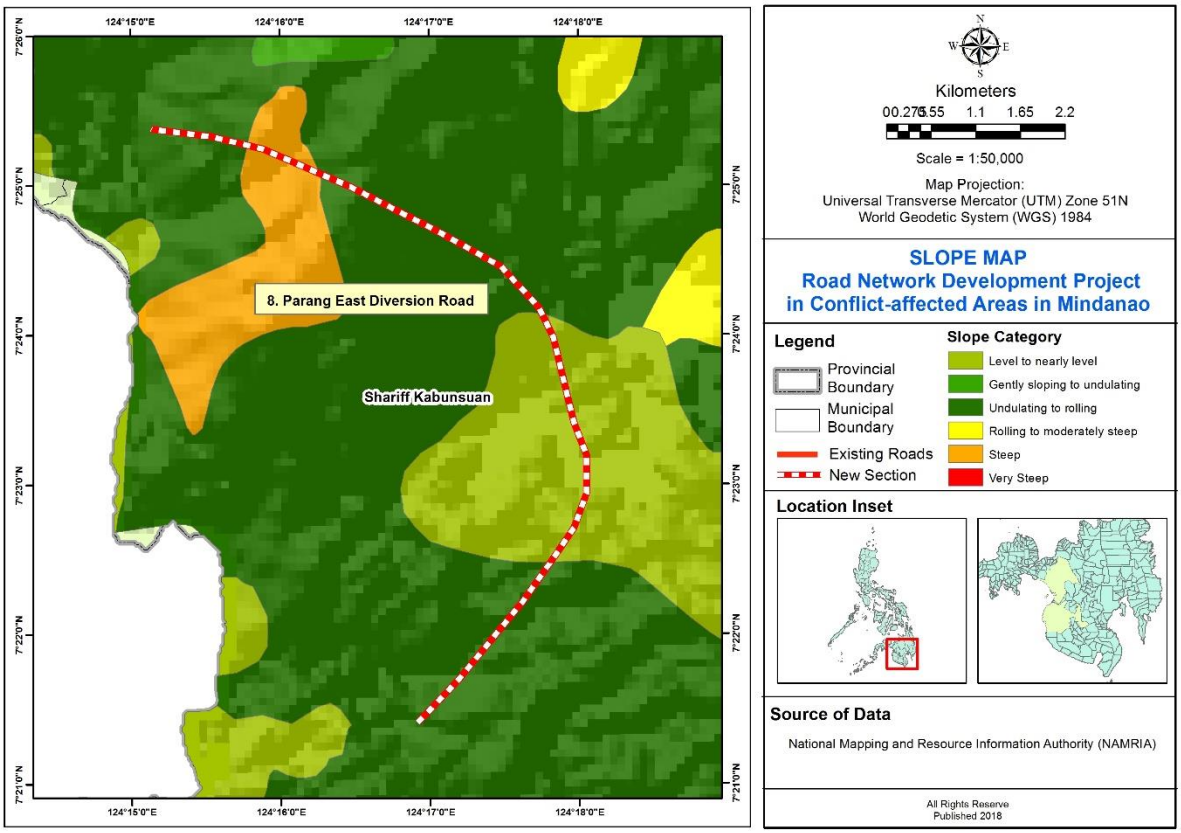
The undulating to rolling area is underlain by volcanic and/or sedimentary rock formation that gave rise to undulating to rolling ground. The ground slope ranges from 8 to 18 degree. The groundwater table is expected to be fairly deep. Most areas are covered with assorted secondary growth trees, coconuts, and grasses.

The rolling to moderately steep terrain has a ground slope range from 18 to 30 degree. It is generally found on the mountain foot slope formed by volcanic and/or sedimentary rock formation. This topography includes rolling hills, ridges and elevated inland valley.

Table 24 shows the slope classification of the project area and **Figure 23** shows the slope map of the project site.

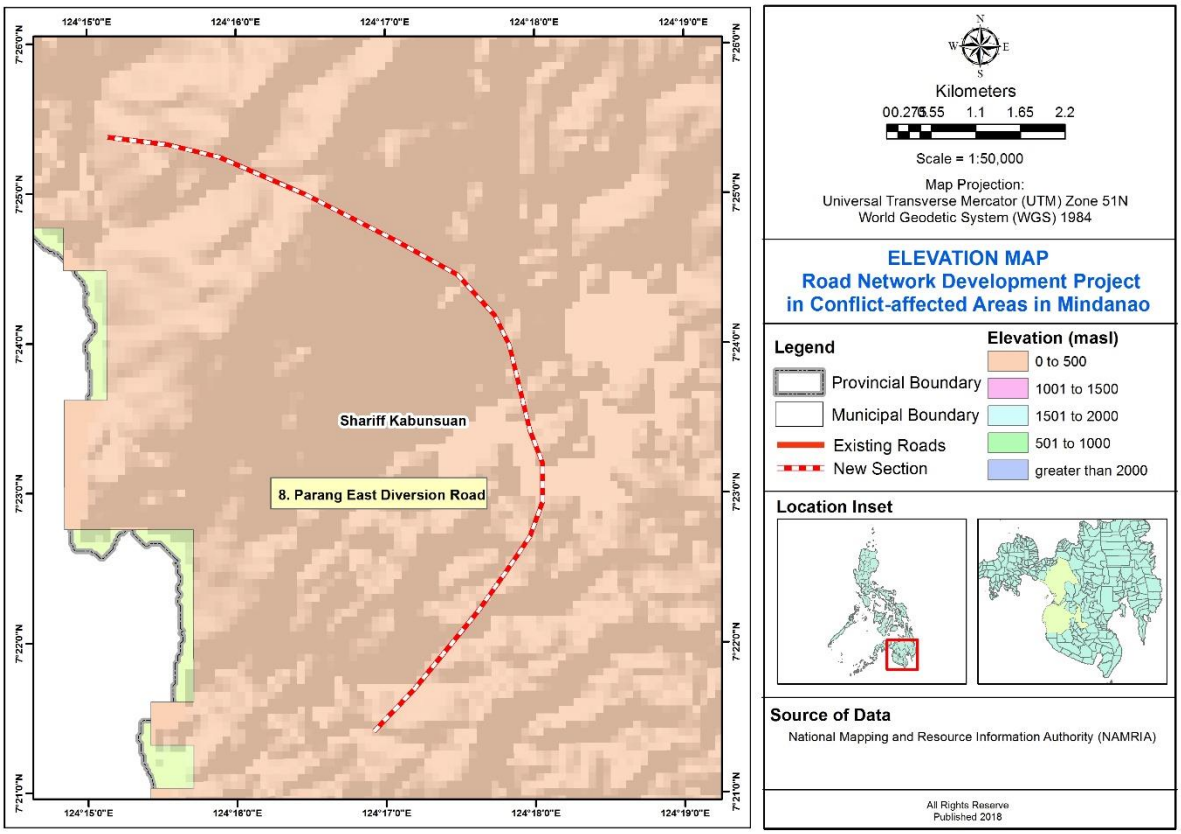
Table 24. Slope Classification of the Project Area

Slope Ranges(°)	Description
0-8	Gently sloping to undulating
8-18	Undulating to rolling
18-30	Rolling to moderately steep
30-50	Steep
50 and above	Very steep



Source: NAMRIA
Figure 23. Slope Map of the Project Area

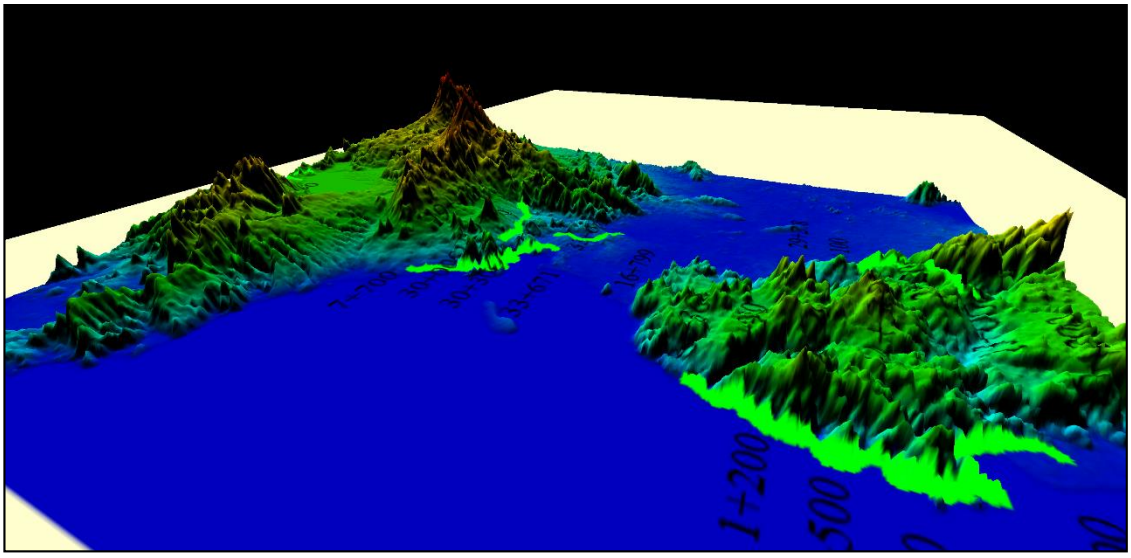
Generally, the elevation within the project area varies from 0 to 500 meter above sea level (masl). The lower elevation is concentrated mainly at SP 8 –Parang East Diversion Road. **Figure 24** shows the elevation map of the project site.



Source: NAMRIA
Figure 24. Elevation Map of the Project Area

3.1.2.2.2 Geomorphology

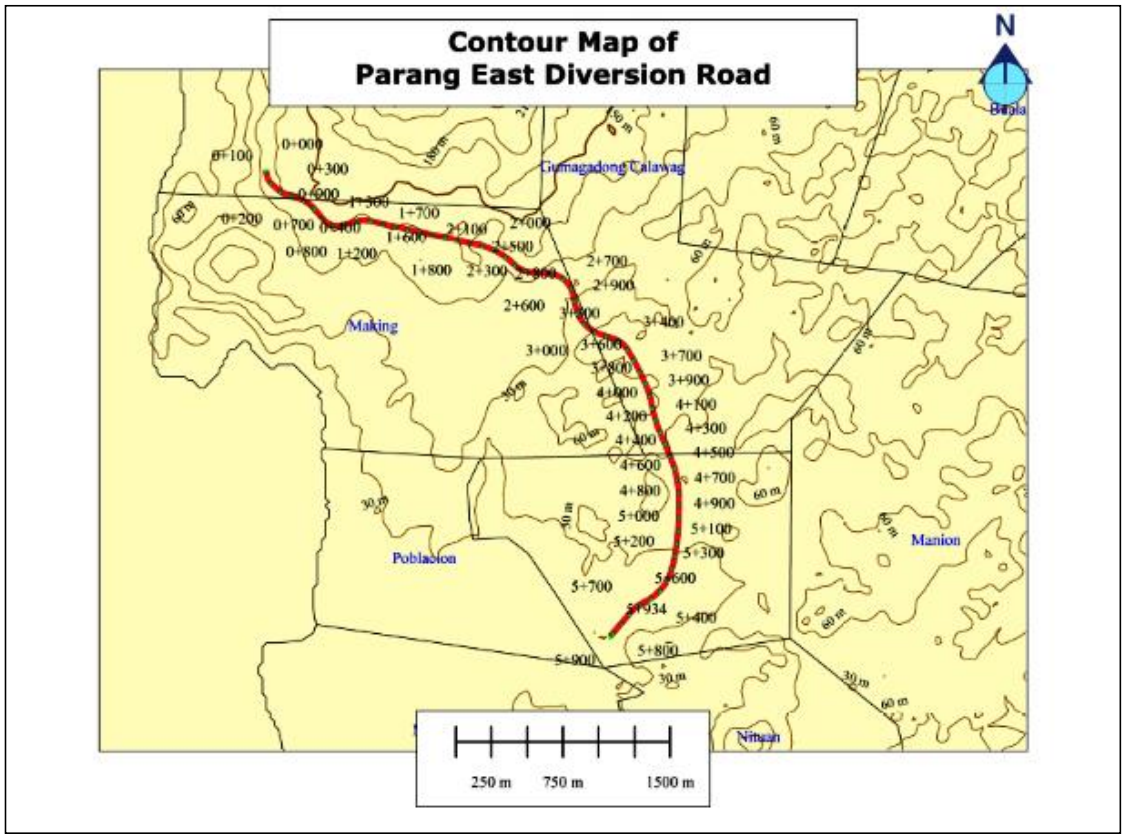
The mountainous areas in the region consist chiefly of basement and Tertiary volcanic rocks; while Tertiary sedimentary rocks predominate in lowland areas. A cluster of inactive volcanoes with associated volcanic lakes in Lanao del Norte and Lanao del Sur.is collectively called the Lanao Volcanic Complex. The volcanoes include Mt. Gadungan, Dos Hermanos Peaks, Mt. Cabugao, Mt. Iniaoan, Lake Nunungan, Mt. Catmon, Mt. Sagada, Mt. Puerai and Gurain Mountains. **Figure 25** shows the type of rock transected by the proposed roads.



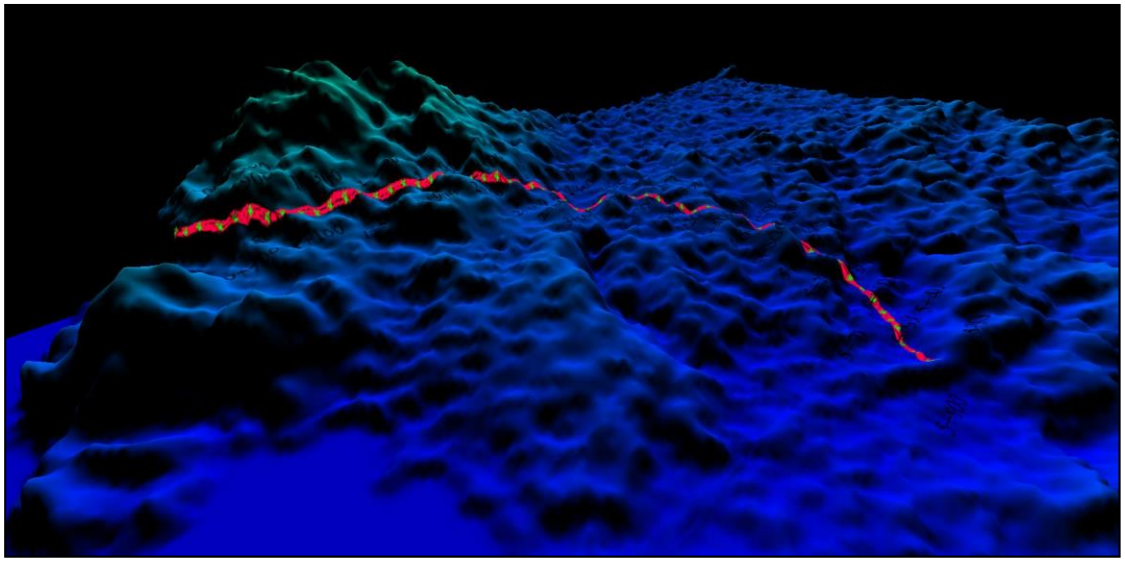
Base Map Source: JICA Study Team
Figure 25. 3D View of Type of Rock (pyroclastics/volcaniclastics/submarine rocks) Transected by the Proposed Roads.

The contour maps and 3D maps of the Project are shown in **Figure 26** and **Figure 27**. The alignment of Sub-Project 8 passes through four barangays of Parang. The construction of the diversion road will decongest the AH26: Narciso Ramos Highway and the primary Cotabato-Pagadian Road, provide a trunk road at the eastern portion of the town which would allow new settlements to establish, and bolster the connection between the planned agri-industry in Buldon, Barira, and Matanog which is expected to generate high volume of vehicular traffic; and the primary Polloc Port, by providing a bypass road at the congested section of the national highway.

The diversion road project is a 6.963-km long RSR Project. The alignment follows a NE-NW alignment. The topography is characterized by low relief and gently undulating to rolling topography with approximate elevation range from 20 to 100 masl.



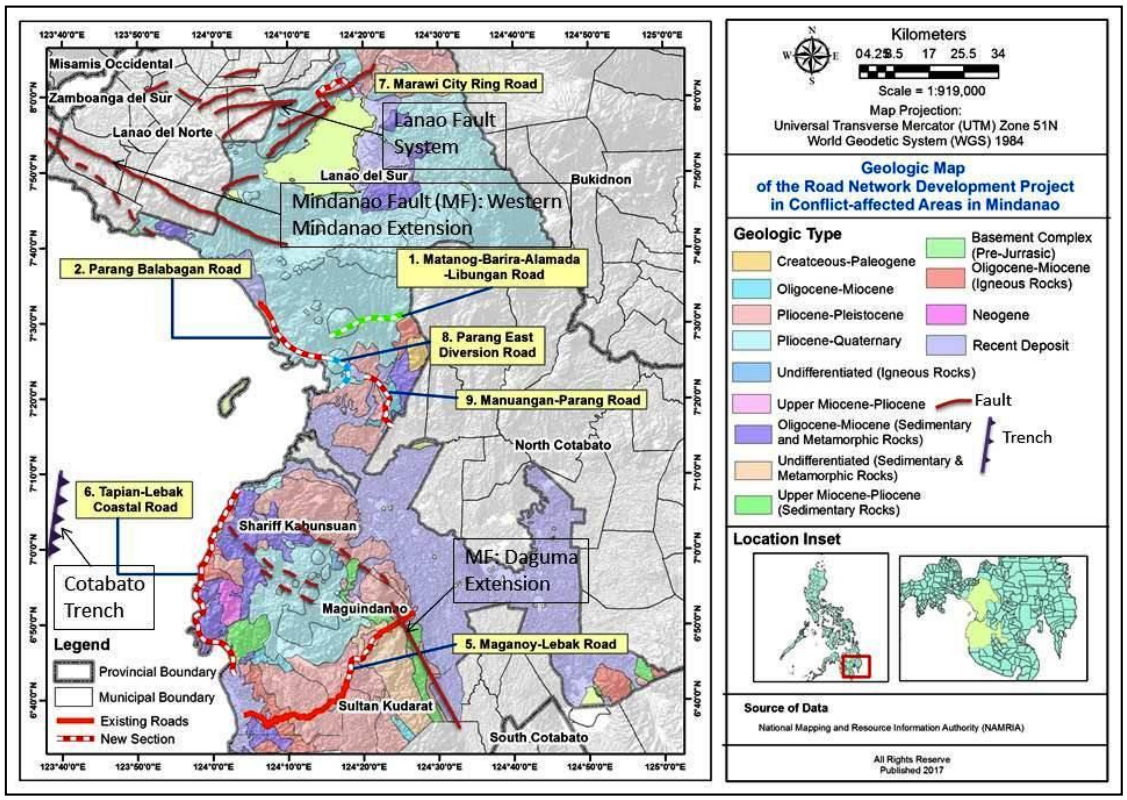
Base Map Source: JICA Study Team
Figure 26. **Contour Map of SP No. 8 Parang East Diversion Road**



Base Map Source: JICA Study Team
Figure 27. 3D View of SP No. 8 delineated by the red line

3.1.2.3 Site Geology

The Project Area is dominated by volcanic plain or volcanic piedmont deposits, chiefly pyroclastics and/or volcanic debris usually found at the foot of volcanoes. Plateau basalt in Pagadian and Lanao regions, and non-active cones are also present. **Figure 28** presents the geologic map of the project area.



Source:JICA Study Team

Figure 28. Geologic Map of the Project Area

The most recent deposits, Quaternary Alluvium, is composed of alluvium, fluviatile, lacustrine and beach deposits, raised coral reefs, and beachrock. Other lithological facies are composed mostly of submarine andesite and basaltic flows intercalated with pyroclastics and clastic sedimentary rocks; and reef limestone lenses largely confined within the axial zones Mindanao.

Thick, extensive, transgressive mixed shelf marine deposits, largely wackes, shales and reef limestone are also present. These are underlain by conglomerate and associated with coal measures in places. Sometimes the rock unit is associated with basic to intermediate flows and pyroclastics. They are largely arkosic and quartzitic clastics, generally well-indurated, folded and locally intruded by quartz-diorite.

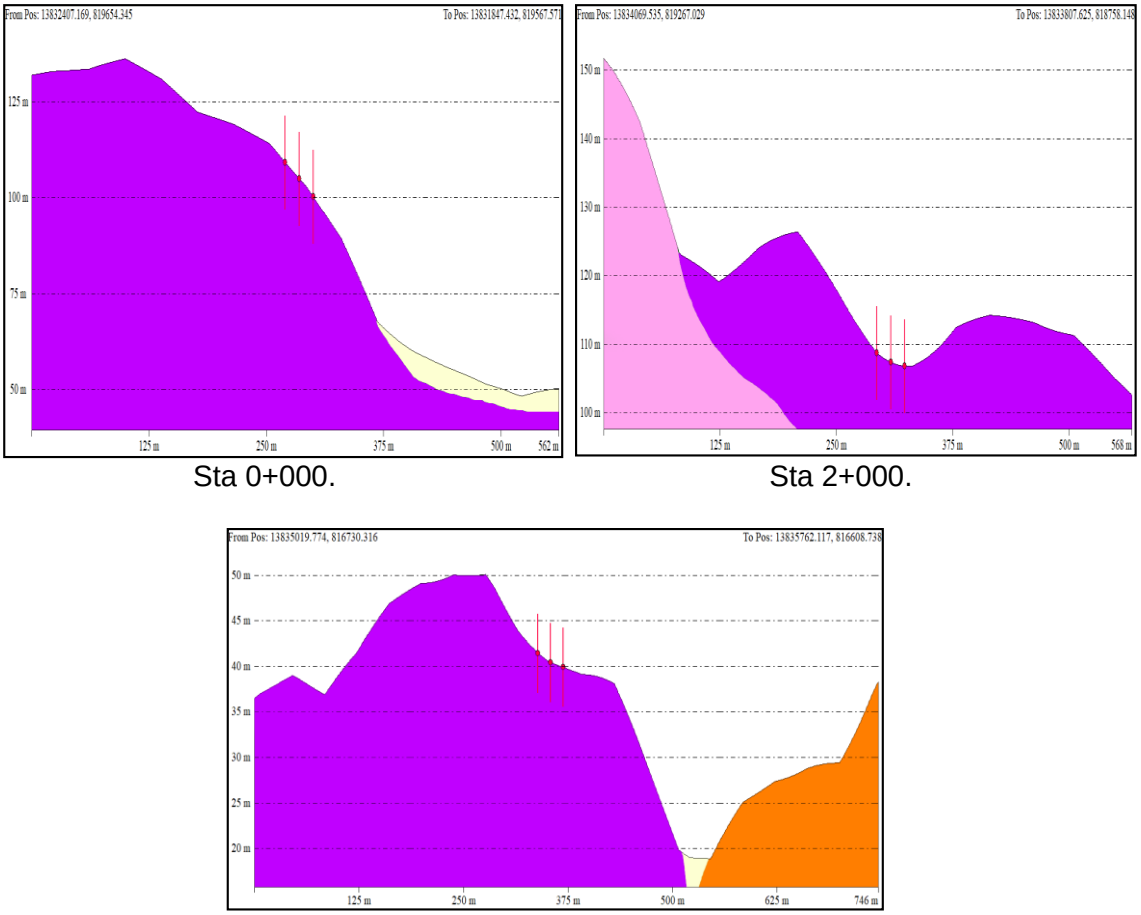
3.1.2.3.1 Geologic Profiles and Sections

Representative geologic sections are presented based on field verification of available geologic data and elevation and topographic data.

The three red vertical lines in the cross sections represent the left, middle and right sections of the proposed road.

Figure 29 shows the geologic profiles along Parang East Diversion Road. At Sta 0+000, it is expected that the volcanic rocks in this section is indurated. Lean to moderate thickness of alluvial materials may be expected. At Sta 2+000, the road section is underlain by volcanic

rocks. At Sta 5+000, the abrupt change in elevation and lithology manifest the presence of local faults in the area. This condition combined with the increased gradient exposes the proposed road to landslide. The V-shaped geomorphology indicates the presence of a river at the 520-meter mark of the cross section.



Sta 0+000. Sta 2+000.

Sta 5+000

(Source: Google Earth Elevation Profile)

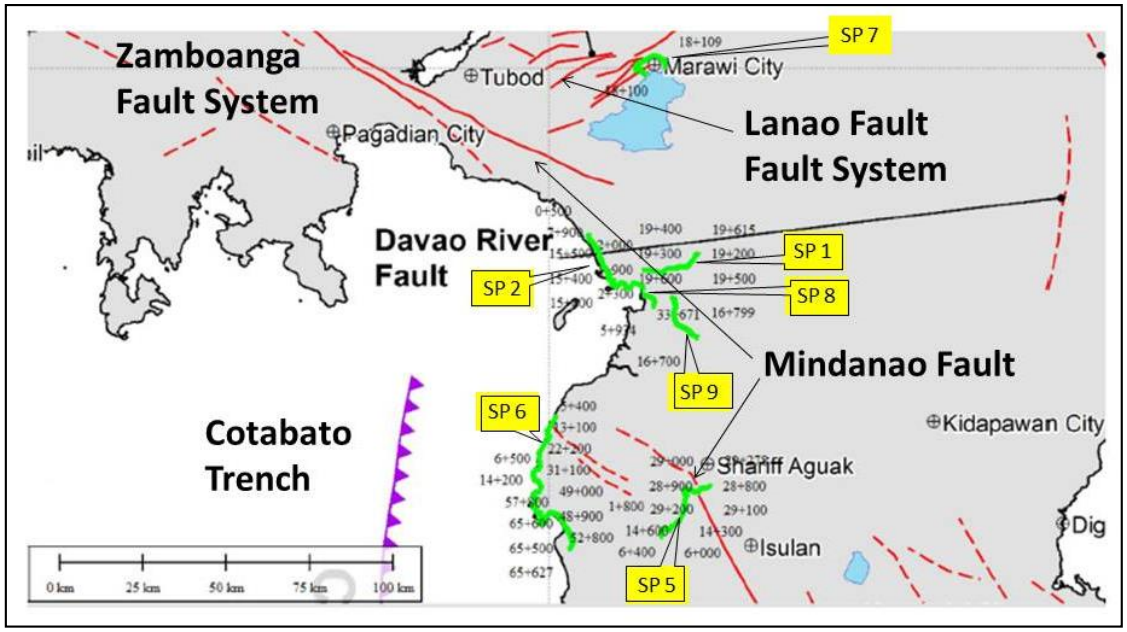
Figure 29. Representative Geologic Profiles along SP No. 8 Parang East Diversion Road

3.1.2.4 Geo-Hazard Assessment

The Project Area may be affected by natural hazards caused either by geophysical or hydrological events. The discussion of geologic hazards covers earthquake risk, ground shaking, ground rupture, tsunami, liquefaction, landslide, and flooding.

3.1.2.4.1 Earthquake Risk

The most likely source of destructive earthquakes within the Project Area are the Mindanao Fault and Cotabato Trench. Historically, the Project Area and neighboring provinces have experienced strong earthquakes in recent memory. The 7.9 magnitude 1976 Moro Gulf Earthquake was generated by Cotabato Trench. The 2002 Palimbang Earthquake with a registered a magnitude of 7.5 was also attributed by PHIVOLCS to subduction along the Cotabato Trench. The road sub-projects transected by active faults is shown in **Figure 30**.



Source: PHIVOLCS

Figure 30. Active Faults in Western Mindanao Transecting the Project Area

3.1.2.4.2 Ground Shaking

Ground-shaking is measured by ground acceleration, and the peak ground acceleration (PGA) is equal to the maximum ground acceleration that occurred during earthquake shaking at a particular location. Regional ground motion hazards emanating from earthquakes were studied by Thenhaus et. al in 1994. The ground acceleration within the Project Area has been estimated to be about 0.21g for bedrock and about 0.60g for soft soils. These values should be taken into account for determining the seismic coefficient to be applied for the design of foundation of the proposed road project.

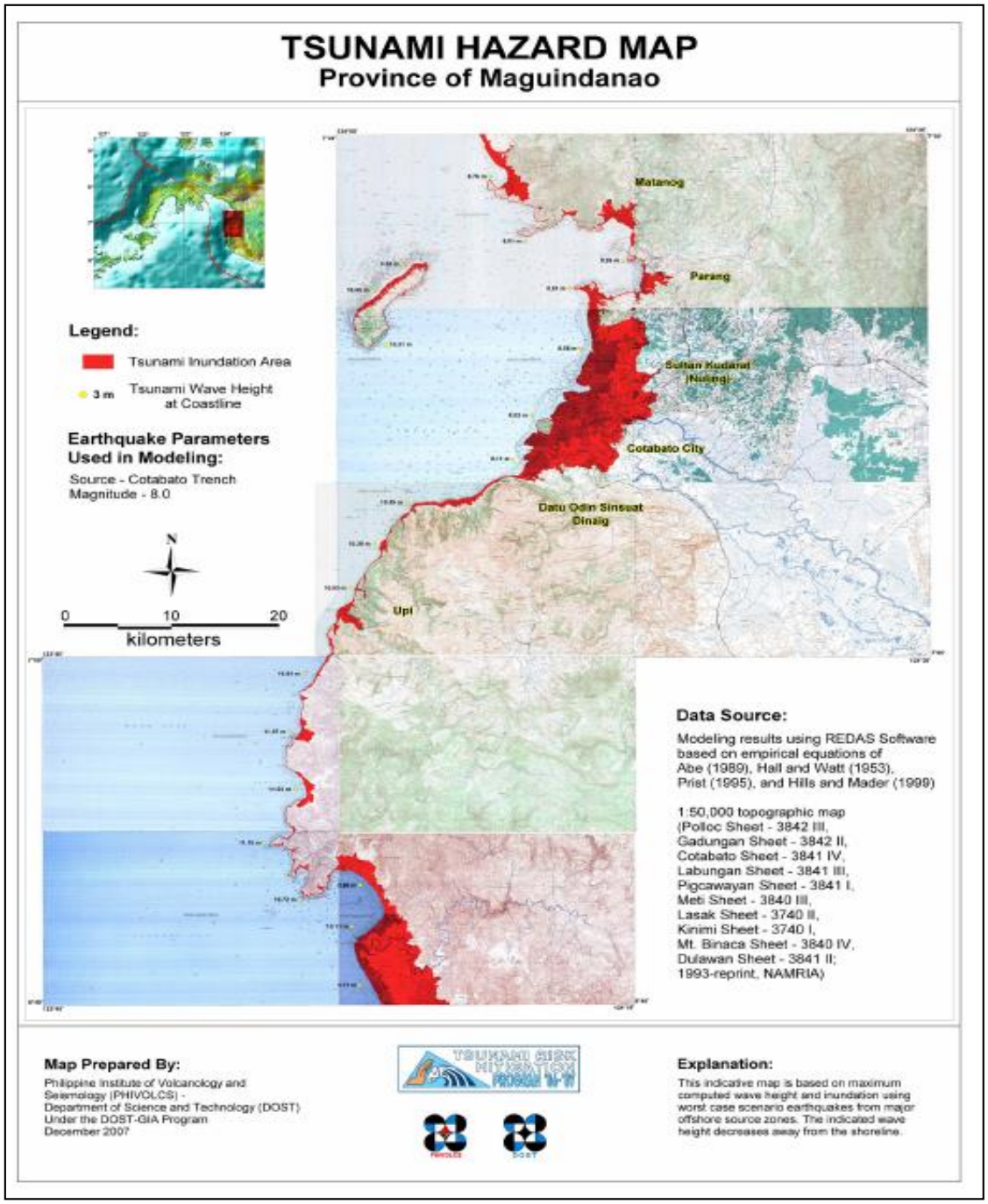
The proximity of active faults to the proposed road alignments indicates that moderately strong to strong ground shaking could be felt in the project area.

3.1.2.4.3 Tsunami

A tsunami is a series of sea waves commonly generated by under-the-sea earthquakes. The Moro Gulf earthquake of August 17, 1976 spawned a tsunami that damaged more than 700 km of coastline bordering Moro Gulf especially on the shores of Pagadian City. After the sea rolled back to its natural flow, thousands of people were left dead, others homeless or missing and millions of pesos lost due to damages to properties.

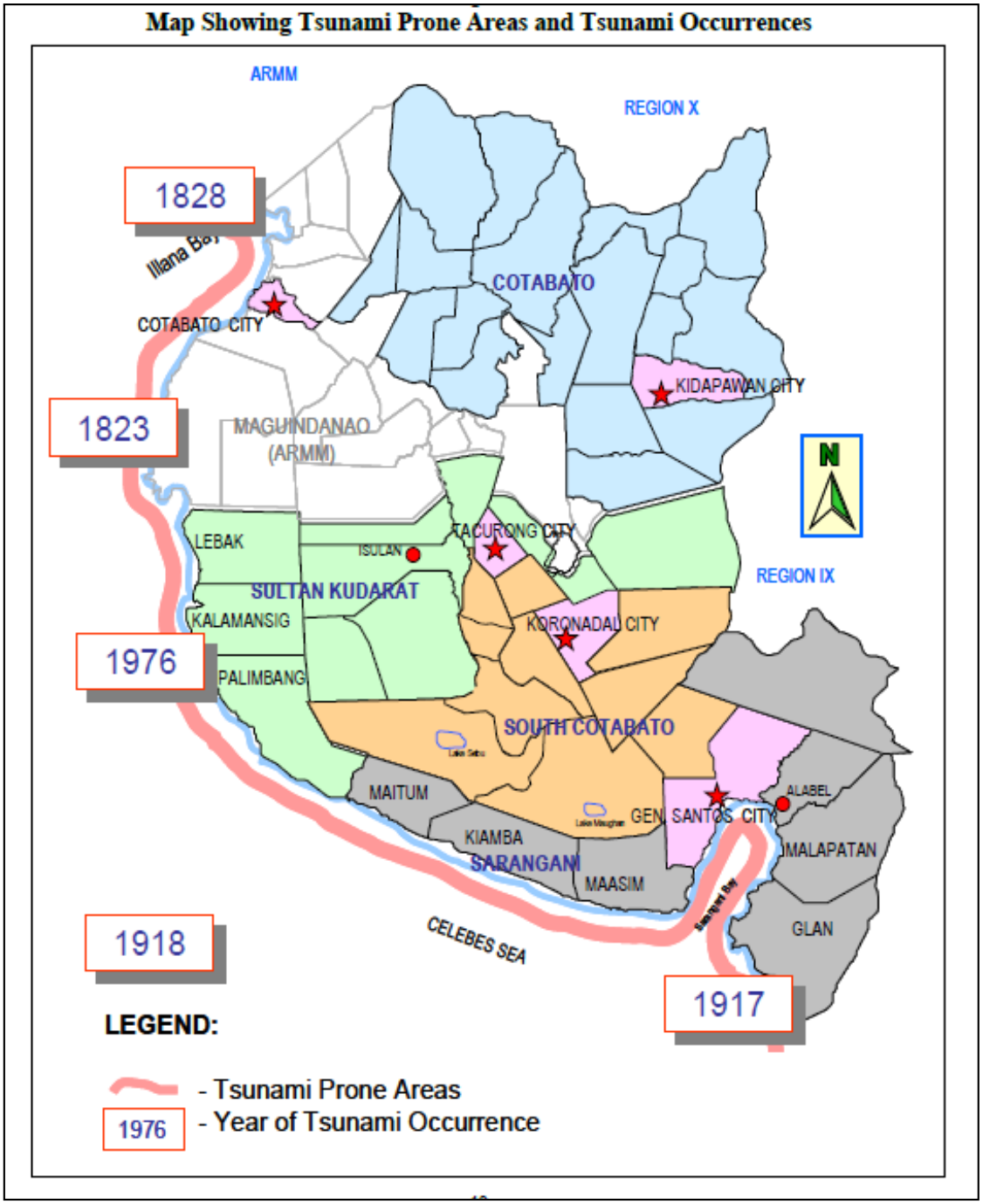
Studies have shown that the Philippine Trench is also capable of generating tsunamigenic (tsunami-generating) earthquakes. The Philippine Trench, located outside the 300-km radius of the Project Area, is the morphological expression of the westward subduction of the Philippine Sea Plate under the eastern Philippine Arc (Cardwell et al., 1980; Fitch, 1970; Hamburger et al., 1983). In 1992, two large earthquakes occurred off the eastern coast of Mindanao with the coastal areas of Davao del Sur and Surigao del Sur experiencing strong ground shaking and tsunamis. The highest tsunami wave was measured at about 6 meters (Besana et al., 2004). The location of the epicenter pointed to an event associated with the Philippine Trench (Narag et al, 1992).

PHIVOLCS has prepared tsunami hazard map for Maguindanao as shown in **Figure 31** using a magnitude 8.0 tsunamigenic earthquake generated by the Cotabato Trench, as parameters. Based on the map, SP-8 is not prone to tsunami since the area is far from the coastal line.



Source: PHIVOLCS
Figure 31. Tsunami Hazard Map of Maguindanao

The historical tsunami occurrences within the region is shown in **Figure 32**.



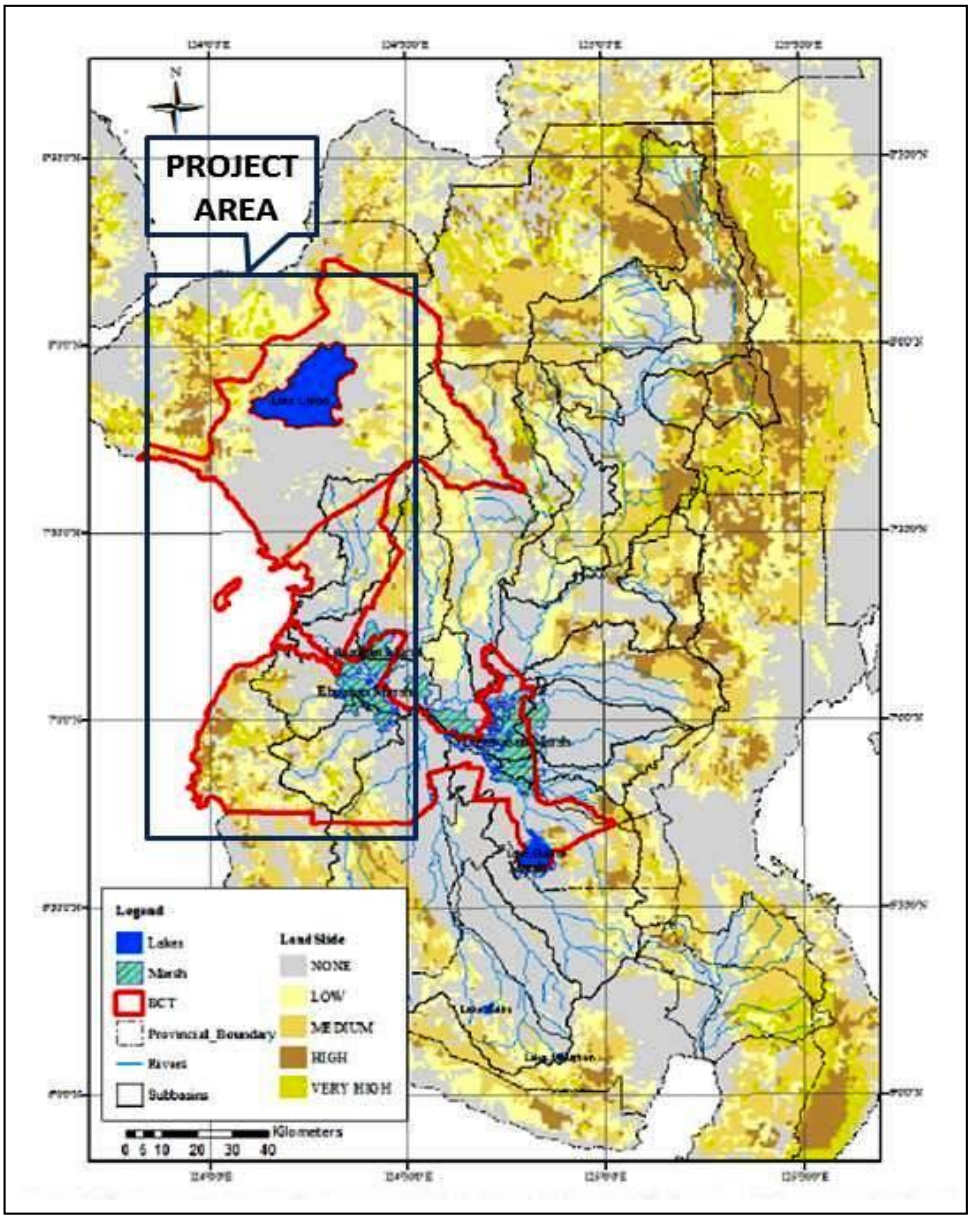
Source: Region XII DRM

Figure 32. Map showing Tsunami Prone Areas and Historical Tsunami Occurrences in Western Mindanao

3.1.2.4.4 Landslide

The primary cause of a landslide is the influence of gravity acting on weakened materials that make up a sloping area of land. The most destructive landslide events usually happen suddenly after a triggering event such as an earthquake or heavy rainfall. Landslide due to earthquake occurs as a direct effect of strong ground motion when the slope become unstable by the inertial loading it imposes or by causing a loss of strength in the slope materials.

As shown in **Figure 33** by the PHIVOLCS regional map of earthquake-triggered landslide, the mountainous areas in the region could experience low to moderate susceptibility to this hazard.



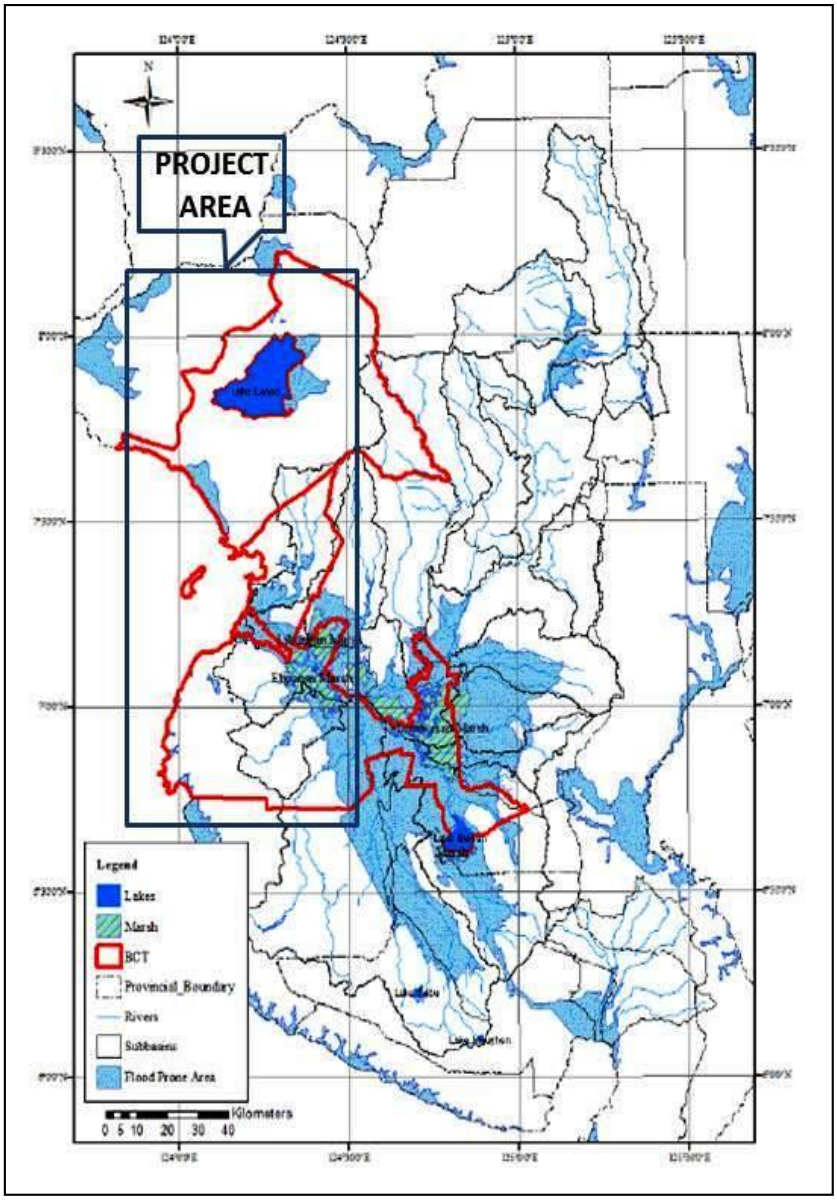
Source: PHIVOLCS

Figure 33. Earthquake-triggered Landslide Map

3.1.2.4.5 Flooding

The Office of Civil Defense (OCD)-ARMM has reported that Maguindanao is usually associated with the occurrence of typhoons, thunderstorms and/or monsoon rains.

Figure 34 shows the flood-prone area in the Bangsamoro region. The lowland area in Maguindanao along rivers such as the Mindanao River and the Simuay River, around Lake Lanao, and some parts of the coastline are flood prone areas.



Source: MGB

Figure 34. Flood-prone Areas in Bangsamoro Region

Flood susceptibility in the Parang East Diversion Road is generally considered low. However, localized flooding may occur due to the overflowing of water from rivers and other bodies of water. This can be triggered either by inadequate river flow whenever channels are clogged by deposition of sediments and debris; or the accumulation of rainwater along drainage systems particularly during intense typhoons, thunderstorms and/or monsoon rains.

3.1.2.4.6 Liquefaction

Liquefaction is the rapid loss of shear strength in cohesionless soils subjected to dynamic loading. The shear strength sometimes falls to nearly zero, while other times it only drops to a lower-than-normal value. Liquefaction occurs when the pore water pressure equals the weight of the overburden, brought about by the decrease in the volume available for interstitial fluids.

The Parang East Diversion Road is underlain by volcanic and/or sedimentary rocks which are not considered susceptible to liquefaction.

3.1.2.4.7 Volcanic Hazard

Five volcanoes within or proximate to the Project Area have been considered by PHIVOLCS as active. These are Mt. Makaturing in Lanao del Sur, Mt. Matutum in Cotabato, Mt. Musuan in Bukidnon, Mt. Parker in South Cotabato/General Santos/North Cotabato/Sarangani Provinces, and Mt. Ragang in Lanao del Sur and Cotabato Active volcanoes are characterized by eruption within historical times (within the last 600 years).

The closest active volcanoes to the Project Area are Mt. Makaturing and Mt. Ragang. However, their volcanic history is quite unclear due to the scarcity of eruption data. In the event of eruption, the impacts of hazards such as pyroclastic flows, lava flows, ashfall, lahars, volcanic gases, debris avalanches, volcanic earthquakes, tsunamis, and landslides will be influenced by the type and scale of eruption.

The other volcanoes within the Project Area are classified as potentially active (morphologically young volcanoes but with no historical record of eruption); and inactive volcanoes. Hence, the impact of volcanic hazard to the Project Area is considered low.

3.1.3 Pedology

The geographical representation of the soils in the Study area shows diversity of soil types ranging rom loam, peat and clay. The presence, distribution, and formation of these soils can be useful in determining the land drainage capabilities of the subprojects, including their properties as engineering foundations of the proposed sub projects road alignments. The type of soil in the project area varies from Balut and Parang clay loam.

3.1.4 Terrestrial Biology

3.1.4.1 Flora and Fauna

The terrestrial assessment was conducted after the desk review of the proposed project alignment, project orientation on the field, identification of sampling sites, coordination with the authorities, preparation of instruments, and field work proper. Selected sampling sites for flora and faunal species are located within the Municipality of Parang covering Barangays Nituan, Gumagandong Calawag and Making. **Figure 35** presents map of the proposed alignment and location of sampling plots. **Table 25** shows the geographic coordinates of sampling sites and name of covering barangays. **Figure 36** shows some photos of vegetation taken in the project area.

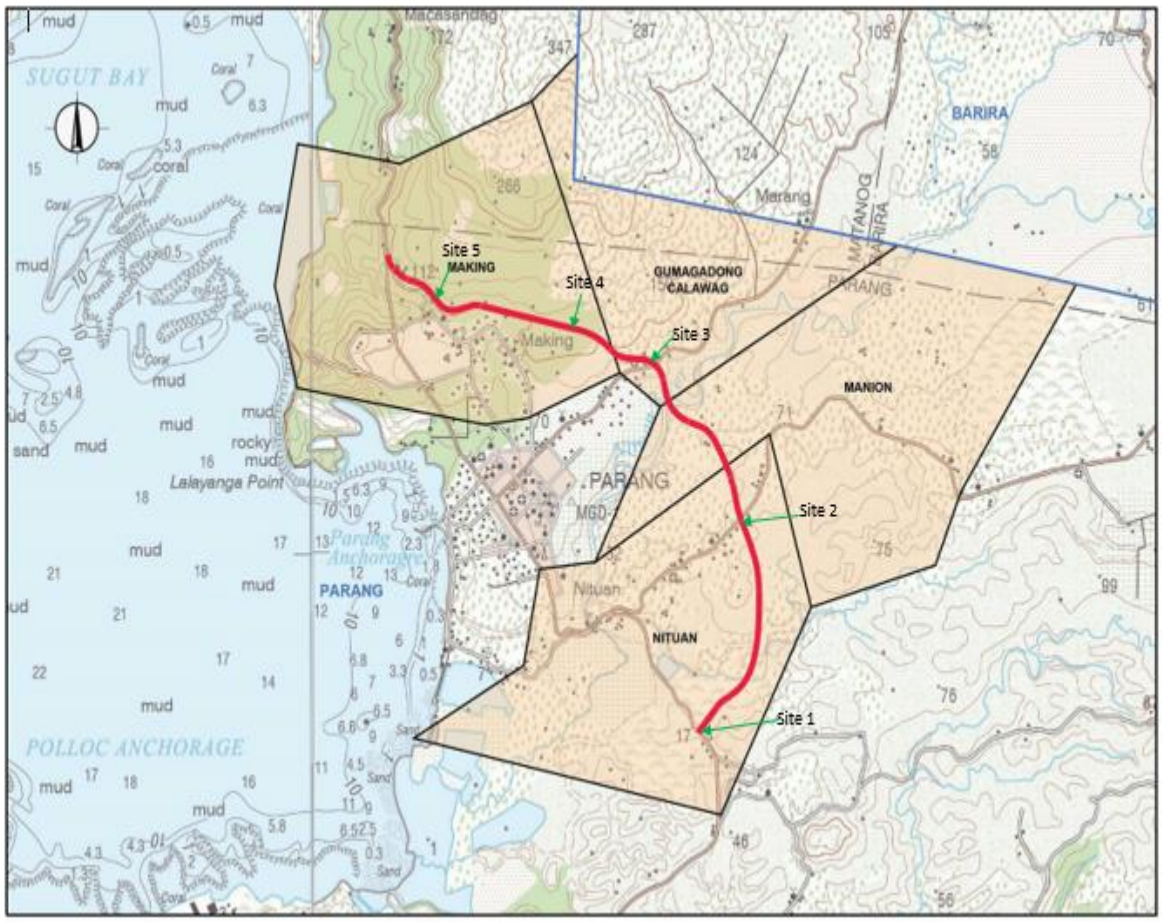


Figure 35. Location of Sampling Sites within the Proposed Road Alignment

Table 25. Geographic Coordinates and Covering Barangays of Selected Sampling Sites

Municipality	Barangay	Geographic coordinates	
		Northing	Easting
Parang	Nituan	7°21'31.10"	124°16'50.41"
	Nituan	7°22'24.52"	124°17'1.60"
	Gumagandong Calawag	7°23'1.59"	124°16'38.17"
	Making	7°23'11.51"	124°16'10.65"
	Making	7°23'16.49"	124°15'44.36"

A. Brgy. Gumagandong Calawag B. Brgy. Nituan

Figure 36. Photos showing the vegetation within and immediate vicinity of the proposed road alignment

3.1.4.1.1 Survey on Flora

Within the selected sites following the proposed road alignment, a 20m x 20m quadrats are measured for the identification of:
(1) tree species at the canopy layer with a diameter at breast height (dbh) of 10 cm and above;
(2) and agricultural crop such as niog with the height exceeding 5m. The species found were recorded for the computation and analysis of species richness, evenness, and distribution.

Inside the 20m x 20m sampling plots, a 5m x 5m sub-plots were also established in one corner for the identification of pole size trees forming the understory layer. All pole size trees with dbh ranging from 5cm to 9.5 cm were recorded. Additionally, agricultural plants which are an exception to the pole size tree criteria (i.e. banana) but has 2 meters and above height are also included. For the ground layer, a 1m x 1m sub-plots are also measured within the sampling plot.

Trees, palms, crops and other plant species observed outside the plots but situated within the proposed road alignment was also identified and recorded. Generated data during the survey were consolidated to form a species checklist indicating the common name, scientific name and family name of identified vegetations.

The following formulas were used to compute the Density, Relative Density, Frequency and Relative Frequency of the identified species:

1) DENSITY = $\frac{\text{number of individuals of any species}}{\text{Area of the plot or quadrant}}$

2) RELATIVE DENSITY = $\frac{\text{density of a species}}{\Sigma \text{ density of all species}} \times 100$

3) FREQUENCY = $\frac{\text{No. of occurrence of species among } n \text{ quadrant}}{n \text{ quadrants}}$

4) RELATIVE FREQUENCY = $\frac{\text{frequency of a species}}{\Sigma \text{ frequency of all species}} \times 100$

For the Diversity index, Shannon- Wiener index (H' and J) and Simpson's Diversity Index (Simpson's Reciprocal) were used with the following formula:

1) SHANNON DIVERSITY INDEX = H' = $-\sum p_i \ln (p_i) = -\sum (n/N) * LN (n/N)$

where:
H' = Shannon-Wiener index/information content of the sample, index of species diversity or degree of uncertainty
p_i = represents the proportion or relative abundance of each individual species to the total (n/N)
n = the total number of taxa of particular species
N = the total number of taxa in all species
LN = Natural logarithm

2) SHANNON EVENNESS = J= sum(H'/LNS)

where:
J = evenness
H' = information content of the sample, index of species diversity or degree of uncertainty
S = number of species in the community
LN = Natural logarithm

3) SIMPSON 'S RECIPROCAL INDEX $D = {}^{1}/_{\sum (n/N)^2}$

where:
D = Simpson Reciprocal Index
N = the total number of taxa in all species
n = the total number of taxa of particular species

4) For Biomass and Carbon Stored

Brown (1997) defined biomass as the total amount of aboveground living organic matter in trees (leaves, twigs, branches, main bole and bark) expressed as oven-dry tons per unit area. It is also referred to biomass density expressed in terms of mass per unit area or tons per hectare.

Brown Allometric Equation $Y = \exp(-2.134 + 2.530 \times \ln D)$

$$\mathbf{T_{TB}} = \frac{\sum \textbf{Biomass of all trees in a transect (Mg)}}{\textbf{Area of the transect (m}^2\textbf{)}} \times \frac{\textbf{10,000m}^2}{\textbf{1ha}}$$

where
Y = tree biomass
exp {…} =raised to the power of {…}
ln = natural log of (…)
y = above-ground biomass in kg

D = diameter at breast height (cm)

Carbon stored will be estimated using the default value of 45% (Lasco and Pulhin 2004):

Carbon stored = Cc × 1 Mg/ha

where:
Carbon content (Cc) = Biomass × 45%

3.1.4.1.2 Survey on Fauna

For the faunal dimension, the survey covers the avifauna and herpeto-faunal groups of wildlife-vertebrates. Prior to the conduct of sampling, general habitat assessment was undertaken to consider different ecosystems in the project area for the selection of observation sites. The rapid survey method was employed in the conduct of faunal diversity assessment. Transect walk of about 200 meters was undertaken in every selected sampling points within and along the proposed road alignment. Species not encountered during the period of assessment is generated through an interview with local informants to obtain other significant information with regard to the presence of other wildlife species in the area. Photo documentation of observed wildlife was also undertaken as much as possible for documentation and for further species verification when necessary.

Birds. Point area count method was used during the survey. All species observed within a radius of about 100 meters from the transect route was recorded. Techniques employed during the survey include ocular and aural observation, identification through wildlife calls, footprints and droppings if any. All bird species seen and heard by the observer at the sampling site were recorded. As much as possible, no double counting was made.

Reptiles and Amphibians. Active search for reptiles and amphibians was done systematically in all the selected observation sites considering the immediate vicinity of the alignment especially in areas with the presence of suitable habitats like underneath of decaying logs, uprooted trees and bamboos. For each species observed and heard, the name of the species, number of individuals and the type of habitat where it was found were recorded. Double counting of the individuals of the same species was definitely avoided. Photos of species encountered at the sampling sites were also undertaken.

Mammals. For non-volant mammals such as rodents, interview with local informants was undertaken to generate significant information relative to the presence/absence of mammal species in the area. Observation during the dusk hour in some selected sites was also undertaken to observe some volant (flying) mammals primarily bats in a selected site.

3.1.4.2 Biodiversity measurement

Biodiversity measurements were computed and analyzed using the Shannon-Wiener Diversity and Pielou's Evenness Indexes, with formulas illustrated below:

Shannon-Wiener Diversity: $H' = -\sum p_i \ln (p_i)$, where,

"H'"- represents the symbol for the amount of diversity in ecosystem (species diversity)
"p_i"- represents the proportion or relative abundance of each individual species to the total (measured from 0 to 1)
"$\ln p_i$" - represents the natural logarithm of p_i

Pielou's Evenness: $J = H'/Hmax = H=H'/\ln S$, where,

J" – represents the symbol for the species richness
"H'" – species diversity

"Hmax" – species maximum diversity
"S" – number of species in the community

The interpretation of the values obtained using the above formulas will be based on the Fernando Biodiversity Scale (1998) shown in **Table 26**.

Table 26. The Fernando Biodiversity Scale (1998)

Relative Values	Shannon –Wiener Biodiversity (H') Index	Pielou's (J') Evenness Index
Very High	3.5 and above	0.75-1.00
High	3.0 – 3.49	0.50-0.74
Moderate	2.5 – 2.99	0.25-0.49
Low	2.0 – 2.49	0.15-0.24
Very Low	1.9 and below	0.05-0.14

3.1.4.3 Determining Species Conservation Status and Endemicity

The International Union for Conservation of Nature (IUCN) Red List of Threatened Species 2016 and DENR-AO 2007-01 "Establishing the National List of Threatened Philippine Plant and their Categories were employed in determining conservation status and endemicity of each species. This is to provide scientifically based information on the status of the species and sub-species at a global level; draw attention to the magnitude and importance of threatened biodiversity; influence national and international policy and decision-making; and provide information to guide actions to conserve biological diversity (*Source: Convention on International Trade of Wild Flora and Fauna, Joint Meeting of the Animals and Plants Committee, Shepherds-town, USA., December 2000, retrieved November 2012*). The IUCN Red list is set upon precise criteria to evaluate the extinction of thousands of species and sub-species. The aim of the Red List is to convey the urgency of conservation issues to the public and policy-makers, as well as to help the international community to try to reduce species extinction. In addition, the DENR AO 2007-01 was also used pursuant to Section 22 of Republic Act 9147, otherwise known as the Wildlife Conservation and Protection Act of 2001.

Conservation Categories and Description

Critically Endangered (CR) - A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

Endangered (EN) - A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

Vulnerable (VU) - A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

Near threatened (NT) - Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

Least Concern (LC) - Taxa which do not qualify for Conservation Dependent or Near Threatened.

Other Threatened Species (OTS) - refers to a species or subspecies that is not critically endangered, endangered nor vulnerable but is under threat from adverse factors, such as over collection, throughout its range and is likely to move to the vulnerable category in the near future.
Not Evaluated (NE) - A taxon is Not Evaluated when it has not yet been assessed against the criteria.

3.1.4.4 Results and Discussion

The floristic composition of the alignment showed that most of the species observed are common and most are naturally growing in the area. A total of 33 species were identified in the 5 sample plots and subplots, and 13 species are observed outside the sampling plots following the road alignment. Recorded species are belonged to 24 plant families dominated by Fabaceae, Araceae, and Moraceae. Species dominating in the canopy layer is the Niog or *Cocus nucifera* while Kakauate or *Gliricidia sepium* dominates in the understory layer. On the other hand, immediate the ground layer is domainated by by blue grass or *Poa* sp.. The computed biodiversity index of the study area reveals a relatively low diversity. In terms of species conservation status, there is no endangered or threatened species in the surveyed portion of the proposed road alignment.

Relative to faunal composition of the study area, most of the species observed are common and distributed in a wide range of habitats, including agricultural areas, settlement areas, grass land and even in urbanized areas. Diversity composition is found to be nominal which is possibly influenced by the current vegetational cover. Out of the 22-faunal species recorded, 5 are endemic in the country (3 avifauna and 2 herpetofauna). Likewise, no endangered species observed nor reported within the study area.

1) Terrestrial Flora

The conservation status of species identified on site was based on the Asia Life Science- The Asia International Journal of Life Sciences “Threatened Plant of the Philippines: Preliminary Assessment 2008”; International Union for Conservation of Nature (IUCN) Red List of Threaten Species (2006); and DAO 2007-01 entitled “The National List of Threaten Plants under Categories. Out of the 46-species identified from the project area, only one (1) species, Pagsahingin (Canarium asperum), is identified to be on the list, and categorize as least concern.

i. Floristic composition

A total of 46 species belongs to 43 genera and 24 families were identified from the proposed Parang-East Diversion Road within and outside the sampling plots, following the alignment. Fabaceae, Araceae, and Moraceae were found to be the dominant families in the project site in terms of species count, having 5 (10.870%) species. Seconded by Euphorbiaceae with 3 (6.555%) species as presented at **Table 27**, while fourteen (14) families are represented by one (1) species and genera. **Figure 37** presents the family percentage in terms of species count.

Table 27. Families with Highest Number of Genera and Species Along the Proposed Area

FAMILY	NUMBER OF SPECIES	PERCENTAGE (SPECIES)	NUMBER OF GENERA	PERCENTAGE (GENERA)
FABACEAE	5	10.870%	5	10.870%
ARACEAE	5	10.870%	5	10.870%
MORACEAE	5	10.870%	2	4.348%
EUPHORBIACEAE	3	6.522%	3	6.522%
MALVACEAE	3	6.522%	3	6.522%
POACEAE	3	6.522%	3	6.522%

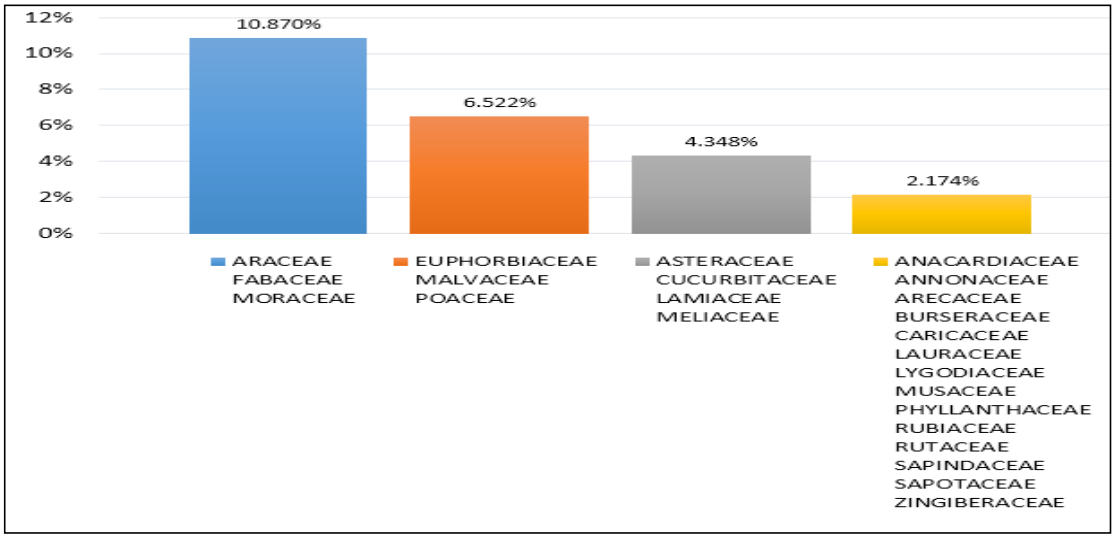


Figure 37. Family percentage in terms of species count

From the 46 plant species identified, 3 species were recorded from the 5 sample (20m x 20m, 5m x5m and 1m x 1m) plots and sub-plots. While 13 species were identified outside the sample plots within the road alignment. Relative to the plant form or category, the majority of the plant species belong to: trees (54.35%); seconded by herb (15.22%), followed by vine (13.04%); shrub (8.70%); grass (6.52%) and; the remaining 2.17% are palm trees (see **Figure 38**). On the other hand, 83% of the recorded species are naturally growing and the remaining 17% are planted on the site. On the other hand, 83% of the recorded species are naturally growing and the remaining 17% are planted on the site.

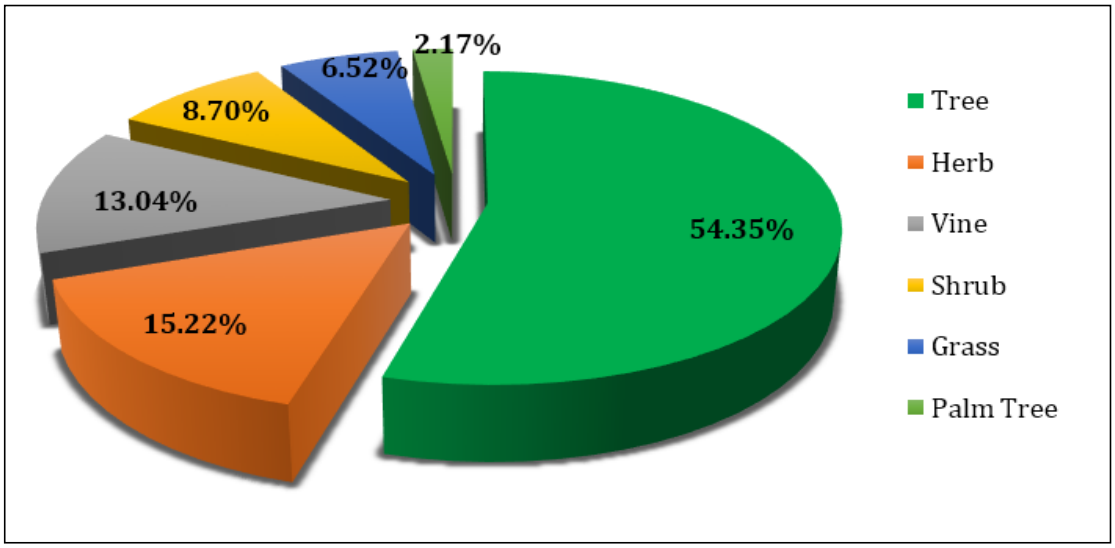


Figure 38. Distribution of plant species by their habits

ii. Canopy Layer

a) Density and Frequency

Density (ρ) is defined as a measurement of the individuals' number in an area. This is computed by counting the numbers of any given species over the area of a sample plot. It is the degree of compactness of a species. It can be used for the thickness description of particular vegetation, extent regeneration and the extent of standing biomass or ground cover. While

Frequency (f) is defined as the number of times the species occurs in a given number of small quadrants or sample points. It is expressed as a fraction of the total relative frequency (Rf). It does not matter how many individuals of species occur in each quadrant since a single occurrence carries the same weight.

As shown in **Figure 39** and details in Annex 13.6.1, out of the ten (10) species recorded in the canopy layer, Niog or *Cocos nucifera* has the highest relative density (Rρ) 45.455% and relative frequency (Rf) with 16.129%. It is followed by Marang Banguhan or *Artocarpus odoratissimus* and Mangga or *Mangifera indica* with both Rρ=12.903% and Rf=7.273%. While 5 species have the lowest Rρ and Rf, have only 1 species count and occurrence, and contribute about 5 (9%) of the total 55 recorded individual species in the canopy cover.

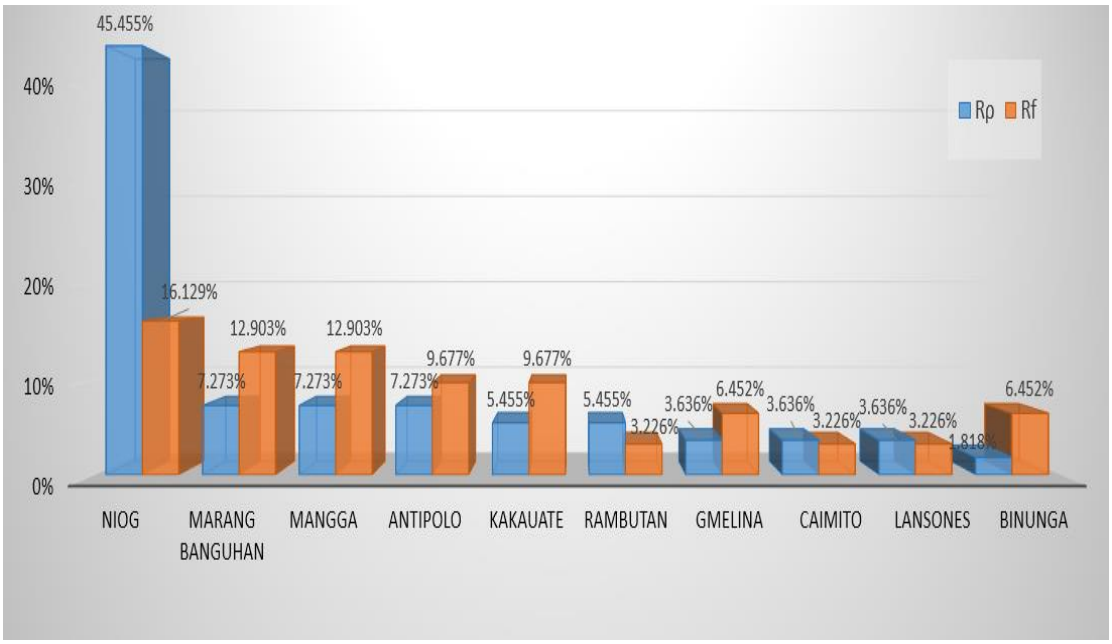


Figure 39. Species in the Canopy Layer with their Corresponding Density and Frequency

b) Biodiversity Index

Species richness and evenness are the important factors in determining the biodiversity of an area. Richness is defined as the total number of species present in a sample while evenness is the relative abundance of the species in a sample. Richness' takes on diversity is-the more different the species in a community, the more diverse the area. Evenness takes into account the number of the individual belonging to the same species (*www.countrysideinfo.co.uk*). It expresses how evenly the individuals in the community are distributed over the different species.

Shannon-Wiener index (H') ranges from 0 to infinity, with zero as no diversity. In practice, though, a value of 7 indicates an extremely rich community while values below 1 suggest a community with low diversity. Often values above 1.7 are taken to indicate a relatively diverse community (Miras, 2014).

As shown in **Figure 40**, sample plots 1 & 2, located in Barangay Nituan, have relatively diverse community with computed value of Shannon H' greater than 1.7. While the remaining three plots (3, 4 and 5) have relatively low diversity having value less than 1.7. In terms of Shannon J' computation, four plots (1,2,3, and 4) are under relatively high abundance of species evenness with value greater than 0.5. While plot 5 has the lowest J' of 0.369 which indicates a low abundance.

In terms of Simpson's D computation, Simpson's reciprocal index (1/D) was used. The Simpson's D value starts with 1 (only one species is present) being the lowest and the maximum value is the total number of species in the sample (which is 15 for the canopy layer) being the highest diversity as shown in **Figure 41**. Based on the figure, it supports the analysis in Shannon H' stating that plots 1 and 2 have relatively diverse community compare to the other plots (3,4 and 5).

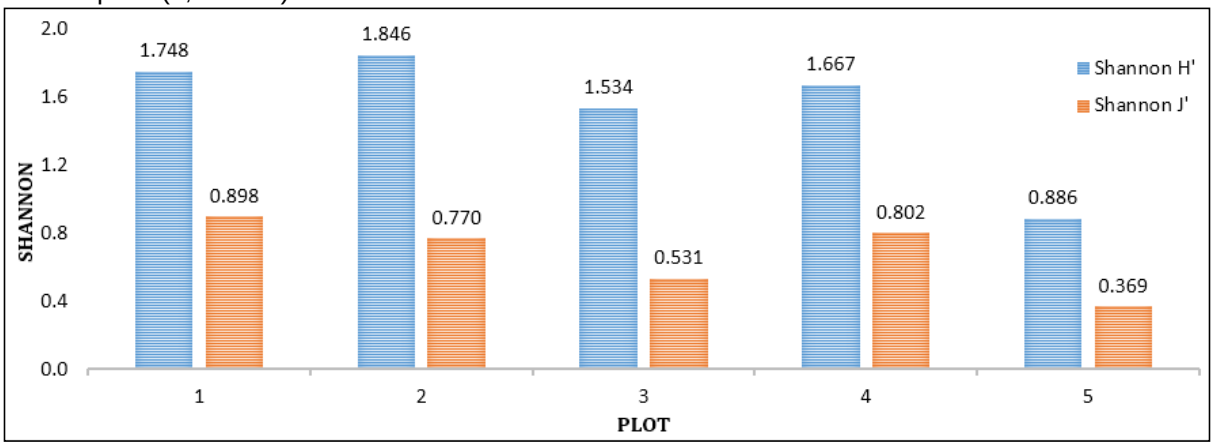


Figure 40. Shannon H' and J Diversity Index in the 5 Sample Plots in the Canopy Layer

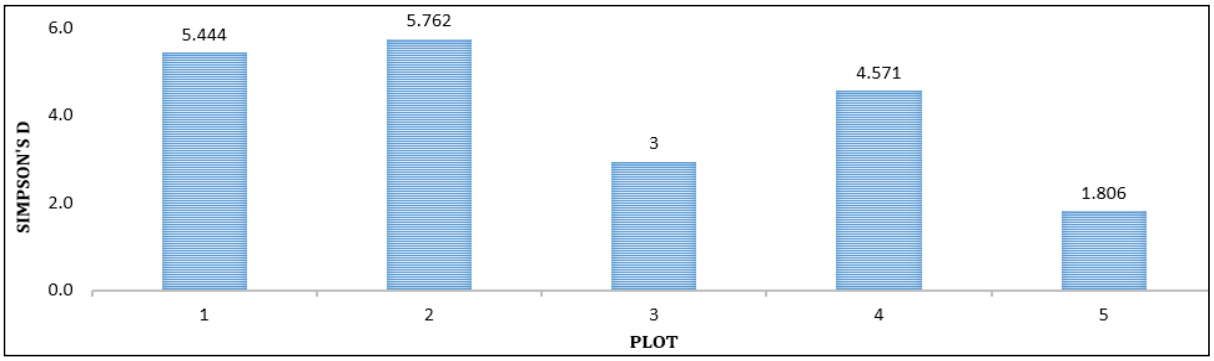


Figure 41. Simpson's D in the 5 Sample Plots in the Canopy Layer

iii. Understory layer

a) Density and Frequency

As shown in **Figure 42,** and details in Annex 13.6.1, Kakauate or *Gliricidia sepium* has the highest in Rρ and Rf with 53.846% and 40%. It was followed by Antipolo or *Artocarpus blancoi* with Rρ =15.385 and Rf 20%. While the rest of the identified species have the same Rρ=7.692% and Rf =10%, and contribute about 3 (23%) of the total 13 recorded individual species in understory layer.

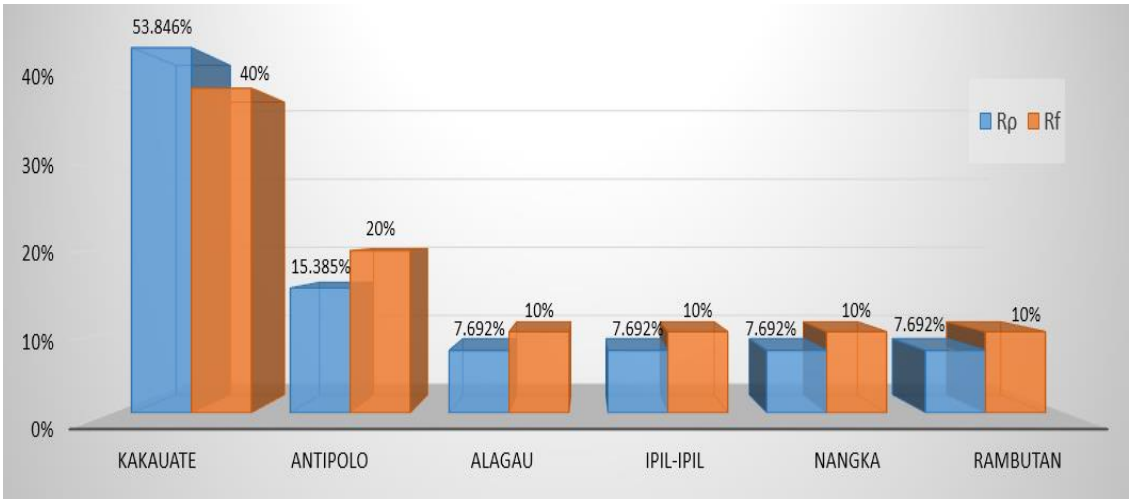


Figure 42. Species in the Understory Layer with their Corresponding Density and Frequency

b) *Biodiversity Index*

As shown in **Figure 43**, from the 5 plot 3 has H' and J' value of 0 which indicates only 1 species is present; plot 5 has NA (not applicable) which means that there are no recorded understory species; and plot 2 has the highest Shannon H' but still falls under relatively low diversity with value less than 1.7. It also has the highest abundance of J=1. While the remaining two plots (1 and 4) are both under relatively low diversity with H'=0.637 but have a relatively high abundance of species evenness with J' greater than 0.5.

In terms of Simpson's D computation, it supports the analysis in Shannon H' stating that plot 3 has only 1 species present having D=1. However, with regards to plot 2, it shows that out of the 6 (maximum value of D and the total number of species can be present in the sample plots) species recorded in the understory layer, the said plot has 5 (83%) species present which shows a very high diversity. Though the computed D has opposite result in Shannon H', in terms of individual species count, plot 2 has a total of 5 individual species recorded which indicates that each species has only 1 representative as shown in **Figure 44**.

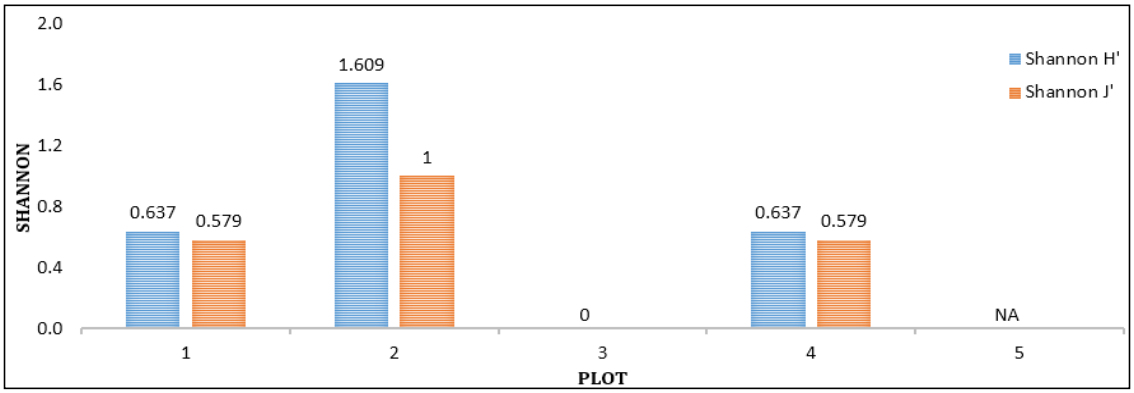


Figure 43. Shannon H' and J' Diversity index in the 5 Sample Plots in the Understory Layer

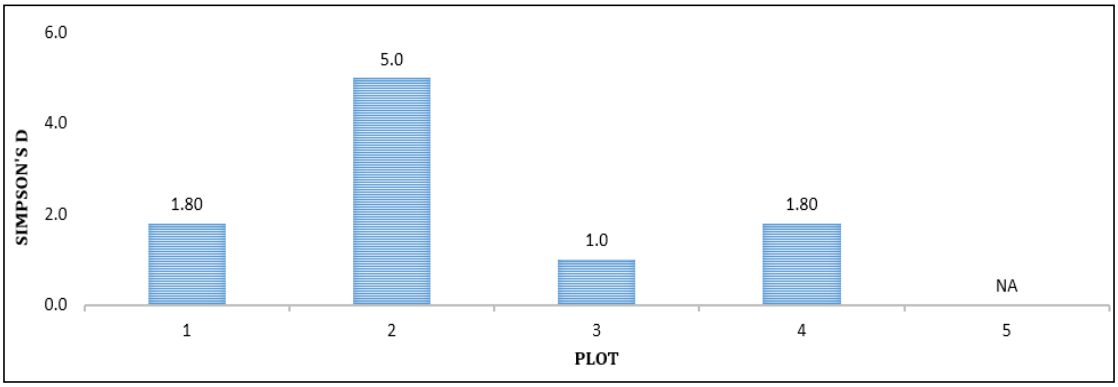


Figure 44. Simpson's D in the 5 Sample Plots in the Understory Layer

iv. Ground layer

a) Density and Frequency

As shown in **Figure 45**, Blue grass or *Poa* sp. has highest Rρ 34.314%, followed by Malasambong or *Vernonia vidalii* and Cogon or *Imperata cylindrical* with Rρ 11.765%. Whereas, Malasambong or *Vernonia vidali* and Kudzo or *Pueraria montana* have the highest frequency with both RF=10.345%. While five (5) species have only 1 species count and occurrence for both Rρ and Rf and contribute about 14 (5%) of the total 102 recorded individual species as shown in Annex 13.6.1.

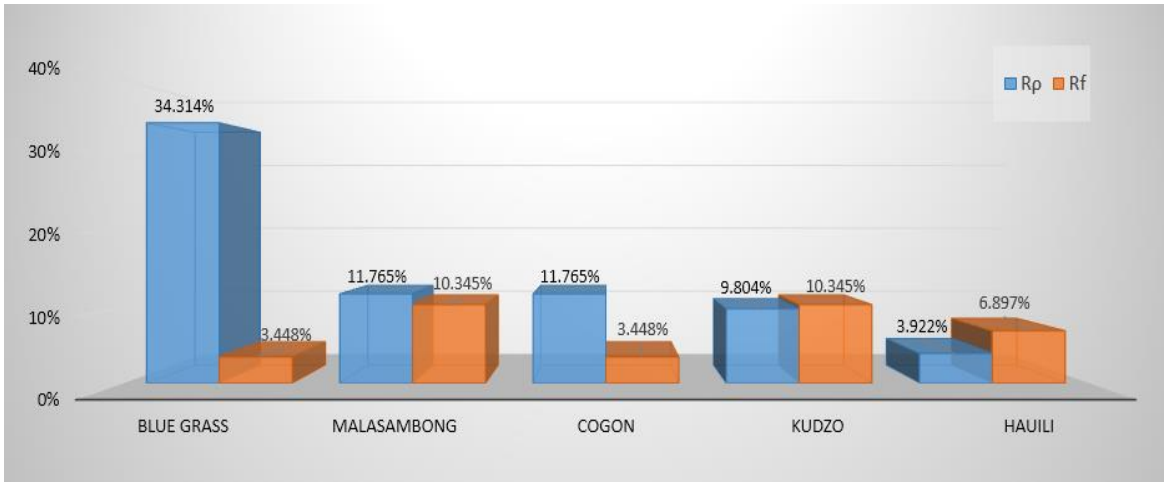


Figure 45. Species in the Ground Layer with Highest Corresponding Density and Frequency

b) *Biodiversity Index*

As shown in **Figure 46**, sample plots 1 and 5, have the highest value of H' and are greater than 1.7 which indicates a relatively diversity community. The remaining three plots (2, 3, and 4) have H' less than 1 which indicates a low diversity. In terms of Shannon J', plots 1, 4 and 5 have a relatively high abundance of species.

In terms of Simpson's D computation, plots 1 and 5 have the highest value of D with 6.760 and 5.121, while plot 3 has the lowest having 1.517 and supports the analysis in Shannon H' as shown in **Figure 47**.

Photos showing the sampling plots were presented in **Figure 48, Figure 49 and Figure 50.**

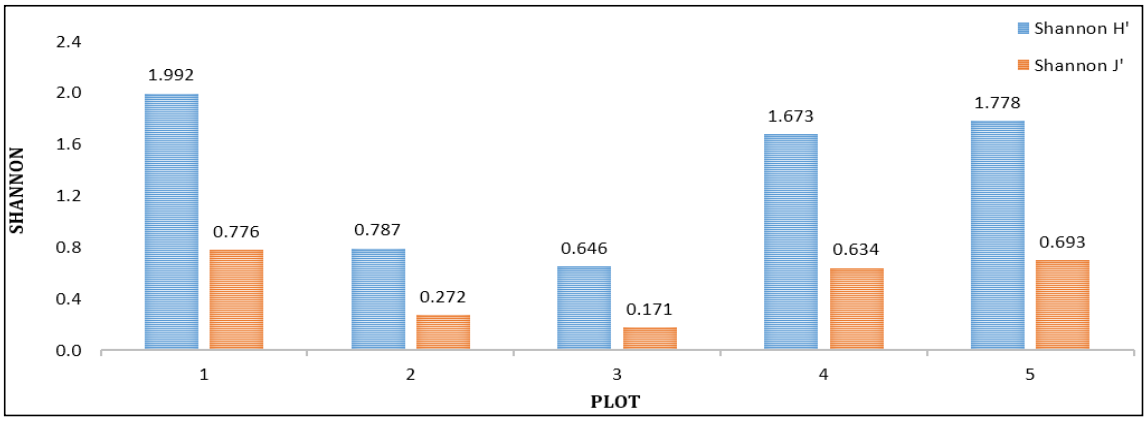


Figure 46. Shannon H' and J' Diversity Index in the 5 Sample Plots in the Ground Layer

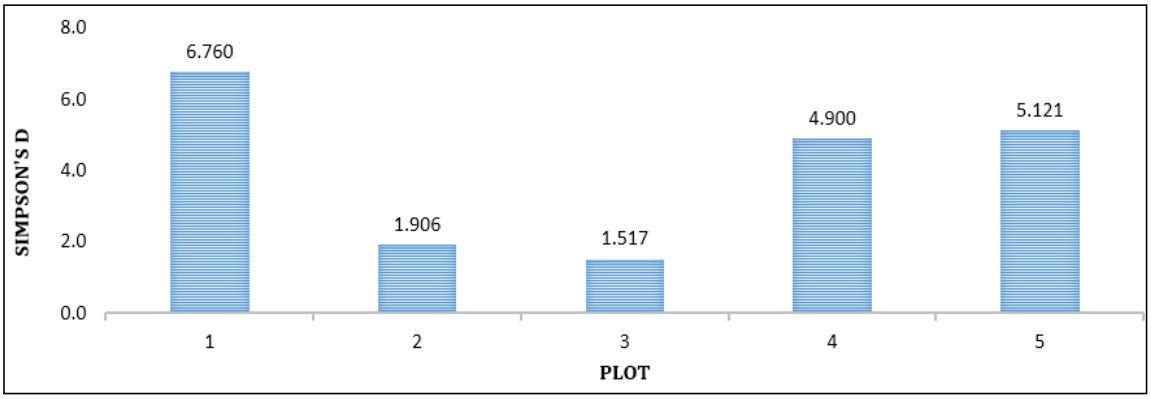


Figure 47. Simpson's D in the 5 Sample Plots in the Ground Layer

Figure 48. Photo of sample plot no. 2 Brgy. Nituan

Figure 49. Photo of sample plots no. 3 in Brgy. Gumagandong Calawag

Figure 50. Photo of sample plot no. 6 in Brgy. Making

2) Terrestrial Fauna

Survey on terrestrial fauna was undertaken simultaneously with flora sampling within the proposed road alignment in the municipality of Parang. The five (5) observation sites for faunal species are situated in 3 urban barangays in Parang, namely; Nituan, Gumagandong Calawag and Making. Observation sites are mostly situated within and along the alignment which land cover are dominantly agricultural primarily coconut plantations. Elevations of selected observation sites are in between 100 to 200 meters above sea level which topography is from gently sloping flat to rolling.

i. Fauna composition and richness

a) Avifauna

The overall result of fauna survey showed the presence of 19 species of Aves belonging to 16 families with a total abundance of 92 accounted within the 5 observation sites. Of the 16 bird families, Columbidae and Laniidae are the dominant families represented by 3 species of Dove and 2 species of Shrike, respectively.

With regard to species abundance, the Eurasian Tree Sparrow *(Passer montanus*), Barn Swallow (*Hirundo rustica*) and Asian Glossy Starlings (*Aplonis payanensis*) under family Passeridae and Sturnidae are the abundant species observed within the sampling sites. The aforesaid species has an observed population of 43 and 10, respectively as shown in **Table**

28. Of the 5 observation sites, site no. 4 has the highest abundance recorded with a total of 23. While, site no. 3 has the least no. of species with only 12 species observed.

The avifaunal composition of the alignment showed that most of the species observed are common in the lowland areas including agricultural areas, shrub lands, grass lands and even settlements areas. These species also thrive even in highly disturb areas including cities.

Table 28. Species distribution and abundance

Family Name	Scientific Name	Species Name	Conservation status (IUCN)	Abundance/Sampling site					Total Abundance
				1	2	3	4	5	
Laniidae	*Lanius schach*	Long Tailed Shrike	Least Concern		1				1
Alcedinidae	*Halchyon chloris*	White Collared King Fisher	Not Evaluated	1	1				2
Rhipiduridae	*Rhipidura javanica*	Pied Fan Tail	Least Concern	1					1
Apodidae	*Collocalia affinis*	Glossy Swiftlet	Not Evaluated			2			2
Columbidae	*Spilopelia chinensis*	Spotted Dove	Least Concern		2				2
Sylviidae	*Megalurus timoriensis*	Tawny Grass Bird	Least Concern				1		1
Columbidae	*Phapitreron leucotis*	White Eared Brown Dove	Least Concern					1	1
Columbidae	*Geopelia striata*	Zebra Dove	Least Concern			2			2
Corvidae	*Corvus enca*	Slender Billed Crow	Least Concern			1			1
Dicaeidae	*Dicaeum pygmaeum*	Pygmy Flower Pecker	Least Concern				5		5
Hirundinidae	*Hirundo rustica*	Barn Swallow	Least Concern		5				5
Laniidae	*Lanius cristatus*	Brown Shrike	Least Concern					1	1
Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	Least Concern				2		2
Nectariniidae	*Nectarinia jugularis*	Olived-Backed Sunbird	Least Concern			1	1		2
Oriolidae	*Oriolus chinensis*	Black-Naped Oriole	Least Concern					1	1
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	Least Concern	12	5	3	8	15	43
Psittacidae	*Bolbopsittacus lunulatus*	Guaiabero	Least Concern				2	1	3
Pycnonotidae	*Pycnonotus goiavier*	Yellow -Vented Bulbul	Least Concern		3		4		7
Sturnidae	*Aplonis payanensis*	Asian Glossy Starlings	Least Concern	5		3		2	10
			Total	**19**	**17**	**12**	**23**	**21**	**92**

b) Herpeto-fauna species

Other fauna species recorded although not encountered but reported to be present within the study area includes 2 species of amphibian and 1 mammal species as shown in **Table 29**. Note

that the Common House Rat is included in the list based in the result of an interview with local informants which recurrent encounter with this wildlife had been told.

Remarkably, presence of other important wildlife in the area is nominal. Among of the observed factors that dictate the presence/absence of wildlife species in the area are possibly influence by the following:

- Existing vegetation cover of the area which is dominantly coconut plantations
- Availability of food sources for wildlife
- Disturbance to wildlife brought by anthropogenic activities
- Proximity of the study area to settlements

Table 29. Summary list of faunal species, conservation status

Family	Scientific Name	Common Name	Conservation Status (IUCN)
Avifauna			
Columbidae	*Spilopelia chinensis*	Spotted Dove	Least Concern
Laniidae	*Lanius schach*	Long Tailed Shrike	Least Concern
Alcedinidae	*Halchyon chloris*	White Collared King Fisher	Not Evaluated
Rhipiduridae	*Rhipidura javanica*	Pied Fan Tail	Least Concern
Apodidae	*Collocalia affinis*	Glossy Swiftlet	Not Evaluated
Columbidae	*Phapitreron leucotis*	White Eared Brown Dove	Least Concern
Columbidae	*Geopelia striata*	Zebra Dove	Least Concern
Corvidae	*Corvus macrorhynchos*	Slender-Billed Crow	Least Concern
Dicaeidae	*Dicaeum pygmaeum*	Pygmy Flower Pecker	Least Concern
Hirundinidae	*Hirundo rustica*	Barn Swallow	Least Concern
Laniidae	*Lanius cristatus*	Brown Shrike	Least Concern
Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	Least Concern
Nectariniidae	*Nectarinia jugalaris*	Olived-backed Sunbird	Least Concern
Oriolidae	*Oriolus chinensis*	Black Naped Oriole	Least Concern
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	Least Concern
Psittacidae	*Bolbopsittacus lunulatus*	Guaiabero	Least Concern
Pycnonotidae	*Pycnonotus goiavier*	Yellow -Vented Bulbul	Least Concern
Sturnidae	*Aplonis payanensis*	Asian Glossy Starlings	Least Concern
Sylviidae	*Megalurus timoriensis*	Tawny Grass Bird	Least Concern
Herpeto-fauna			
Muridae	*Rattus rattus* mindanensis	Common Philippine field rat	Not Evaluated
Microhylidae	*Kalaulo picta*	Asian Narrow Mouth Frog	Least Concern
Bufonidae	*Bufo marinus*	Marine Toad	Introduce, Least Concern

c) Endemism and conservation status

In terms of avifauna species endemicity, only 3 species are found to be endemic in the country and the rest of the recorded species are native/non-endemic species. Among the endemic species are the Guaiabero *(Bolbopsittacus lunulatus*), Pygmy Flower Pecker *(Dicaeum pygmaeum),* and the White-Eared Brown Dove (*Phapitreron leucotis*).

On the herpetofaunal group, the Common Philippine field rat (*Rattus rattus* mindanensis*)*, and Asian Narrow Mouth Frog (*Kalaulo picta*) of the Mammalian and Amphibian groups are endemic to the Philippines. Conversely, the Marine Toad (*Bufo marinus*) is an introduced species in the country. **Table 29** shows the summary of faunal species in the proposed project site, their

conservation status and corresponding geographical distribution (Source: http://www.iucnredlist.org/).

With reference to the International Union for Conservation of Nature (IUCN) (2017), conservation status of recorded species within the project area has no Critically endangered nor endangered species in category. Majority of the species are under least concern in category, the rest are not evaluated (Glossy Swiftlet, White Collared King Fisher, and Common Philippine field rat). **Table 30** summarized the conservation status of recorded terrestrial fauna species within the study area.

Table 30. Conservation Status of Observed Fauna Species (IUCN red list 2017)

Conservation status	Aves	Mammal/s	Reptiles	Amphibians	Total
Critically endangered	0	0	0	0	0
Near Threatened	0	0	0	0	0
Vulnerable	0	0	0	0	0
Least Concern	17	0	0	2	19
Not evaluated	2	1	0	0	3
TOTAL	**19**	**1**	**0**	**2**	**22**

d) Computed Biodiversity index

Biodiversity indices particularly Shannon-Wiener Diversity Index (H') and Pielou's Evenness Index (J') were computed for this survey using the avi-faunal data. The computed biodiversity index of the sampling sites (getting the average biodiversity index of the 5 observation sites shown in **Table 31** has a computed biodiversity index of 1.365 with species evenness value of .7958. Interpretation of these values using the Fernando's Biodiversity Scale (1998) (table 2) showed that the area has **very low biodiversity** with **high to very high species evenness**.

Computed diversity richness of the 5 sampling sites reveals that all of the sites have very low diversity richness with a very high species evenness. Sampling site no. 3 and 4 have the highest scale of diversity of 1.705 and 1.701, respectively. However, computed diversity index still showed a very low diversity. While site no 1 registered the lowest scale of biodiversity index (.951). In terms of species evenness site no. 3 has the highest evenness value of .951, conversely, site no. 5 has the lowest evenness value of .583, respectively.

Table 31.Computed Biodiversity Index of Sampled Sites using the Avi-Fauna Species

Sampling site no.	Shannon-Wiener Biodiversity index (H')	Pielou's Index (J') species Evenness	Fernando's Biodiversity Scale (1998)
1	.951	.686	Very low diversity with high species evenness
2	1.424	.885	Very low diversity with very high species evenness
3	1.705	.951	Very low diversity with very high species evenness
4	1.701	.874	Very low diversity with very high species evenness

5	1.044	.583	Very low diversity with high species evenness
Average	**1.365**	**.7958**	**Very Low diversity with very high species evenness**

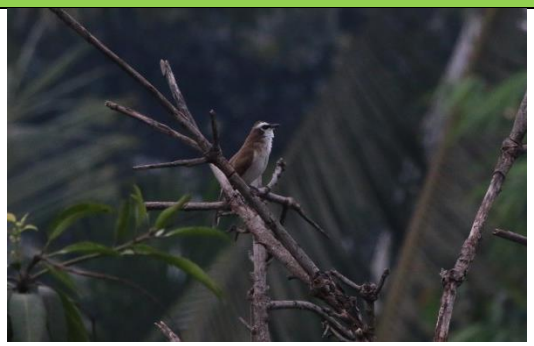
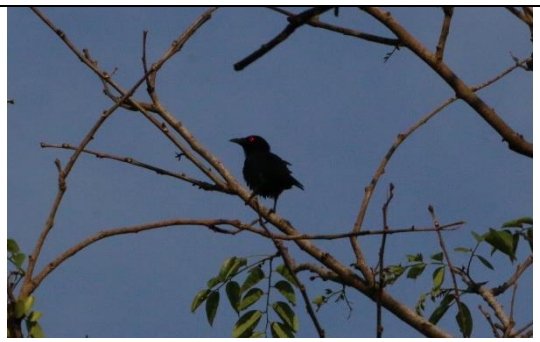
e) Species Relative Frequency

Within the 5 observation sites in the proposed project alignment, there are 19 species of avifauna were recorded with a total abundance of 92 as shown in **Table 32**. Species occurrence in every observation sites shows that the Eurasian Tree Sparrow (*Passer montanus*) and Asian Glossy Starling (*Aplonis payanensis*) has the highest relative frequency with a computed value of 17.241% and 10.345%, respectively. In contrary, the species with the lowest relative frequency of 3.448% includes the Barn Swallow (*Hirundo rustica*), Black Naped Oriole (*Oriolus chinensis*), Brown Shrike (*Lanius cristatus*) and other 10 more species are shown in **Table 32**. Some faunal species found in the study area are shown in **Table 33**.

Table 32. Species Relative Frequency

Family Name	Scientifc Name	Common Name	Rel. Frequency (%)
Sturnidae	*Aplonis payanensis*	Asian Glossy Starling	10.345
Hirundinidae	*Hirundo rustica*	Barn Shallow	3.448
Oriolidae	*Oriolus chinensis*	Black Naped Oriole	3.448
Meropidae	*Merops philippinus*	Blue Tailed Bee Eater	3.448
Laniidae	*Lanius cristatus*	Brown Shrike	3.448
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	17.241
Apodidae	*Collocalia affinis*	Glossy Swiftlet	3.448
Psittacidae	*Bolbopsittacus lunulatus*	Guaiabero	6.897
Laniidae	*Lanius schach*	Long Tailed Shrike	3.448
Nectariniidae	*Nectarinia jugalaris*	Olive-Backed Sunbird	6.897
Rhipiduridae	*Rhipidura javanica*	Pied Fan Tail	3.448
Dicaeidae	*Dicaeum pygmaeum*	Pygmy Flower Pecker	3.448
Corvidae	*Corvus macrorhynchos*	Slender Billed Crow	3.448
Columbidae	*Spilopelia chinensis*	Spotted Dove	3.448
Sylviidae	*Megalurus timoriensis*	Tawny Grass Bird	3.448
Alcedinidae	*Halchyon chloris*	white Collared King Fisher	6.897
Columbidae	*Phapitreron leucotis*	White Eared Brown Dove	3.448
Pycnonotidae	*Pycnonotus goiavier*	Yellow Vented Bulbul	6.897
Columbidae	*Geopelia striata*	Zebra Dove	3.448
		Total	**100**

Table 33. Some Faunal Species Photo Documented During the Survey

Photo	*Common Name/ Scientific Name*	**Conservation Status (IUCN)**	**Location/ Geographic Coordinates**
	*Yellow Vented Bulbul* *(Pycnonotus goiavier)*	*Least Concern*	Site 4 Brgy. Making Parang (7°23'11.51"Northing 124°16'10.65")
	*Zebra Dove (Geopelia striata)*	*Least Concern*	Site 3 Brgy. Gumagadong Calawag Parang (7°23'1.59" Northing 124°16'38.17" Easting)
	*Brown Shrike (Lanius cristatus)*	*Least Concern*	Site 5 Brgy. Making Parang (7°23'11.51" Northing 124°16'10.65" Easting)
	Asian Glossy Starlings *(Aplonis payanensis)*	Least Concern	Site 1 Brgy. Nituan Parang (7°21'31.10" Northing 124°16'50.41"EEasting)

	*Pygmy Flower Pecker* *(Dicaeum pygmaeum)*	*Least Concern*	Site 4 Brgy. Making Parang (7°23'11.51"Northing 124°16'10.65")
	*Olive-Backed Sunbird* *(Nectarinia jugalaris)*	*Least Concern*	Site 5 Brgy. Making Parang (7°23'11.51" Northing 124°16'10.65" Easting)
	*Black Naped Oriole (Oriolus chinensis)*	*Least Concern*	Site 5 Brgy. Making Parang (7°23'11.51" Northing 124°16'10.65" Easting)

3.1.5 Environmental, economic significance and threats

3.1.5.1 Terrestrial Flora

Flora plays an important role in the climate change moderation as sinks of atmospheric carbon dioxide. Plants managed to assimilate carbon dioxide through the photosynthesis process, and store carbon in biomass and in soil (Watson et al, 2000; Brown et al, 1996) for their growth and metabolism.

Flora species are very important in lives of people in many aspects. People depend upon plants to satisfy such basic human needs such as food, clothing, shelter, and health care. Along the project site, the families with the highest vegetational cover are: (1) Fabaceae, also known as legumes, helps increase soil nitrogen and provide rich sources of vegetable protein for humans, livestock, and wild animals; (2) Moraceae, where some of the trees of this family produce edible fruits, while some plants in this family, used as medicine; and (3) Araceae, where some of the plants in this family are used as ornamentals, and species such as gabi is used as source of food. There are many species in the area having a high economic importance, such as Gmelina which is used for medicinal purposes; and Mangga and Nangka which not only can be used as a source of lumber but also produce fruits that are sold in the market. There are also major and/or important agricultural crops that are found in the area such as banana, coconut, and cassava.

Flora species also provide shelter, protection, and medicine to man and animals. A strong gust of wind and rain can be blocked by a tree, therefore, minimizing its damaging impact on lives and properties. Shrubs and trees and even grasses have also a positive impact on soil erosion control. Other plants in the area are also a good source of medicine, food, etc.

Conversely, threats to flora brought by the opening of roads will require removal of the remaining vegetation within the proposed road right of way. This will result to a certain decrease of trees, crops, and species population in the ecosystem and locality. Removal of vegetation cover would result to the release of carbon dioxide in the atmosphere as well as decrease of carbon sinks or carbon storage capacity of the ecosystem.

3.1.5.2 Terrestrial Fauna

Faunal species are a good indicator of the existing environment of certain ecosystem or area. They play a significant role in many aspects that include enhancement of the ecological balance and food chain cycle and other natural environmental processes. Other faunal species are also known as natural agents in seed dispersal and pollination which aid in the transport of varieties of seeds in the environment. They also act as natural predators to some pest in our agricultural crops.

Aside from the wildlife's significance in the ecosystem, they also provide economic importance in various aspects. They are even valuable source of food and medicines. Commercially, some wildlife species are being exploited as trade pets as source of income. They are also considered among of the aesthetic value of the ecosystem which they are economically important for the tourism industry. Faunal species are also significant in the field of science and research. Existence of varieties of faunal species is part of country's cultural asset.

Continuous loss of faunal habitats due to degradation of forest cover brought by land clearing, conversion of forest lands to settlements and other land uses. Though, faunal species are mobile in nature this situation will force them to migrate to other areas to search for new habitat. Migration of other wildlife to new territory/is or ecosystem will pose threat to their existence. They can be further exposed to hunting, persecution, and trading. Continuous destruction of faunal habitats and disturbance will threaten the remaining species population and survival in the near future if not prevented. Thence, the decrease of a population to some species in this area will be expected to happen while others may not significantly be affected. Wildlife offers a variety of commercial values and opens several livelihood sources, utilization is not regulated as to the case of illegal poaching and hunting and over-collection. Though conservation actions are currently being made, illegal activities still continuously happen. The scenario puts wildlife population at risk of being threatened and has the probability of getting extinct if left unresolved.

3.2 Baseline in Water

3.2.1 Hydrology

The river systems that affect the proposed road alignment are the Nituan River and **(Figure 51).** During the conduct of field investigation, no ground water wells or springs were found that may be affected by the project and also based on the data from the National Water Resources Board (NWRB) and Local Water Utilities Administration (LWUA) **(Figure 52)**.

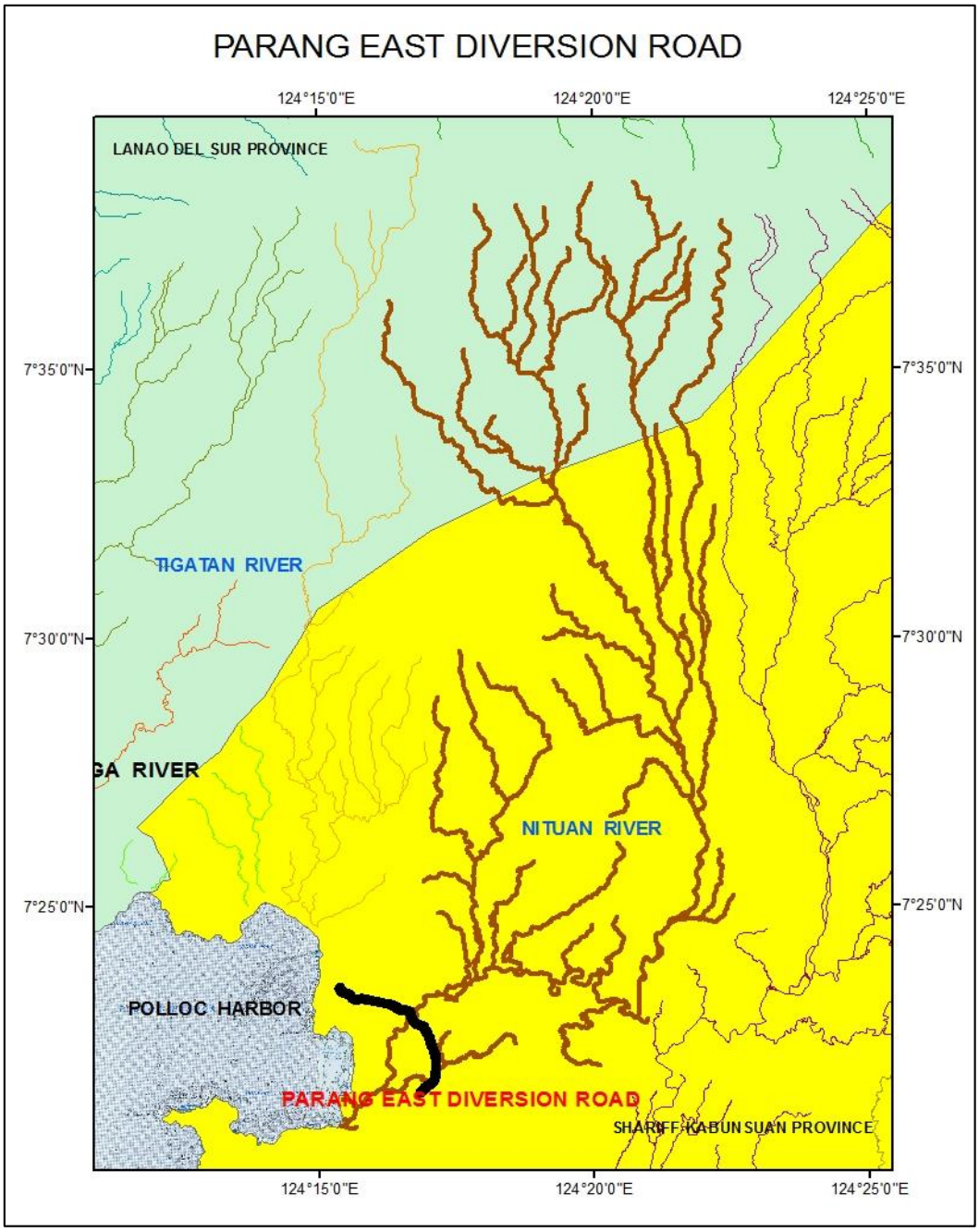


Figure 51. Rivers affecting Parang East Diversion Road

Source: Google Earth

Figure 52. Location of Groundwater Wells or Springs affected by Parang East Diversion Road

3.2.2 Water Quality

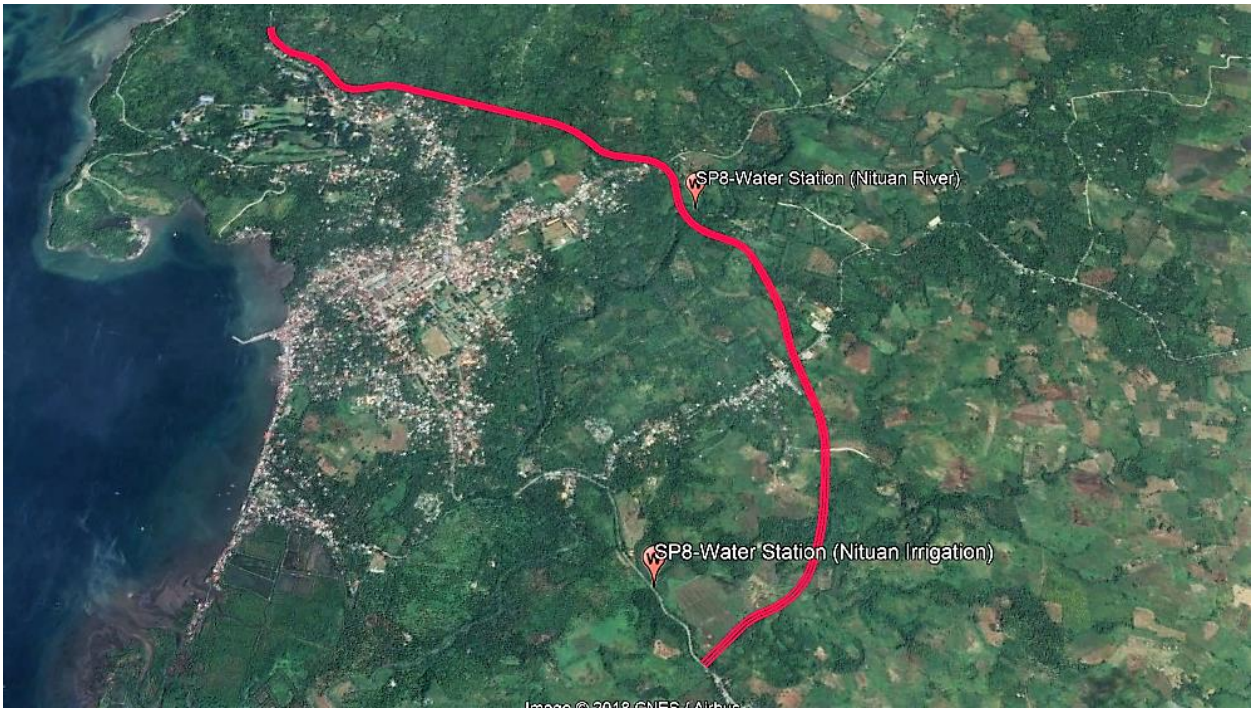
Grab sampling was used for surface water quality measurement. Samples were collected on December 5, 2017 on a sunny weather. Stainless pale and rope were used to collect water samples. Samples were put in glass and plastic containers, properly sealed, labeled and preserved with ice at lower temperature inside coolers and transported to the laboratory. On-site measurement was done for pH, temperature and dissolved oxygen. Samples were submitted for laboratory testing to CRL Environmental Corporation, a recognized DENR and DOH accredited laboratory. **Table 34** presents the sampling sites, date and time of collection conducted in Barira and Buldon, Maguindanao. **Figure 53** presents the sampling map of Sub-Project No. 8.

Table 34 – Summary of Surface Water Sampling Sites, Coordinates, Weather condition, Date and Time of Samplings

Station No.	Sampling Stations	Coordinates	Weather Condition	Date and Time of Samplings
S1	Nituan River	7°22'53.0" N 124° 16'44.2" E	Sunny	December 5, 2017, 1347H
S2	Nituan Irrigation	7°21'42.2" N 124° 16' 41.8" E	Sunny	December 5, 2017, 1532H

3.2.2.1 Methodology

The approved test methods use by CRL are in accordance to DENR Administrative Order No. 93, Series of 1998 and DENR-EMB Memorandum Circular 2016-012. These methods are based on Standard Methods for Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Waterworks Association (APHA/AWWA). Field and Laboratory testing methods used are presented in **Table 35.**



Source: Google Earth

Figure 53. Sampling Map of Water Quality Stations Collected at Sub-Project No. 8

Table 35. Parameters and Analytical Methodology

Parameter	Analytical Method
pH	Glass Electrode; pH Meter
Temperature	pH/Temperature meter
Turbidity	Nephelometric Method
Biochemical Oxygen Demand (BOD)	Azide Modification (Dilution Technique) Titrimetry
Total Suspended Solids (TSS)	Gravimetric Method
Dissolved Oxygen (DO)	Azide Modification (Winkler Method)

3.2.2.2 Results and Discussions

Table 36 shows the results of physical and chemical analyses for surface water collected in Parang. Based on the results, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), pH and TSS meet the criteria guidelines of the DENR Administrative Order No. 2016-08, Water Quality Guidelines and General Effluent Standards of 2016. It should be noted that DENR does not have regulatory standard for Turbidity.

Table 36. Results of Physico-chemical Analyses of Surface Water

Parameters, units	S1	S2	DAO No. 2016-08, Class C Limits
pH	7.7	6.9	6.5 – 9.0
Temperature, °C	28.9	30.5	25-31
Turbidity, NTU	2.0	4.1	---
BOD, mg/L	1	2	7
TSS, mg/L	11	21	80
DO, mg/L	8	6	5.0 mg/L minimum

Hereto attached as Annex 13.6.2 are the results of Water Quality Stations. **Figure 54** and **Figure 55** show the sampling pictures taken at SP No. 8.

Figure 54. Water Sampling at Nituan River

Figure 55. Water Sampling at Nituan Irrigation

3.3 Baseline In Air

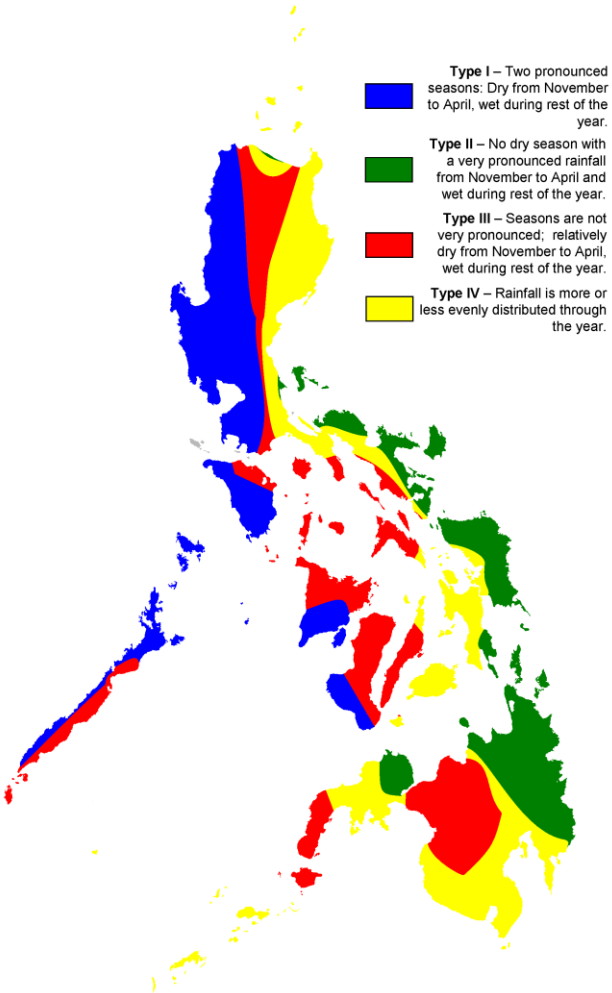
3.3.1 Meteorology

The nearest PAGASA synoptic station is in Cotabato City. Based on the data from this station the average annual rainfall from a 30-year record is 2487.8 millimeters. The rainiest months are from May to October.

The annual mean temperature is 27.8°C with high temperature of 28.6°C in April and low temperature of 27.3°C in July. The lowest recorded temperature of 18.9°C occurred on 26 January 2014 while the highest recorded temperature was 37.7°C which occurred on 28 March 1997. The average wind speed is 2 meters per second distributed over the whole year at NNW direction.

Relative humidity averages from 73% to 76% and vapor pressure averages from 28.4 millibars to 29 millibars. Mean sea level atmospheric pressure varies from 1012.6 millibars to 1011.2 millibars, with higher value in February then lower in October.

The area belongs to Type III climate according to the Modified Coronas Classification as shown in **Figure 56** from which seasons are not very pronounced, relatively dry from November to April and wet during the rest of the year.



Source: PAGASA

Figure 56. Modified Coronas Classification

3.3.1.1 Natural Calamities

Per record from PAGASA, natural calamities that mostly affect the area are local flooding and landslide. There were also recorded incidents of big waves and strong winds in this coastal area. Landslides and flashfloods occur in some areas associated with heavy rainfall. There were also records of drought in 2010 and 2014 in the area.

For the past 47 years, there was only one recorded typhoon that passes over the region. This was Typhoon Titang which occurred from October 16 to October 24 in 1970 as shown in **Figure 57**.

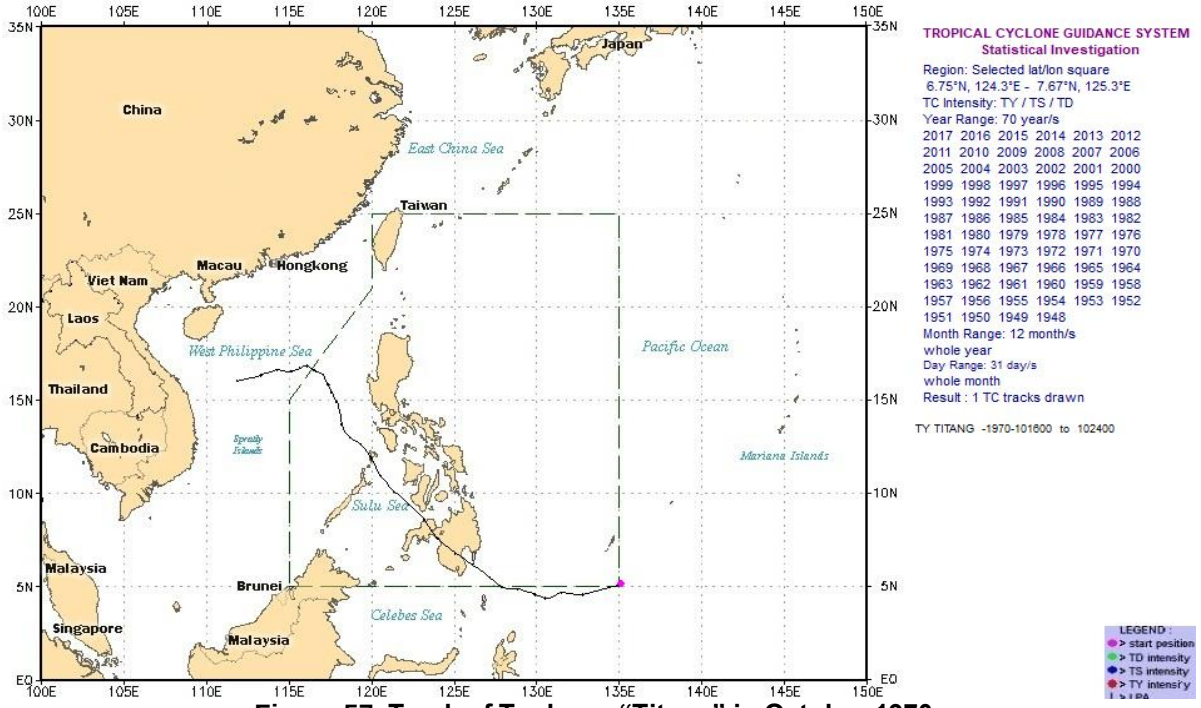


Figure 57. Track of Typhoon "Titang" in October 1970

3.3.2 Ambient Air Quality

Air Samples were collected on December 7-9, 2017 at Purok Dulangan I, Brgy. Nituan, Parang and Brgy. Making, Parang, Maguindanao. **Figure 58** shows the sampling locations for two stations. Weather condition at the time of sampling was sunny to cloudy with slight rains. Twenty-four (24) hours measurement were sampled for Total Suspended Particulates, PM10, Nitrogen Dioxide and Sulfur Dioxide. **Table 37** presents the date and time of sampling and air sampling coordinates.

Source: Google Earth

Figure 58. Sampling location at SP 8 Parang East Diversion Road

Table 37 – Summary of Air Sampling Sites, Coordinates, Date and Time of Samplings

Station No.	Sampling Stations	Coordinates	Date and Time of Samplings
A1	Purok Dulangan I, Brgy. Nituan, Parang	7°22'4.76" N 124° 17'0.87" E	December 7-8, 2017, 1120H
A2	Near Reservoir Area, Brgy. Making, Parang	7°23'14.75" N 124° 15'45.52" E	December 8-9, 2017, 1245H

3.3.2.1 Sampling Equipment

There were three (3) major types of ambient air equipment used as described in **Table 38.**

Table 38. Ambient Air Monitoring Equipment Specifications

Equipment Name/Description	Brand/Model	Testing Capabilities
High Volume Sampler	Tisch Environmental /5170	TSP
Dual Channel Dust Sampler	Instrumex	PM_{10}
Personal Sampler	SKC	NO_2, SO_2
Anemometer	Testo	Wind speed

*TSP – Total Suspended Particulate Matter; PM10 – Particulate Matter at 10µ; NO2 – Nitrogen Dioxide; SO2 – Sulfur Dioxide

The high volume sampler is equipped with all weather shelter timer and flowchart meter and is powered by electricity through external power sources. The Personal Sampler

is equipped with flow meter powered by external/internal power sources and a low flow controller. It is attached to parallel tubing with two (2) pieces of midget impingers. For SO_2, the bubbler has a straight orifice nozzle while for NO_2 the bubbler has a fritted nozzle. While for the anemometer and it has a range of 0.4m/s - 20m/s (2.8km/hr - 108km/hr) with 0.1m/s resolution and is calibrated against standards that are traceable to National Institute of Standards and Technology (NIST).

3.3.2.2 Sampling Methodologies

The ambient air quality measurement conducted by CRL Calabarquez Corporation was performed at an elevation of at least two (2) meters above the ground level and sampling was strategically stationed within the project site. After sampling was conducted for each station, the gas samples were carefully recovered in the sampling bottles and preserved at low temperature and were immediately submitted to the laboratory for analysis.

3.3.2.2.1 FILTRATION METHOD BY HIGH-VOLUME SAMPLER

3.3.2.2.1.1 Total Suspended Particulates (TSP) SAMPLING

Principle of Sampling - Ambient air was drawn through a glass fiber filter over a period of time. The filter paper containing the sample was weighed hence the final weight of the sample over that of the standard volume of air sampled gave the concentration of TSP.

3.3.2.2.1.2 PM_{10} SAMPLING (Reference Method Appendix J to Part 50)

Principle of Sampling - Ambient air was drawn at a constant flow rate into a specially shaped inlet where the suspended particulate matter is inertially separated into one or more size fractions within PM_{10} size range. The particles were collected in a glass fiber filter and determined by measuring gravimetrically. The filter paper containing the sample was weighed hence the final weight of the sample over that of the standard volume of air sampled gave the concentration of PM10.

3.3.2.2.2 ABSORPTION IN LIQUIDS FOR GASEOUS POLLUTANTS

3.3.2.2.2.1 Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2) SAMPLING

Principle of Sampling - A known volume of air (0.4L/min for NO_2, 0.5L/min for SO_2) was sampled with a wet-chemical system where a constant air sample passes through a suitable reagent (absorbing reagent) that was reactive to the specific pollutant desired. As the air sample passes through the bubbler rack, the air diffuses forming air bubbles and slowly reacts to the chemical reagent forming a complex ion. The personal sampler was calibrated with NIST traceable digital calibrator to assure its accuracy. The samples were then analyzed using prescribed and approved methods.

3.3.2.3 Results and Discussions

Results of air quality for all parameters measured at two (2) sites are compared with National Ambient Air Quality Guideline Values (NAAQGV) of Republic Act 8749 or known as Philippine Clean Air Act. All parameters tested are within the DENR allowable limits. **Table 39** presents the results of air quality in two (2) sites for Sub-project 8. **Table 40** and **Table 41** present the meteorological data observed during sampling.

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Figure 59 and Figure 60 present the photos during the actual air sampling at two sites.

Table 39. Ambient Air Test results taken in Parang, Maguindanao

Station No.	Location	Date and Time Sampling	TSP (µg/Ncm)	PM_{10} (µg/Ncm)	NO2 (µg/Ncm)	SO2 (µg/Ncm)
A1	Purok Dulangan I, Brgy. Nituan, Parang	December 7-8, 2017 1120H – 1120H	25.5	6.4	2.7	1.2
A2	Near Reservoir Area, Brgy. Making, Parang	December 8-9, 2017 1245H – 1245H	22.7	4.6	3.6	1.4
***DENR National Ambient Air Quality Guideline Values (NAAQGV)**		**24-hr Sampling**	**230**	**150**	**150**	**180**
Remarks			**Passed**	**Passed**	**Passed**	**Passed**

TSP, PM_{10}, NO_2, SO_2 – corrected at 25^oC, 760mm Hg; *RA 8749 (Philippine Clean Air Act of 1999)

Figure 59. Air Sampling at Purok Dulangan I, Brgy. Nituan, Parang, Maguindanao

Figure 60. Air Sampling Near Reservoir Area, Brgy. Making, Parang, Maguindanao

Table 40. Meteorological Data at Purok Dulangan, Brgy. Nituan, Parang, Maguindanao

Purok Dulangan I, Brgy. Nituan, Parang, Maguindanao

Division of 24-Hour Sampling	Prevailing Wind	Temperature (deg. C)	Barometric Pressure (mmHg)	Remarks
December 7-8, 2017 1120H	S-N	35.6	749.0	Sunny
1320H	W-E	35.1	747.8	Sunny
1520H	SE-NW	33.4	748.3	Cloudy
1720H	NW-SE	29.7	748.7	Fair
1920H	NW-SE	28.2	750.0	Fair
2120H	N-S	25.7	750.8	Fair
2320H	SE-NW	24.7	750.8	Rains Lightly
0120H	E-W	25.2	750.1	Rains Lightly
0320H	SE-NW	25.0	750.0	Fair
0520H	S-N	24.7	750.8	Fair
0720H	N-S	28.1	751.1	Sunny
0920H	NW-SE	30.4	751.0	Sunny

Table 41. Meteorological Data Near Reservoir Area, Brgy. Making, Parang, Maguindanao

Near Reservoir Area, Brgy. Making, Parang, Maguindanao

Division of 24-Hour Sampling	Prevailing Wind	Temperature (deg. C)	Barometric Pressure (mmHg)	Remarks
December 8-9, 2017 1245H	NW-SE	33.6	746.9	Sunny
1445H	NW-SE	32.6	746.1	Sunny
1645H	NE-SW	33.2	746.3	Cloudy
1845H	N-S	28.5	747.1	Fair
2045H	N-S	25.5	748.1	Fair
2245H	NE-SW	25.7	748.3	Fair
0045H	NW-SE	25.9	747.9	Fair
0245H	NW-SE	25.5	747.3	Fair
0445H	SW-NE	24.4	747.4	Fair
0645H	SW-NE	30.2	748.1	Sunny
0845H	SW-NE	32.0	748.4	Sunny
1045H	NE-SW	30.9	748.3	Sunny

3.4 Noise Quality

3.4.1 Sampling Equipment

A digital sound level meter was used in the noise measurement activity conducted by CRL Calabarquez Corporation. The sound level meter used was Lutron that meets the IEC 61672 standard, class 1. The equipment has A frequency weighting and fast time weighting with a measurement range of 30 dB to 130 dB and resolution of 0.1 dB. **Table 42** presents the sampling coordinates, date and time of noise sampling.

Table 42 – Summary of Noise Sampling Sites, Coordinates, Date and Time of Samplings

Station No.	Sampling Stations	Noise Coordinates	Date and Time of Samplings
N1	Purok Dulangan I, Brgy. Nituan, Parang	7°22'4.64" N 124° 17'1.90" E	December 7-8, 2017, 1120H
N2	Near Reservoir Area, Brgy. Making, Parang	7°23'14.51" N 124°15'44.24" E	December 8-9, 2017, 1245H

3.4.2 Sampling Methodologies

The noise measurements were conducted within the two (2) stations. The lowest and highest noise levels monitored were manually recorded. The multiple sounds reading each station was recorded and summarized by getting its logarithmic average. The result of this gave the equivalent noise level (Leq).

3.4.3 Results and Discussions

Table 43 and Table 44 present the results of noise level monitoring conducted from the two (2) stations. The results of each station are summarized by getting the lowest (Min) and highest (Max) readings and by computing the equivalent continuous noise level in its logarithmic form (L_{Aeq}) for each time period. The results are compared with the DENR Ambient Noise Quality Standards Sec. 78 Chapter IV, Article 1 of National Pollution Control Commission (NPCC) Rules and Regulations, 1978 standard limits for Class A Residential category. During morning and daytime, noise levels were within the allowable levels of the DENR. Noise levels during evening and nighttime are slightly higher where noise coming from animals such as barking from dogs, rooster's crow, goats' bleat, sounds from insects such as crickets etc. may have impacted the increase in sound measurement. Most of the noise sources measured came from animal and insects during nighttime. Activities from residents near the sampling area also influenced the sound measurements during morning time.

Table 43. Noise Data at Purok Dulangan I, Brgy. Nituan, Parang, Maguindanao

December 7-8, 2017 Sampling time	Average dB (A)	DENR Standard Maximum Allowable Noise Level, Class A, dB (A)***	Remarks	Noise Sources
1120H	49.4	55	Within	Residential area, birds, goats
1320H	49.7	55	Within	Residential area, birds, goats
1520H	51.3	55	Within	Residential area, birds, goats
1720H	50.9	55	Within	Residential area, birds, goats, insects
1920H	49.3	50	Within	insects
2120H	46.9	50	Within	insects
2320H	49.6	45	Exceeded	insects
0120H	48.2	45	Exceeded	insects
0320H	48.0	45	Exceeded	insects
0520H	51.2	50	Exceeded	Insects, roosters, goats
0720H	51.5	50	Exceeded	Residential area, birds, roosters
0920H	50.8	55	Within	Residential area, birds, goats

***Category "A": A section which is primarily a residential area
0900H – 1800 H 65 dB (Daytime)[Maximum allowable limit based on division of 24-hour sampling]
1800H – 2200 H 60 dB (Evening)[Maximum allowable limit based on division of 24-hour sampling]
2200H – 0500 H 55 dB (NIghtime)[Maximum allowable limit based on division of 24-hour sampling]
0500H – 0900 H 60 dB (Morning)[Maximum allowable limit based on division of 24-hour sampling]
Note: Monitoring was conducted on a 2-hour interval. In practice, the start of sampling time is used as the basis for noise divisions.

Table 44. Noise Data Near Reservoir Area, Brgy. Making Parang, Maguindanao

December 8-9, 2017 Sampling time	Average dB (A)	DENR Standard Maximum Allowable Noise Level, Class A, dB (A)***	Remarks	Noise Sources
1245H	47.4	55	Within	Birds, roosters
1445H	46.9	55	Within	Birds, roosters
1645H	48.6	55	Within	Birds, roosters
1845H	47.8	50	Within	insects
2045H	47.8	50	Within	insects
2245H	47.1	45	Exceeded	insects
0045H	47.5	45	Exceeded	insects
0245H	47.8	45	Exceeded	insects
0445H	50.5	45	Exceeded	insects
0645H	49.2	50	Within	Birds, roosters
0845H	47.0	50	Within	Birds, roosters
1045H	48.9	55	Within	Birds, roosters

***Category "A": A section which is primarily a residential area
0900H – 1800 H 65 dB (Daytime)[Maximum allowable limit based on division of 24-hour sampling]
1800H – 2200 H 60 dB (Evening)[Maximum allowable limit based on division of 24-hour sampling]
2200H – 0500 H 55 dB (NIghtime)[Maximum allowable limit based on division of 24-hour sampling]
0500H – 0900 H 60 dB (Morning)[Maximum allowable limit based on division of 24-hour sampling]
Note: Monitoring was conducted on a 2-hour interval. In practice, the start of sampling time is used as the basis for noise divisions.

Figure 61 and Figure 62 sho6w the photos of noise sampling conducted at SP 8.

Figure 61. Noise Sampling at Purok Dulangan I, Brgy. Nituan, Parang, Maguindanao

Figure 62. Noise Sampling Near Reservoir Area Brgy. Making, Parang, Maguindanao

3.5 Social Condition (The People)

3.5.1 Demographic Data

3.5.1.1 Population and Growth Rate

The Parang East Diversion Road - SP 8 is located within the Municipality of Parang in Maguindanao. As of 2015, Parang has a total population of 89, 194 (PSA Census, 2015). Out of the 25 barangays of Parang, four (4) barangays are along the proposed road alignment. These includes Nituan, Gumagadong Calawag, Making and Manion. Among the barangays covered by SP 8, Barangay Making has the highest population of 5,989 which comprised 6.71% of the municipality's total population while the Gumagadong Calawag has the lowest population of 1,513 (1.70%). Populations of the barangays covered is shown in **Table 45** while other economic indicators in the project area is indicated in **Table 46** .

Table 45. Population per Barangay Covered by the Project (2015)

Municipality	Barangay	Population
Parang	Nituan	3,764
	Gumagadong Calawag	1,513
	Making	5,989
	Manion	1,941
Total		**13,207**

Source: Philippine Statistics Authority (2015)

Table 46. Socio Economic Condition of Parang, Maguindanao (SP8)

Item	Value	Year	Remarks
Population growth	3.09	2015	Average annual growth from 2000-2015
Population Density (persons per km^2)	105	2015	
Household size (person)	5.8	2015	Total household in Parang is 15,307
Poverty Incidence	74%	2010	Poverty Incidence in Maguindanao (57.2%) and ARMM (53.7%) in 2015.
Average income (Maguindanao) in pesos/family/year	108,170	2012	
Average expenditure (Maguindanao) in pesos/family/year	106,330	2012	
Employment and workforce (person)	29,520	2015	
LGU Income (IRA + other income)	171,000,000	2015	
Area	850.78	2015	

Historically, there are significant changes in terms of population growth in the project area. Between the Census Year of 1960 to 1970, there is a decrease in population from 37, 267 to 31, 667. The population of Parang increases from Census Year of 1975 up to 1990 and declined again of about 10% or a decreased of 5,793 between 1990 and 1995. From 2000 to 2007, the population continuous to grow from 60, 935 to 102, 247, the highest increased of population recorded in the area. However, the population significantly declined in 2010 of about 28% or a decreased of 29,099 from the previous Census Year. The latest Census Year in 2015 recorded a total population of 89,194.

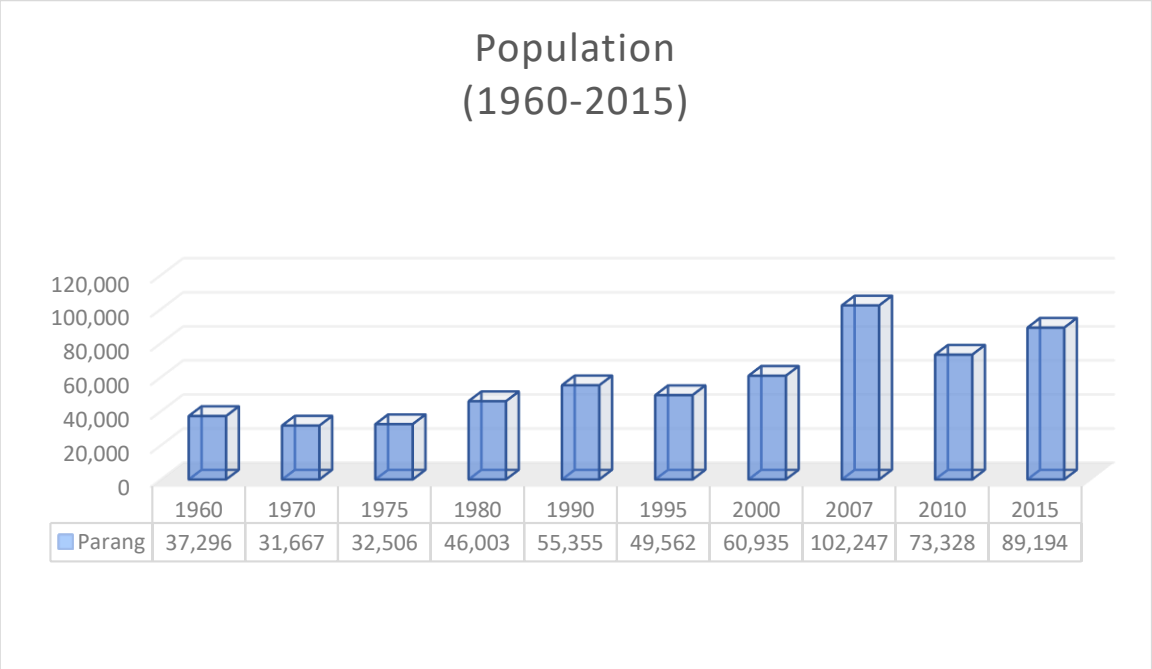

Figure 63: Population per Census Year in the Municipalities Affected by SP 8

In terms of population growth, Parang has experienced faster growth between 2010 and 2015 compared with the prior 10 years between 2000 and 2010. The annual average growth rate in Parang from 2010 to 2015 is 4.00 percent, while that from 2000 to 2010 is 1.87 percent. These rates are close to the averages in Maguindanao province (4.22 percent for 2010 to 2015 and 1.66 percent for 2000 to 2010) as presented in the Table below.

Table 47. Population Growth in Parang, Maguindanao (2000-2015)

Province	Municipality	Annual Average Growth Rate (in percent)		
		2000-2010	2010-2015	2000-2015
Maguindanao	Parang	2.03	4.33	3.09

Source: Philippine Statistics Authority, 2015

3.5.1.2 Population Density

Based on 2015 Census of Population and Housing of Philippine Statistics Office, population density in Parang, Maguindanao is 105 persons per km^2 which is lower than the national average of 337 persons per km^2 in 2015.

3.5.1.3 Household and Household Size

In terms of household number, there is a total of 15,307 households in the municipality of Parang with an average household size of 5.8 (PSA, 2015). About 14, 028 households are male-headed-households while 1,279 are female-headed-households.

3.5.1.4 Religious Affiliation

Majority of the population in Maguindanao belong to Islam comprising about 58% of the total population next to Roman Catholic with about 36%. Other religious groups in the area are National Council of Churches in the Philippines, different religious sectors such as Aglipay, Buddhist, Baptist, among others.

3.5.1.5 Ethnicity

In terms of ethnicity based on the Municipal Profile of Parang (2015), Iranun is the most dominant ethnic group with almost 30% of the total population. Maguindanaon and Cebuano are the next dominant both comprising 20% of the population. Other ethnic group are Ilocano (10%), Maranao (9.96%), other Visayan language (7.20%), and Tagalog (2%).

3.5.2 Access to Basic Services

3.5.2.1 Education

Table 48 presents the population of students per level of education within the project area. Based on the data from the LGU-Profile DILG ARMM (2015), student population in Parang has a total number of 35,450 students from pre-school, elementary, secondary, and tertiary. Record shows that Elementary School has the highest student population with 13,932 enrolled students.

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Table 48: Student Population in Parang, Maguindanao

No.	School Level	Student Population
1	Pre-school	6,195
2	Elementary School	13,932
3	Secondary School	7,237
4	Tertiary	8,066
	Total	35,430

Source: LGU-Profile DILG ARMM and Parang Profile, 2015

In terms of educational services, there are 47 school facilities available in the municipality of Parang. Out of 47 schools, 11 are private and 36 are public. Table below shows the number of school facilities for each school level.

Table 49: School Facilities in Parang, Maguindanao

No.	School Level	No. of School Facilities	
		Private	Public
1	Pre-school	0	1
2	Elementary School	2	29
3	Secondary School	4	6
4	Tertiary	5	0
	Total	11	36

Source: LGU-Profile DILG ARMM and Parang Profile, 2015

3.5.2.2 Health Service

The municipality of Parang has 24 health service facilities that caters most of the communities in the area. Out of the 24 health facilities, 17 are public while 6 are private. There is one hospital located in barangay Making but only caters PNP & their dependents. Table below shows the health facilities available in the municipality.

Table 50: Health Facilities in Parang, Maguindanao

No.	Name of Health Centers	Barangay	Type (Private/Public)
1	Rural Health Center	Poblacion 1	Public
2	Birthing Center	Poblacion 1	Public
3	Laboratory room	Poblacion 1	Public
4	Brgy. Health Center	Landasan (Sarmiento)	Public
5	Birthing Center	Landasan (Sarmiento)	Public
6	Brgy. Health Center	Making	Public
7	Birthing Center	Making	Public
8	1 Ultra Sound Machine	Making	Public
9	Barangay Health Center	Bongo Island (Litayen)	Public
10	Birthing Center	Bongo Island (Litayen)	Public
11	Barangay Health Station	Poblacion 2	Public
12	Barangay Health Station	Tagudtungan	Public
13	Barangay Health Station	Magsaysay	Public
14	Barangay Health Station	Polloc	Public
15	Barangay Health Station	Pinantao	Public
16	Barangay Health Station	Gumagadong Calawag	Public
17	Barangay Health Station	Orandang	Public
18	Medical Diagnostic Laboratory	Nituan	Private
19	Medical Diagnostic Laboratory 1	Poblacion 1	Private
20	Maternity Clinic	Poblacion 1	Private
21	Peuriculture Center	Poblacion 1	Private
22	Camarudin Clinic	Poblacion 1	Private

23	Quiñones Dental Clinic	Magsaysay	Private
24	Camp PRO-ARMM Hospital	Making	PNP & Dependents Only

Source: LGU-Profile DILG ARMM and Parang Profile, 2015

3.5.2.3 Water and Power Supply

Water source in the municipality comes from Level II Water Supply which provide service on the 25 barangays of Parang. Some households however are still using dugwells and springs as source of domestic and drinking water.

Parang municipality's power source comes from Magelco. Magelco has a capacity of 10-MVA, 69/13.2KV substation and provides electrification services on all 25 barangays. For the years starting 2010 up to 2014, MAGELCO has implemented load curtailment in its franchise area due to generation deficiency in Mindanao GRID. However, not all households in each barangay are connected with Magelco, some used solar power.

3.5.2.4 Communication Networks

Communication Networks available in Parang includes Globe, PLDT, Smart and Sun Cellular which service all its 25 barangays.

3.5.2.5 Transportation and Road Networks

Parang municipality is accessible to people coming in from its connected municipalities and provinces through public road transport include vans, trisikads, town ace and single motors. Based on the record of Parang, trisikads are the most dominant way of transportation in the municipality with about 675 registered units. Mode of transportation recorded in the data of Parang are presented in the table below.

Table 51: Mode of Transportation in Parang, Maguindanao

No.	Mode of Transportation	Range of Transport	Number of the above
1	Vans	45 mins to CotabatoCity	120
2	Trisikads	Within the municipality	675
3	Town Ace	1 hour to Cotabato City	85
4	Single Motor	Within the municipality	50

Source: LGU-Profile DILG ARMM and Parang Profile, 2015

3.5.2.6 Poverty Incidence

Low family income as a result of high unemployment appears to be one of the key constituting factors why poverty incidence is quite high in Parang. This is further aggravated by low agricultural production. Farm productivity is still a problem largely because of restrictive cost of farm inputs and the shortage in terms of improvement in agricultural infrastructure.

According to the National Color-Coded Agricultural Guide Map of the Department of Agriculture, which contains a municipal poverty database created in 2010, poverty incidence in Parang is 74.0 percent. This figure is very high compared with the average poverty incidence in Maguidanao (57.2%) and ARMM (53.7%) in 2015.

3.5.2.7 Gender and Children Rights

The LGU of Parang has been implementing Gender and Development (GAD) compliance to the Section 33 of the Republic Act No. 10633 in accordance known as the FY 2014 General Appropriation Act and allowed by the Commission on Audit to implement GAD Programs for the succeeding years. Women's group are organized in each barangay and participated municipal and provincial wide activities/programs for women's development.

On the other hand, Early Childhood Care and Development (ECCD) services for children in remote and disadvantaged communities, particularly 20 barangays in Parang (including municipalities of Malungon, Saranggani and Upi, Maguindanao) supported by private companies and LGUs. Activities include orientation and advocacy, organization of home-based ECCD services, education of parents and community leaders, and training of national trainers.

3.5.2.8 Income and Expenditure

According to the Family Income and Expenditure Survey 2012 of the Philippine Statistics Authority, income and expenditure estimates for Maguindanao province are 108,170 pesos and 106,330 pesos respectively.

Major economic activities in Parang are agricultural farming. In 2015, rice production mostly cultivated in barangays Orandang, Guiday T. Biruar, Macasandag, Nituan, Polloc, and Landasan have a total production of 2,852 metric ton and value of 42,780,000 pesos (Municipal Profile, 2015). Fishing is also another source of livelihood in the area. Barangays in Parang engaging this kind of activity includes Polloc, Landasan (Sarmiento), Nituan, Magsaysay, Macasandag and Making.

3.5.2.9 Employment and Work Force

The 2015 Census of Population by the Philippine Statistics Authority grouped major occupations into ten (10) classifications which include managers, professionals, technical and associate professionals, clerical support workers, service and sales workers, skilled agricultural forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations and armed forces occupation. Other occupations elsewhere classified and not reported are also accounted. These workers included in the statistics are gainful workers 15 years old and above.

In terms of classification, out of the total of all the municipalities/cities covered by the project, the highest number of employment are those on Skilled Agricultural Forestry and Fishery Workers with a total of 9,228.

In terms of classification, out of the total of all the municipalities/cities covered by the project, the highest number of employment are those on Skilled Agricultural Forestry and Fishery Workers with a total of 18,145 for the three municipalities.

Table 52. Employment/Workers in the Municipalities Affected by SP 8

Sex, Major Occupation Group, and City/Municipality	Population
Total	29,520
Managers	2,108
Professionals	1,052
Technicians and Associate Professionals	575
Clerical Support Workers	728

Service and Sales Workers	5,381
Skilled Agricultural Forestry and Fishery Workers	9,228
Craft and Related Trades Workers	1,016
Plant and Machine Operators and Assemblers	3,218
Elementary Occupations	3,075
Armed Forces Occupations	212
Other Occupation Not Elsewhere Classified	-
Not Reported	2,927

Source: Philippine Statistics Authority, 2015

Based on the 2015 data, the IRA of the municipality of Parang, Maguindanao is Php 164,312,348.00 and local source revenues is Php 6,687,652.00. LGU's local sourced revenues came from Municipal Taxes, Fees and other Charges. Barangay IRA on the other hand is presented in **Table 53**.

Table 53. Income In the Project Area

No.	Barangay	Income
1	Bongo Island (Litayen)	Php 2,727,592.00
2	Cabuan	Php 0.00
3	Campo Islam	Php 0.00
4	Datu Macarimbang Biruar	Php 0.00
5	Gadungan	Php 1,172,961.00
6	Gadungan Pedpandaran	Php 0.00
7	Guiday T. Biruar	Php 1,649,609.00
8	Gumagadong Calawag	Php 1,218,416.00
9	Kutongan	Php 1,304,321.00
10	Landasan (Sarmiento)	Php 5,594,151.00
11	Limbayan	Php 1,457,782.00
12	Macasandag	Php 1,415,247.00
13	Magsaysay	Php 2,425,256.00
14	Making	Php 2,939,852.00
15	Manion	Php 1,192,561.00
16	Moropoint	Php 0.00
17	Nituan	Php 1,864,789.00
18	Orandang	Php 1,202,988.00
19	Pinantao	Php 1,335,180.00
20	Poblacion 1	Php 4,289,729.00
21	Poblacion 2	Php 4,406,076.00
22	Polloc	Php 2,103,324.00
23	Samberen	Php 929,424.00
24	Tagudtungan	Php 1,367,290.00
25	Tucamaror	Php 1,477,799.00

Source: LGU-Profile DILG ARMM and Parang Profile, 2015

IRA dependency in Parang based on the Bureau of Local Government Finance, Department of Finance (2017) is relatively high ranging 92%-98% of the municipality's total annual regular income from 2009-2016.

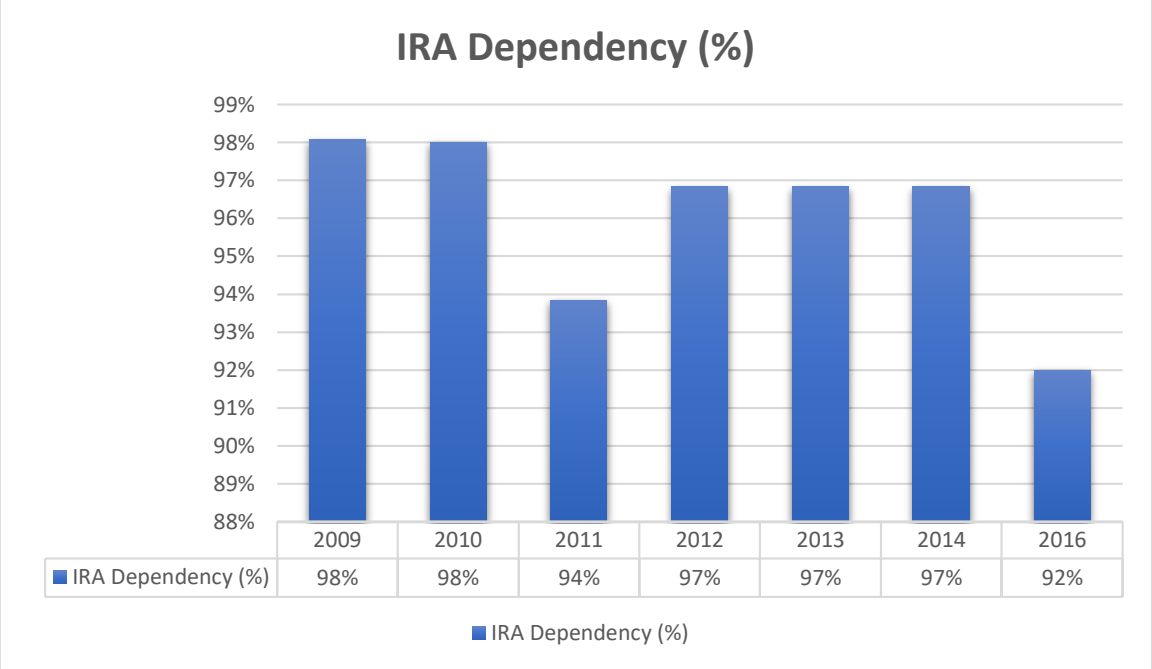

Figure 64: IRA Dependency in Parang, Maguindanao

3.5.3 Socioeconomic Profile and Perception of the Affected People

Project affected includes crop, trees and structures that might be damaged once the project is implemented. Based on the RAP Survey, the following are the project affected by SP8:

Table 54: Project Affected by SP 8

Municipality	Barangay	Crops	Trees			Structures			Post	Water System
			Fruit Bearing	Timber	Cash Crops	Wood	Semi-Concrete	Concrete		
Parang	Nituan	Ongoing Comp	200	191	13	-	-	-	-	-
	Gumagadong Calawag		79	34	-	4	-	3	-	-
	Making		336	82	-	-	-	7	-	-
	Manion		161	122	-	-	-	-	-	-
	Total		776	429	13	4	-	10		

Source: RAP Survey Team

A comprehensive understanding of the socio-economic conditions and the level of participation/acceptance of households in the influence areas is deemed essential for the baseline profiling. In this undertaking, a household is defined as a unit comprising of more than one person who usually living together in the same dwelling and making common provisions for living essentials. In the absence of existing household level data, random sampling conducted, a total of 102 respondents were interviewed for this survey distributed in the Municipality Parang, Maguindanao with 4 barangays covered by the project. Random (purposive) survey was conducted to gather pertinent data and perceptions of the community covered by the proposed project. Communities residing within or near the road alignment were interviewed.

Survey Administration

In order to ensure that the requirements of the survey process are met, the study recruited municipal staff and census workers to administer the survey. These staff who have the qualifications and capacity to administer the survey, underwent a one-day preparatory training to familiarize themselves with the objectives of the survey, administration biases and strategies to minimize them, and the details provided in the survey questionnaire. The questionnaire was first pre-tested and subsequently modified when required.

Data Analysis

Data were analyzed using a standard statistical package for the social sciences (SPSS) program and Microsoft Excel. In order to control the differences in population size, the study employed weighted average in the calculation of results. The results are reported in percentages and are displayed in frequency tables and graphs.

Figure 65.Perception interview within SP 8

3.5.3.1 Respondent's Profile and Household Information

Of the 102 respondents surveyed, around 71 or 69.61% are female while the remaining 31 or 30.39% are male (**Figure 60**). More females were interviewed, since during the conduct of the survey, most of the male household heads were at work.

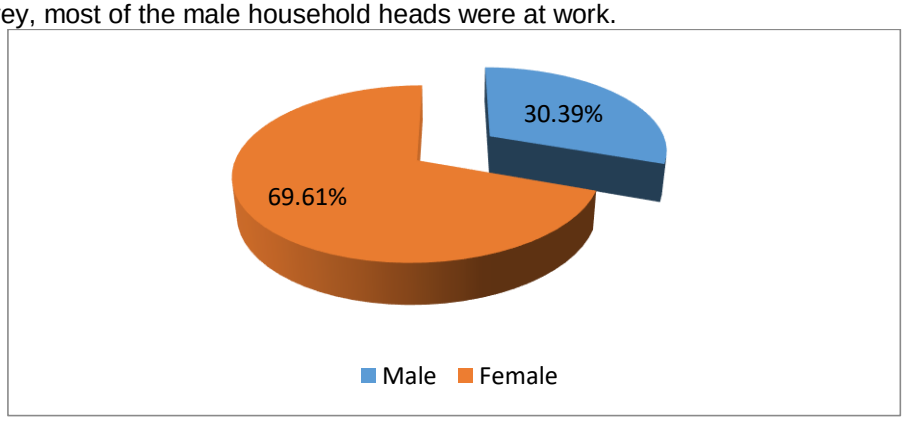

Figure 66: Gender of Respondents

In terms of age, those between 40 to 44 and 30 to 34 are the largest age group interviewed with both age groups representing 47.05% of the respondents. A summary of the age distribution of the respondents is shown in **Table 55**.

Table 55. Age Distribution of the Respondents

Age	Frequency	% Percentage
20-24	4	3.92%
25-29	9	8.82%
30-34	22	21.57%
35-39	19	18.63%
40-44	26	25.49%
45-49	7	6.86%
50-54	6	5.88%
55-59	3	2.94%
60-64	1	0.98%
65 and above	5	4.90%

Figure 67 shows the civil status of the respondents. Majority 98 or 96.08% of the respondents are married with spouse present. Only 4 or 3.96% of the respondents are single.

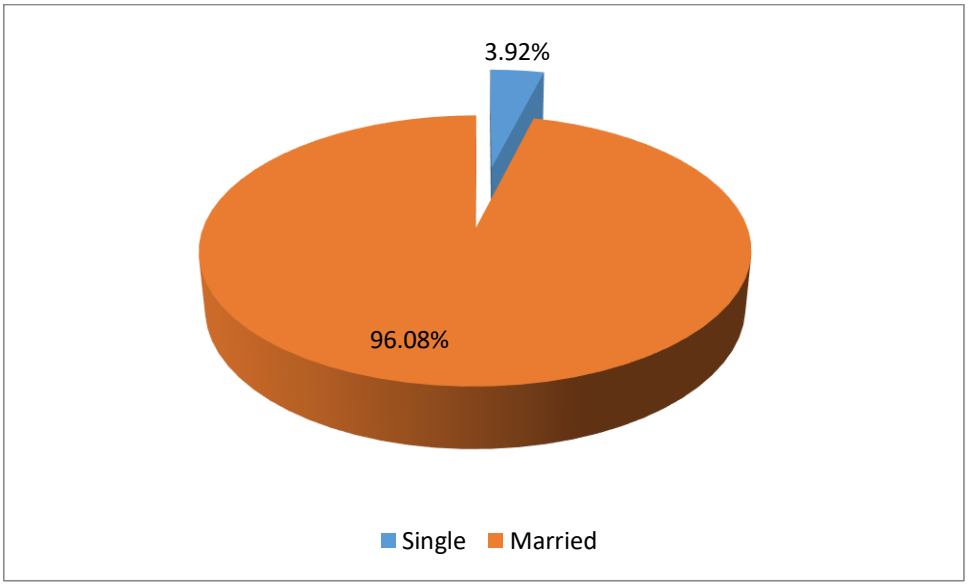

Figure 67: Civil Status of the Respondents

Figure 62 shows the highest educational attainment of the respondents. Around 36 or 35.29% of the respondents reported that they were finished up to elementary level while 33 or 32.35% reported being able to finished up to high school level only. Around 17 or 16.67% of the respondents reported they have not received any formal education.

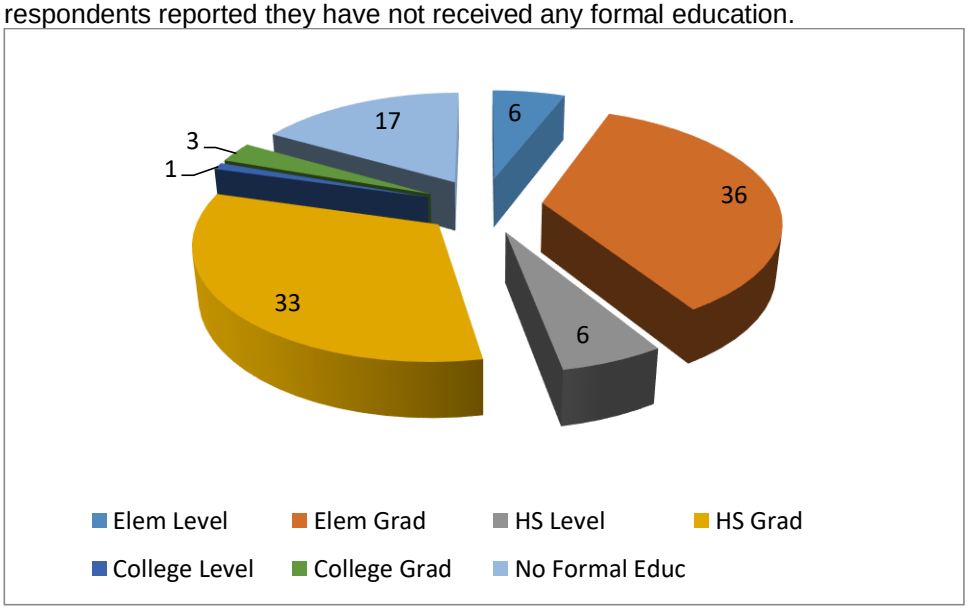

Figure 68: Educational Attainment of the Respondents

Table 56 shows the religious affiliation of the respondents. Majority of the respondents 57.84% are Islam. Other religious denominations present in the project area include Roman Catholic.

Table 56. Religious Affiliation of the Respondents

Religion	Frequency	% Percentage
Baptist	0	0.00%
Born Again Christian	0	0.00%
Iglesia Ni Cristo	0	0.00%
Islam	59	57.84%
Roman Catholic	43	42.16%

Table 57 shows the number years that the respondents have lived in the barangay. The three highest frequency of stay in the barangay are 40 to 44, 30 to 34 and 35 to 39. The data notices that most of the respondents lived in the barangays or communities since their birth.

Table 57. Respondent's Years in the Barangay

Years in Barangay	Frequency	% Percentage
5 years and below	0	0.00%
5-10	0	0.00%
11-15	0	0.00%
16-20	2	1.96%
21-24	2	1.96%
25-29	9	8.82%
30-34	22	21.57%
35-39	19	18.63%
40-44	26	25.49%
45-49	7	6.86%
50-54	6	5.88%
55-59	3	2.94%
60-64	1	0.98%
65 and above	5	4.90%

3.5.3.2 Income and Employment

Table 58 shows the employment profile of the households. Based on the occupation or source of income of the respondents, most of them depend on farming 45.10% and laborers 35.29% in the project area. Farming is the most strategic form of work due to the proximity of these people to the community. Around 19.61% are employed while 9.80% are engaged in others occupation. Households' employment profiles are not limited with one (1) work hence the frequency are more than the number of the respondents.

Table 58. Employment Profile

Household Employment	Frequency	% Percentage
Farming	46	45.10%
Employed	20	19.61%
Self-employed	10	9.80%
Business	3	2.94%
Fishing	0	0.00%
Laborers	36	35.29%
None	6	5.88%
Others	20	19.61%

The household income of the respondents reflects the status and capacity of providing the basic needs of the family. **Table 59** shows the household income reported by the respondents. As per interview, 50.00% have a total monthly income of 5,000-10,000 pesos, 21.57% are 11,000 to 15,000 pesos, 6.86% earned 16,000 to 20,000 pesos, 10.78% have an income of 21,000 to 25,000 pesos, 4.90% earns an income of 26,000 to 30,000 pesos 3.92% for income earner of 31,000 to 35,000 and 1.96% earns 26,000 to 40,000 pesos.

Table 59. Household Income

Household Monthly Income	Frequency	% Percentage
5,000-10,000	51	50.00%
11,000-15,000	22	21.57%
16,000-20,000	7	6.86%
21,000-25,000	11	10.78%
26,000-30,000	5	4.90%
31,000-35,000	4	3.92%
36,000-40,000	2	1.96%
41,000 and above	0	0.00%

3.5.3.3 Gender Roles

In terms of gender role in the community, results from the household survey show that in the activity profiling, farming is dominantly performed by men, including construction activities. Reproductive activities such as childcare, home maintenance, food preparation, and other household choirs are done by women. On the other hand, based on gender access and control, the economic aspect in households is equally controlled by both genders.

3.5.3.4 Health and Sanitation

In terms of health, headache, allergy, cough, diarrhea, hypertension and flu are the most common form of illness experienced by the respondents and their family members. The common causes of death are cancer, heart disease and pneumonia.

Most respondents go the Barangay Health Center and Rural Health Center for their medical needs. More serious cases are referred to the Provincial Hospital or private medical practitioners in Cotabato City.

3.5.3.5 Access to Water

Figure 69 shows the resources of drinking water of the respondents. Majority of the respondents utilize water from local water district for their domestic and drinking water needs. Other drinking water sources include from spring.

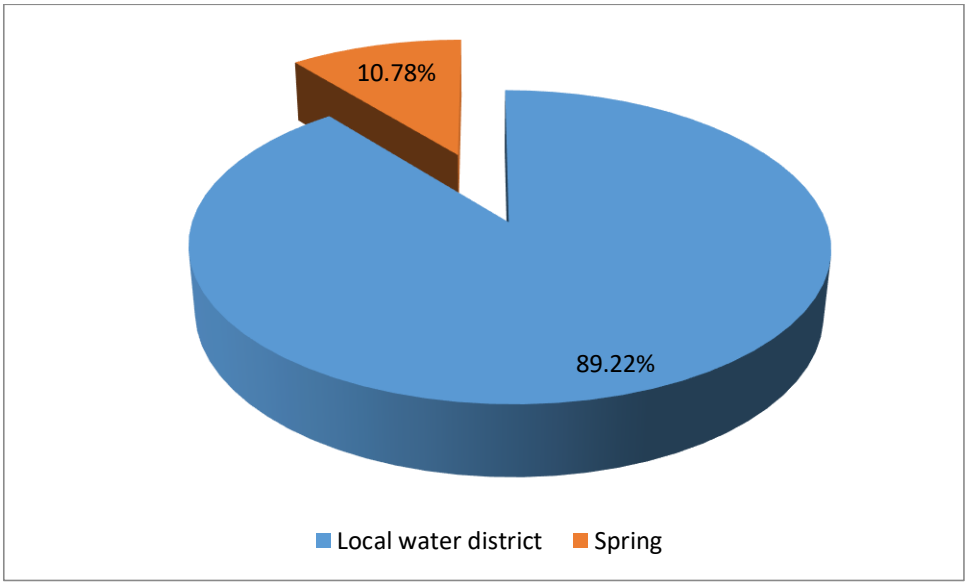

Figure 69: Source of Electricity

3.5.3.6 Access to Electricity

All of the respondents' source of electricity comes from Maguindanao Cooperative Inc. (MAGELCO) This result indicates that most people in the area are capable of acquiring and paying for power connection.

3.5.3.7 House Types

Among the respondents, 65.69% of them have semi-concrete house structures, 34.31% are made of concrete materials as shown in **Figure 70**.

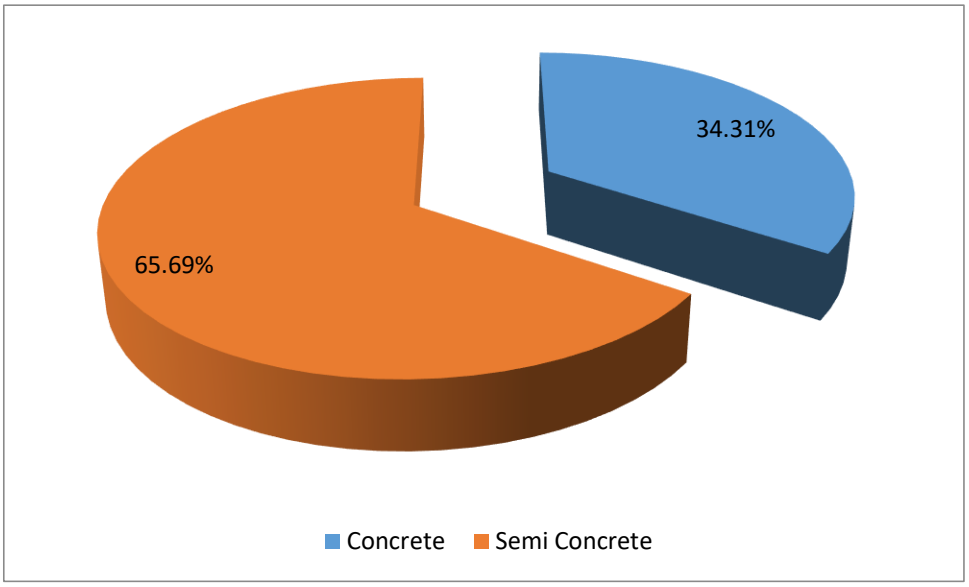

Figure 70: Type of House

3.5.3.8 Waste Management

The domestic waste disposal practiced by the respondents stated that e. Also, they practice open pit as a means of waste disposal.

3.5.3.9 Type of Toilet System

In terms of type of toilet system, survey result shows in **Figure 71** that 93 or 91.18% of the respondents have their own private toilet system. Around 9 or 8.82% respondents mentioned that they shared by household.

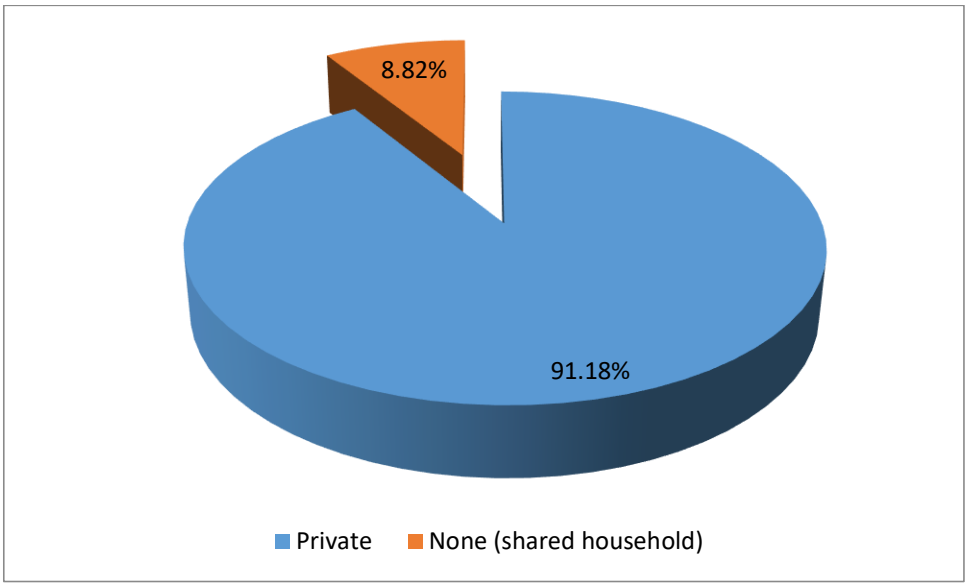

Figure 71: Type of Toilet System

3.5.3.10 Knowledge of the Project

When asked if they are aware of the proposed construction of road network development project in conflict-affected areas in Mindanao, all of the respondents mentioned that they are fully aware of the proposed project. When asked of their source of information about the project, local officials are the most common source of information for those aware of the project. Other government agencies and the project proponent were also identified as sources of information about the project by the respondents.

Figure 72 shows that around 70 or 68.63% of the respondents mentioned that the project to have very beneficial while around 32 or 31.37% believe that the project would be extremely beneficial in their communities.

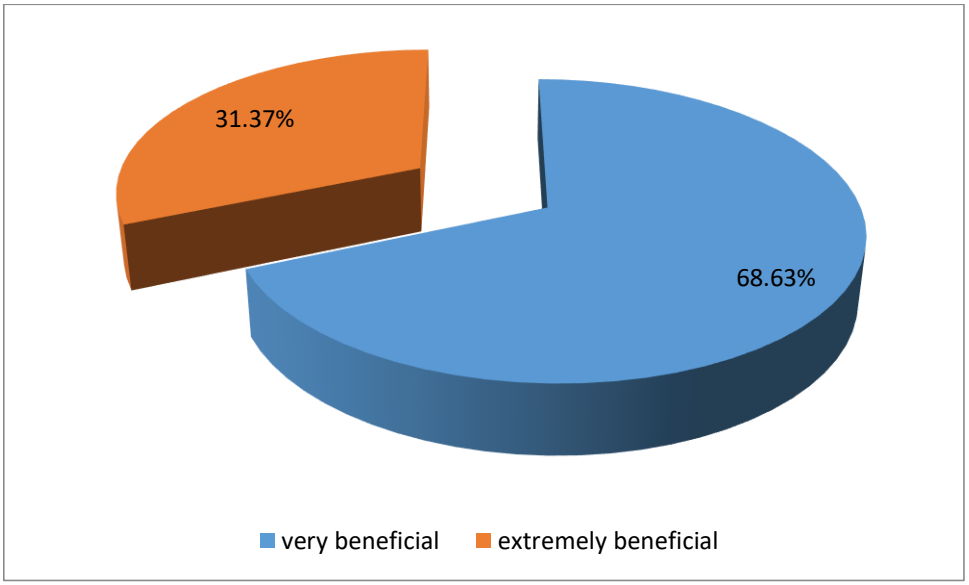

Figure 72: Perceived Beneficial Effects of the Project

a) Perceived Positive Effects

Most of the respondents mentioned that the project implementation may have positive effects on the economic aspect of the residents especially those engaged on business. Also, the respondents mentioned that the proposed project will improve accessibility, farm products delivery and quality of their life. This will also open opportunity for tourism which will benefit not only the LGUs but most especially the locals.

b) Perceived Negative Effects

When respondents were asked to identify possible problems in the implementation of the project in the area, they said that it may affect the livelihood and businesses that depends on the land/lot. With the implementation of the project, these livelihood activities might be displaced or removed. Other major concern of the respondents is the houses that may be affected by the proposed project.

During the consultation, right of way acquisition are the most significant issues and concern raised.

The respondents were also asked about their recommendation on the possible activities that can be undertaken to avoid the negative effects of the project and mentioned that careful identification and planning should be implemented. When further asked of their suggestion to improve the implementation of the project, the respondents answered the following:

- Minimize disturbance of residents
- Intensive consultation with the affected people
- Proper relocation/compensation for the affected families
- Provide information dissemination for the starting of the construction of the project at the barangay level
- Close coordination between project proponent and the local government

c) Project's Favorability

The results of the survey show that most of the respondents mentioned that they are in favor of the implementation of the project. There are respondents who are uncertain (5.88%) are anxious that they will be displaced and loss their income.

The consultation also reflects favorability among stakeholders, however the main concern is the compensation/relocation of affected people.

Considerations on the implementation of the project from the respondents are also acquired during the survey. The respondents mentioned that the project proponent should consider the needs of the people that will be affected. Just compensation on the affected houses should also be settled as well as consider the livelihood of those income that will be affected. Appropriate implementation of the project should consider so that the positive effects of the project will be realized.

d) Summary of the Study Conducted

In summary and conclusion, the positive effects of the proposed project are recognized by the concerned communities. The developments will provide local businesses, create employment and enhance the lives of the local government and community. Based on the perception survey conducted, it can be concluded that the proposed project is socially acceptable at this stage. However, some are hesitant because of the fact that their settlements might be affected during the project implementation. According to them, it is not easy to give up their properties (house, livelihood, etc.) adding to the fact that they have lived in the area for a number of years. It is possible that the residents will change their mind if extensive consultation and transparent communication are undertaken to discuss issues and concerns with the proponent, owner, tenants and LGUs and provision of measures to address such issues and concerns.

Section 4

SCOPING

4. SCOPING

4.1 Barangay Scoping

The EIA team conducted Barangay Scoping in Parang East Diversion Road (SP 8) dated January 11, 2018 and January 12, 2018 with the Barangay Officials and possible Project Affected Persons (PAPs). The EIA team conducted the said scoping to gather and address the queries and concerns and provide responses and clarifications to queries on the proposed project. The participants also identified the foreseeable positive and negative effect of the Project based on the matrix prepared by the study team (Refer to Annex 13.6.1 on filled up and signed matrix). **Table 60** presents the objectives of the scoping and number of participants. Attendees for barangay scoping's were attended by 46 male and 21 female.

For barangays along SP 8, issues and concerns raised foremost of which was about the compensation of Project Affected People (PAPs); request for farm to market roads; and considerations on the irrigation canals that might be affected. Some barangay officials also requested to prioritize locals in hiring construction workers once the project is implemented. There are also reiterations of support for the project from the participants which according to them are beneficial for the community. They requested for the fast implementation of the project. The major opinions of the participants are the process of land acquisitions and compensations as shown in **Table 61**. The queries and comments on the barangay scoping checklist was responded by the Study team.

Table 60. **Contents Of Stakeholder Meeting on Scoping Stage Barangay Level**

Date (venues)	Objectives of the meeting	Major Agenda	Participants	No. of Participants
Jan. 11 & 12, 2018 Barangay Hall	Barangay Scoping in accordance with Philippines EIA Guidelines	1. Inform and generate awareness and understanding of the concerned public about the project; 2. To gather and address the queries and concerns and provide responses and clarifications to queries on the proposed project; and 3. To identify the foreseeable positive and negative effect of the Project based on the barangay scoping matrix.	Barangay Officials, Project-Affected Persons (PAPs), RAP, and JICA Study Team	Manion: Male – 15, Female - 0 Making: Male – 14, Female – 8 Nituan: Male – 12, Female - 2 Gumagadong Calawag Male – 5, Female - 11

Table 61. Major Opinions in Stakeholder Meetings on Scoping Barangay Level

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
Jan. 11 & 12, 2018 Barangay Scoping in accordance with Philippines EIA Guidelines	1. Introduce the project and discuss the project objectives and the positive and negative impacts of the project.	Socio/The People	Livelihood	1. (Brgy. Manion and Chairman Belinda Molina of Brgy. Gumagadong Calawag) Barangay officials appealed to prioritize locals in hiring construction workers.	1. Yes, this will be the priority of the project and will be recommended to the proponent considering that they are qualified for the job.
			Properties	2. (Brgy. Captain Reynaldo Quitor) the affected owners of the private properties should be compensated prior to the road implementation. In case that the owner cannot present the proof of ownership, the barangay chairman committed to intervene for any form of negotiations and settlement.	2. Private property owners are advised to present proof of ownership like land titles, certifications or tax declaration, and have them presented to the RAP Team during survey inventory/validation.
			Infrastructure	3. (Brgy. Captain Precious Johanney Binwar) informed the team that there is irrigation canal to be traversed by the project.	3. This will be noted for considerations of JICA in designing the project.

Hereto attached are the results of scoping checklists and attendance sheets for SP 8.

4.2 Summary of Baseline Survey and Forecast

Table 62. Summary of Baseline Survey and Forecast

Category	No.	Impacted Item on JICA Guidelines (Philippines Item)	Rating				Summary Result		
			Pre/ During Construction	Operation Phase	Pre/ During Con-struction	Operation Phase	Baseline	Forecast	Evaluation (Quantitative Standard)
Pollution	1	Air Pollution (Air Quality & Noise)	B-	B-	B-	B-	Result of (TSP, PM10, SO2, NO2) at 2 stations are below the standard value.	Forecast value do not exceed standard values	Expected impacts by the project are not significant because all the forecasted values are within the standard values Quantitative Standards is shown in Table------
	2	Water pollution (water Quality)	B-	D	B-	D	Result of (pH, Temp, BOD, TSS, DO) are within the guidelines	During construction activities may cause turbidity in water and oil and grease contamination. Likewise, domestic waste may be discharge from the camp	Impacts may be minimized or mitigated by provision of erosion control measures such as settling traps, use of portable toilet, etc
	3	Waste	B-	D	B-	D	Not required	Clearing and deforestation activities are expected to generate construction waste such as soil, debris, cut trees Also, additional domestic waste may be generated from the construction camp.	Impacts can be mitigated by proper management and disposal of waste like practice ecological waste management, segregation at source, 3R, etc
	4	Soil Contamination (Soil Quality)	B-	D	B-	D	Not required	Soil maybe contaminated from the construction equipment and transportation.	Impacts can be mitigated by proper maintenance of equipment and transportation, proper containment and disposal of oil,etc
	5	Noise	B-	B-	B-	B-	There are some measurement of noise that exceeded the standard	During construction, noise measurement will exceed because of	Impacts may be mitigated by avoidance and other measures such as no construction during the night and dawn,

							particularly during the night due to presence of insects like crickets that make noise during the dark.	the construction equipment use and transportation vehicle coming in n out of the site	use of personal protective equipment for workers such as ear plug, muffler or sound proof barrier.
	6	Ground Subsidence	D	D	D	D	The ground terrain is characterized by low relief and gently undulating to rolling topography.	No impact is expected.	Detailed quantitative survey is not necessary.
	7	Odor	D	D	D	D	Not required	Few impacts are expected. Obnoxious odor may come from vehicle exhaust, clearing & dredging of river banks.	Qualitative measurements based on sensitivity of receptors against unobjectionable odor
	8	Sediment Quality	B-	D	B-	D	Not required	During construction sediment will most likely erode into the water particularly during heavy rains	Impacts may be mitigated though erosion /sedimentation control measures, or stoppage of soil clearing during heavy rains, use of silt trap
	9	Protected Area	D	D	D	D	Not required	No impact is expected	No protected area is observed in the area.
Natural l Environment	10	Ecosystem (Terrestrial Flora and Fauna)	C	C	C	C	Floristic composition of the alignment is relatively low comprised of 46 species dominated by trees. Recorded species are common and naturally growing in the area. Result of the assessment reveals that there are no threatened species under the IUCN categories. Fauna composition of the area is very low with only 22 species recorded dominated by avifauna. Recorded species are common in the lowland areas including in the agricultural areas, shrubland, grassland and even settlements areas.	The project development will require removal of vegetation cover to give way for the construction of the proposed road project. Further loss of vegetation cover as a result of land clearing may encourage movement/migration of wildlife species in the area aggravated by the loss of habitat/abode and remaining sources of food for survival. Likewise, wildlife disturbance due to noise pollution brought about by the operation of heavy equipment's during construction will force some faunal species to migrate to other or nearby areas/habitat where disturbance is less.	Prior to project implementation the proponent will coordinate to the DENR and Philippine Coconut Authority (PCA) to seek clearance for the identification of required documents for the issuance of needed tree and coconut cutting permits (PD 705). Moreover, to compensate the loss of habitats, the proponent will replace the number of trees removed/cut and plant them in nearby areas or in accordance with the advice of the DENR. Species that will be used for the reforestation must be indigenous trees and/or fruit bearing trees endemic in the place that can attract wildlife species. Planting of trees will help in sequestering carbon in the environment. As per **DENR Memorandum Order no. 05 of 2012** mandated that "Uniform replacement ratio for cut or relocated trees" item 2.2 "For planted trees in private land and forest lands... tree

							These species also thrive even in highly disturb areas including cities. Five (5) species are endemic in the study area dominated by Aves. No endangered or threatened species are included in the IUCN list.		replacement shall be 1:50 while naturally growing trees in the same area, including those affected by the project, shall be 1:100 ratio in support of the National Greening Program (NGP) and Climate Change Initiatives of the Government". Compensation for affected coconut palms shall be based on Section 5 of Republic Act No. 8048, an act providing for the regulation of the cutting of coconut palms. Replacement ratio of cut coconut palm shall be 1:1.
	11	Hydrology	B	B	B	B	The river systems that affect the proposed road alignment are the Nituan River and one of its tributary**.** During the conduct of field investigation, no ground water wells or springs were found that may be affected by the project and based on the data from the National Water Resources Board (NWRB) and from Local Water Utilities Administration (LWUA) **.**	Most likely not affected as no wells were found on the alignment	Not give serious impact on the ground water
	12	Topography and Geology	B	B	B	B	The topography is characterized by low relief and gently undulating to rolling topography with approximate elevation range from 20 to 100 masl.	• The proximity of active faults exposes the project to moderate to strong ground shaking. • Some sections passing through steep to very steep, hilly to mountainous terrain may be susceptible to slope failure, soil erosion, and rock fall.	• Conduct Probabilistic Seismic Hazard Assessment (PSHA). • Impacts may be mitigated by slope protection

Social Environment	13	Involuntary resettlement (People)	B-	D	B+	D	c/o RAP for the exact accounts of affected	Land acquisition may cause acquisition of agricultural land, crops and resettlement. Thus, RAP is prepared in accordance with JICA Guidelines and Philippine Laws.	Appropriate compensation and assistance in accordance with RAP is prepared to minimize adverse social impacts.
	14	The Poor (People)	B-/+	C	B+	C	Based on the profiles of the respondents during perception survey, 50 percent of the households are earning below poverty line (5,000 to 10,000pesos/month). This composed of the total income of the households per month which only reflects that half of the respondents are living in poverty	Land acquisition by the project gives some adverse impact to poor people under poverty line	Appropriate compensation and and assistance in accordance with RAP is prepared to minimize adverse social impacts
	15	Indigenous and ethnic people (Indigenous People)	C	C	C	C	According to the LGU of Parang, no CADC/T in the affected area. In terms of ethnicity based on the Municipal Profile of Parang (2015), Iranun is the most dominant ethnic group with almost 30% of the total population. Maguindanaon and Cebuano are the next dominant both comprising 20% of the population. In barangay Making in Parang, around 40 migrant IP families concentrated in three areas, sitio Green view, sitio Gmellina, and zone beach area. Their	Few impacts are expected on designated indigenous and ethnic group. However, religious group(s) such as Iranun shall be monitored, and then adequate assistance and coordination shall be given, if necessary.	Appropriate compensation and assistance in accordance with RAP is prepared to minimize adverse social impacts

							location is far from the proposed road alignment.		
	16	Local Economy such as employment and livelihood (People)	B-	D	B-	D	Based from the occupation or source of income of the respondents, most of them depend on farming 45.10% and laborers 35.29% in the project area. Farming is the most strategic form of work due to the proximity of these people to the community. Around 19.61% are employed and employed as laborers while 9.80% are self-employed.	Land acquisition by the project gives some adverse impact to tenant farmers and employees of the shops.	Appropriate compensation and social assistance in accordance with Resettlement Action Plan (RAP) is prepared and minimize the adverse social impacts. Provision of livelihood/income to the poor may be consider
	17	Land Use and utilization of local resources (Land Use and classification)	B-	D	B-	D	The project alignment is passing through mainly agricultural area such as plantation and residential zone	.In terms of the Agricultural Land Zone (AG), impacts are considered as both positive and negative. Positive in the sense that the road can provide better and faster way, and as such more economical way of transporting products from these areas to trading centers and other distribution sites. Negative in the sense that there is an imminent danger of illegal conversion into other uses	some impacts are expected; thus these impacts and risks are minimized by appropriate land management
	18	Water usage (hydrology/hydrogeology/water quality)	B-	B-	B-	B-	Water supply is scarce in some portions of project affected areas. Water source comes from dugwells and springs which are used for domestic and drinking water. In Balabagan, there are water delivery trucks in some areas that supplies water which	Earthworks may cause turbidity of river water as being use for domestic.	Minimized by control measures like silt trap , sedimentation pond, etc Or appropriate assistance for tapping other source of water

Note) Rating:

							costs Php 50 pesos per drum.		
	19	Existing Social infrastructures and services (People)	B-	D	B-	D	c/o RAP for the exact account of social infrastructure affected	The project does not give any impact to social infrastructures. Thus it is not likely to give any serious impacts on this item	Appropriate compensation and social assistance in accordance with Resettlement Action Plan (RAP) is prepared and minimize the adverse social impacts, if any impacts are expected in the detailed design
	20	Social institutions such as social infrastructure and local decision-making institutions	C	C	C	C	Impacts are not expected, since local decision-making institute represented by local governments will continue after the road construction.	Impacts not Expected	Not required
	21	Misdistribution of benefit and damage	D	D	D	D	Misdistribution of benefit and damage caused by the road constructions not expected.	Impacts not Expected	Not required
	22	Local Conflict of interest (People)	C	D	C	D	Most of the stakeholders requested to provide work opportunities as a construction worker during construction in the stakeholder meetings on scoping stage	The local conflicts regarding work opportunities between local communities may be raised in case of unfair employment.	This risk is minimized by mitigation measures such as provision of priority in hiring during construction period.
	23	Cultural Heritage (People)	C	D	C	D	No cultural heritage affected.	Impacts not Expected	Not required
	24	Landscape	D	D	D	D	Not required	Few impact is expected	Not required
	25	Gender	D	D	D	D	LGU has implemented GAD projects	Impacts on Gender are mostly positive since opportunity for livelihood is expected (small business to women, employment to men)	Prioritization in hiring during construction and assistance for livelihood development
	26	Right of Children	D	D	D	D	Not required	Few impact is expected	Not required

	27	Infectious diseases such as HIV/AIDS (People)	B-	D	B-	D	No infectious illness recorded in the project area. Project should not to create a habitat of mosquito that transmits dengue fever in incidental pond in the construction area without appropriate drainage.	Infectious diseases such as STD are possible to be spread due to inflow of construction workers. Furthermore, alteration to ground by cut land and filling may provoke to provide habitats of mosquito that possibly transmits dengue fever	This risk is minimized by mitigation measures such as construction of sufficient drainage, management of construction yard and health check & education for workers.
others	28	Labor environment (including Work safety)	B-	D	B-	D	Not required	There are risks for workers during construction, if the construction contractor does not comply with relevant labor laws and regulations.	These risks are avoided and minimized by complying with relevant laws and regulations by the contractor under observation of DPWH
	29	Accident (Traffic Situation)	B-	B-	B-	B-	No serious problem on traffic	Construction vehicles may use existing local road near residential areas, thus number of traffic accident may increase	Can be minimized by installing traffic sign board, lighting in the night, trained personnel and use of PPE
	30	Cross boundary impacts and climate change (Meteorology/climatology)	D	D	D	D	Not required	During Construction, deforestation will incur. On loss of vegetation, the project development will require removal of vegetation cover to give way for the construction of road project. The removal of vegetation will also result in the reduction in the population of plant species growing within the project area. Future vegetation will face a great threat during the clearing activity. This activity will hinder the opportunity of these regenerants to grow and replace those mature vegetation in the area. During operations, generation of carbon monoxide and other gases will be generated from exhaust vehicles which will impact the ozone layer	On loss of vegetation: During site preparation, clearing of the road ROW will result to the removal of of an estimated tree above ground biomass (using large of trees with dbh of 10 cm and above, and pole size tress with $\geq$ 5 cm dbh to 9.5 cm) of 1.59×10^{-4} and 2.87×10^{-4} megaram per hectare, and with estimated Carbon stored value of 3.53×10^{-4} and 6.38×10^{-4} megagram per hectare, respectively. It was computed using the brown allometric equation.

A+/-: Serious impact is expected. B+/-: Some impact is expected. C: Extent of impact is unknown (**serious impacts are not expected, but survey and analysis shall be done**) D: Few impacts are expected. Detailed quantitative survey is not necessary.
Source: JICA Survey Team

Table 63. **Summary of Baseline and Forecasted Value (Air, Noise and Water)**

No.	Item	St.	Location	Baseline Value (Standard Value)					Quantitative Forecast Analysis (Standard Value)				
		Parameter		TSP	PM10	NO2	SO2		TSP	PM10	NO2	SO2	
1	Air Pollution	1	Purok Dulangan I, Brgy. Nituan, Parang	25.5	6.4	2.7	1.2		-	6.4	2.7	1.2	
		2	Near Reservoir Area, Brgy. Making, Parang	22.7	4.6	3.6	1.4		-	4.6	3.8	1.4	
2	Water Pollution	St	Location	pH (6.5-9)	Temp, ^{o}C (25-31)	BOD (7)	TSS (80)	DO (5ppm min.)	pH	Temp, ^{0}C	BOD	TSS	DO
		1	Nituan River	7.7	28.9	1	11	8	-	-	-	-	-
		2	Nituan Irrigation	6.9	30.5	2	21	6	-	-	-	-	-
3	Noise	St	Location	Morning (50)	Daytime (55)	Evening (50)	Night time (45)		Morning	Evening	Evening	Night Time	
		1	Purok Dulangan I, Brgy. Nituan, Parang	**51**	50	48	**49**		**54**	54	49	**50**	
		2	Near Reservoir Area, Brgy. Making, Parang	48	48	48	**48**		**53**	**53**	**49**	**49**	

STANDARD VALUES OF AIR QUALITY

Item	TSP	PM10	NO2	SO2
Philippine Standard	230ug/Ncm	150 ug/Ncm	150ug/Ncm	180ug/Ncm
Japanese Standard	0.2 mg/m3		0.04-0.06 ppm	0.1 ppm

STANDARD VALUE FOR WATER QUALITY

Item	pH	Temp ^{o}C	BOD	TSS	DO
Philippine Standard	6.5-9	25-31	7	80	Min of 5 ppm
Japanese Standard	6.5-8.5		3	25	5ppm

STANDARD VALUE OF NOISE LEVEL

Class		Morning Time 05:00-09:00 (dB(A))	Day Time 9:00-18:00 (dB(A))	Evening Time 18:00-22:00 (dB(A))	Night Time 22:00-5:00 (dB(A))
Philippines Standard	Class AA	45	50	45	40
	Class A (General)	50	55	50	45
	Class A (facing 4 lanes road area)	50	60	50	45
	Class B (Commercial area)	60	65	60	55
	Class C	65	70	65	60
Japanese Standard	Class AA	-	(6:00-22:00) 50	(22:00-6:00) 40	-
	Class A	-	55	45	-
	Class A2	-	60	55	-
	Class B	-	55	45	-
	Class B2	-	65	60	-
	Class C	-	60	55	-
	Class C2	-	65	60	-
	Class D	-	70	65	-

Note1: Definition of Class on Philippines Standards (Agreement between DPWH, EMB and MMT as indicated in Annex 2-20 of the RPM for DAO 2003-30)

"AA" categorized areas (a section or contiguous area which requires quietness, such as an area within 100 m from school sites, nursery schools, hospitals, places of worships, and special homes for the aged)

"A" categorized areas (general residential areas)

"A" categorized areas (directly facing/fronting a 4 lanes road in residential area):

"B" categorized areas (general commercial areas)

"C" categorized areas (light industrial areas)

Note2: Definition of Class on Japanese Standards (Ministry of Environment in Japan)
"AA" categorized areas (sensitive area required to be calm such as hospital and social welfare facilities)
A" categorized areas (general residential areas)
"A2" categorized areas (directly facing/fronting more than 2 lanes road in "A" area):
"B" categorized areas (mainly residential areas)
"B2" categorized areas (directly facing/fronting more than 2 lanes road in "B" area)
"C" categorized areas (mixed area with residential, commercial and industrial areas)
"C2" categorized areas (directly facing/fronting more than 2 lanes road in "C" area)
"D" categorized areas (directly facing/fronting trunk road)

Table 64. Environmental Management Plan

Category	No.	Impacted Item on JICA Guidelines (Philippines Item)	Major Mitigation Measures		Responsibility	
			Pre and During Construction Phase	Operation Phase	Implementation Agency	Responsible Agency
Pollution	1	Air Pollution (Air Quality/Noise)	(Dust) ▪ Water sprinkling near residential area ▪ 20 kph speed limit for construction transportation/machines	(NO2, SO2, TSP) ▪ Setting up green buffer zone along the road (the zone and planting trees are carried out during construction)	Contractor	During Construction) DPWH (Operation Phase) LGU
	2	Water Pollution (Water quality)	(Turbidity) ▪ Discharge through sedimentation pond and silt fence ▪ Installation of Portable Toilet for workers ▪ Proper Waste and Construction Equipment management	Not required	Contractor	DPWH

	3	Waste (Abandonment)	(Construction waste (trees and waste soil) ▪ After considering the possibility of reuse, construction waste is disposed in designated disposal site) (Garbage from base camp) ▪ Garbage send to disposal site ▪ Used oil sent to TSD facility	Not required	Contractor	DPWH
	5	Noise	(Construction Noise) ▪ Installation of Noise barrier and selecting low noise equipment ▪ Avoiding works of heavy equipment during the night ▪ Informing the construction schedules to surrounding communities to obtain their consensus.	(Traffic Noise) ▪ Establishment of green belt as buffer zone along the road ▪ Secure sufficient distance from boundary of the road to residential area ▪ after construction of the road (Secure noise delay distance on land use plan along the road ▪ Installation of noise barrier along sensitive area, if required	Contractor	

	6	Sediment Quality (Soil Quality)	▪ Reuse or disposed at designated site	Not required	Contractor	DPWH
Natural Environment	10	Ecosystem (Terrestrial Biology Freshwater or Marine Ecology)	▪ Relocation and replanting of trees along the road in ROW ▪ Tree planting along DENR identified sites ▪	▪ Appropriate land use management not to develop natural area along the road	During Construction) Contractor (Operation Phase) LGU	During Construction) DPWH (Operation Phase) LGU
	11	Hydrology	▪ Designating of bridges with sufficient capacity ▪ Installation of sufficient drainage facilities ▪ Secure waterways in construction area	Not required	Contractor	DPWH
	12	Topography and Geology	▪ Installation of Slope protection measures	Not required	Contractor	DPWH
	13	Involuntary resettlement (People)	▪ Appropriate compensation and social assistance in accordance with RAP	▪ Assessing whether resettlement have been met, particularly with regards to livelihood and restoration and/or enhancement of living standards in	DPWH	LGU

				accordance with RAP		
	14	The Poor (People)	▪ Appropriate assistance in accordance with RAP	▪ Assessing whether resettlement have been met, particularly with regards to livelihood and restoration and/or enhancement of living standards in accordance with RAP	DPWH	LGU
	15	Indigenous and Ethnic People (Indigenous people)	Not required However, situation of minority religious group (s) such as Islamic group shall be monitored and adequate assistance and coordination shall be given, if necessary	Not required for designated Indegenous and Ethnic group specially if NCIP has been issued. However situation of minority Religious group such as Islamic group shall be monitored and adequate assistance and coordination shall be given, if necessary	-	-
	16	Local Economy such as employment and livelihood	▪ Appropriate compensation and social assistance in accordance with RAP	Not required	DPWH	LGU
	17	Landuse and utilization of Local resources(Land use and classification)	▪ Appropriate land acquisition and compensation for Agricultural area	▪ Management of appropriate land use in accordance with approved	DPWH, LGU	LGU

				detailed zoning map		
	18	Water Usage (Hydrology/Hydrogeology/Water Quality)	▪ Installation of alternative water distribution system when unexpected situation such as reduction of spring water and water level of wells	▪ Installation of alternative water distribution system when unexpected situation such as reduction of spring water and water level of wells	DPWF, LGU	DPWH, LGU
	19	Existing Social Infrastructures and services	▪ Appropriate compensation and/or relocation in accordance with RAP	Not required		LGU
	22	Local Conflict of interest	▪ Local workforce is prioritized for construction of road.	Not required	Contractor	DPWH
	23	Cultural Heritage	▪ Appropriate compensation and/or relocation in accordance with RAP	Not required	Contractor and DPWH	LGU
	27	Infectious diseases such as Dengue and HIV/AIDS	▪ Installation of sufficient drainage facilities not to provide habitat for vector mosquito ▪ Provision of adequate temporary sanitation facilities	Not required	Contractor	DPWH

			▪ Enforcement of medical screening and periodical medical check up ▪ In order to prevent spread of infectious diseases such as HIV/AIDS, awareness of the labors is promoted			
	28	Labor Environment (including Work Safety)	▪ Complying with relevant laws and regulations by the contractor under observation of DPWH	Not required	Contractor	DPWH
Others	29	Accidents (Traffic Situation)	▪ Deploying flagman at the gate and crossing points of the construction vehicles ▪ Installation of safety sign board ▪ Installing fence around the construction site to keep out local people such as children ▪ Installation of lighting in the night time	Not required	Contractor	DPWH

			▪ Installation of parking for idling construction machines ▪ Safety training for the workers ▪ Safety patrol at the construction site by supervisors			
	30	Cross boundary impacts and climate change (Meteorology/Climatology)	▪ Replanting natural native trees and other agricultural trees such as coconuts	Not required	Contractor	DPWH

Source: JICA Survey Team

Section 5

ENVIRONMENTAL/ ECOLOGICAL RISK ASSESSMENT

5.0 ENVIRONMENTAL RISK ASSESSMENT

Introduction

This chapter on Environmental Risk Assessment (ERA) supplements the Initial Environmental Examination (IEE) study conducted for the proposed Road Network Development Project.

ERA is a process of analyzing the risks associated with a project or activity with particular focus on its impacts to human health. It deals with further analysis of hazards identified in the EIS. The basic questions in conducting an ERA are the following:

Methodology

The ERA will generally follow the revised EIA guidelines prescribed in DAO 96-37 and DAO 2003-30 to integrate risk assessment in the conduct of environmental impact assessments. This ERA addresses the following information requirements:

- Information relating to the scope of analysis used
- Information relating to the construction activities
- Information relating to every hazardous substance in the construction sites
- Information relating to possible hazardous situations in the construction
- Information relating to the consequences of major accidents and probability of occurrences
- Information relating to the safety management system.

To manage construction risks, the following source of potential risks should be included in the Risk Management Plan. **Figure 73** presents the overview of quantitative risk assessment procedure.

- Contractual risks. Missing milestone deadlines can cost time, money and a business its reputation.
- Occupational risks. The nature of a construction site means there are many risks that can cause injury and possible death. Worker behavior, technology, working methods, weather or a third party can cause accidents.
- Project risks. The lack of good project management, workplace procedures, or workplace policies and procedures that are ignored and poor time management are just few project risks.
- Financial risks. Financial risks include rising interest rates, a surge in material prices and a lack of sales.
- Stakeholder risks. Use project management software to bridge communication problems, miscommunication over changes and deliverables.
- Competition. Competitors can make life tough. They can drop prices to undercut prices and build times. This can put you under pressure to meet the same terms and put the project's profit at risk.
- Natural risks. Natural risks (storms, earthquakes) are beyond your control but can shut a construction site down.

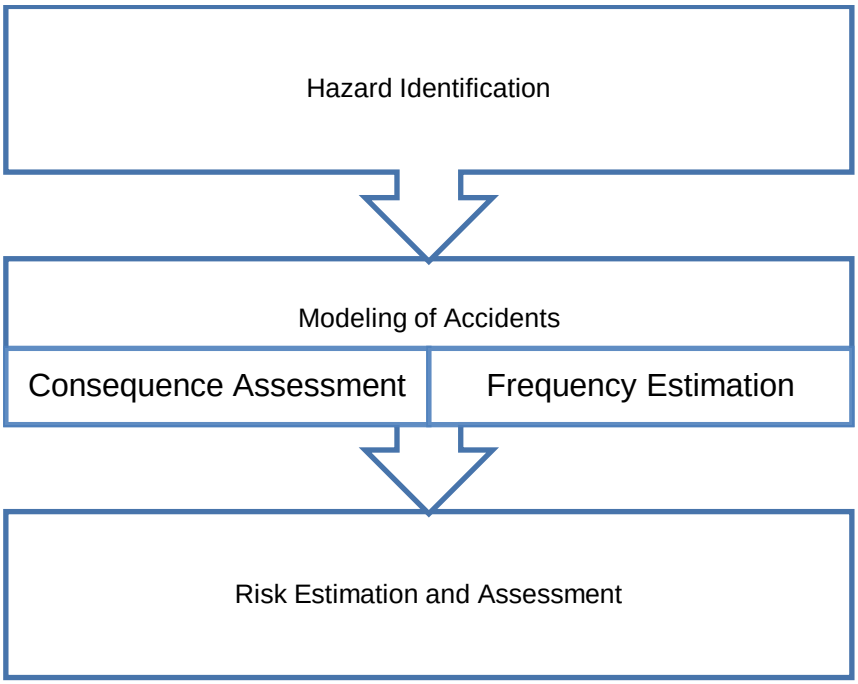

Figure 73. Overview of Quantitative Risk Assessment Procedure (IAEA, 1995)

The hazard identification phases involve the identification of hazardous substances and the potentially hazardous situations or activities in the facility. Based on the initial hazards identified, environmental pathways leading to the release of these substances due to the potentially hazardous situations will be assessed. The next steps in the procedure, which include consequence assessment and frequency estimation, are actually part of the whole risks characterization and evaluation process. This step will determine the likelihood of accident occurrences and the magnitude of impacts once they occur. The final stage involves the assessment of the resultant risks, whether they are significant from the point of view of risks unacceptability. Usually, a risk in the range of 10^{-6} frequency is deemed acceptable (ADB, 1991). Risk reduction measures should be developed for risks higher than this level. Otherwise, a risk management and prevention program is sufficient.

Assess risks for their order of importance

Assess the risks into order of importance from most likely to occur to the least likely. Also, rate each risk for the level of damage it can do if it does occur and the potential cost to your business.

5.1 Hazard Identification

A. Chemical Hazards

Hazardous Materials and Their Health Effects

Hazardous construction materials are natural or synthetic chemical substances that are harmful to humans or the environment. The chemicals and solvents to be stored and handled by the Project will be categorized according to the Revised DAO 2003-30 and Republic Act 6969 of the Department of the Environment & Natural Resources (DENR). The guidelines describe hazardous substances according to their reactivity, ignitability, corrosivity and toxicity potential. The hazardous materials that will be stored/ used by the project are presented in **Table 65**.

Table 65. Hazardous Materials that will be stored/used by the Project

HAZARDOUS SUBSTANCES
Paints
Thinners
Epoxy
Oils
Silica from cement

Based on the guidelines, paints/thinners are flammable substance with a flash point of $<60^0$C (closed up) or 60^0C (open cup). Ignitables are substances which can create fire under certain conditions, including but not limited to the following: liquids, such as solvents that readily catch fire and friction-sensitive substances. Ignitable liquid is any liquid with a flash point of not more than 60^0C, closed-cup test or 65.6^{o}C, open-cup test.

Volatile Organic Compounds (VOCs) are commonly found in solvents, paints, adhesives and protective coatings. VOCs usually cause irritation to eyes and respiratory track, dizziness, memory impairment, damage to kidney, liver and central nervous system.

Silica is a natural occurring substance found in stone, sand, concrete, tiles and bricks. It is absorbed in the body through inhalation after construction or demolition involving cutting, dressing, grinding or blasting stone or concrete release it in the air. Long term exposure to silica leads to lung infections and lung cancer.

Safety Data Sheet (SDS) of the hazardous materials to be used are required during construction activities. SDS presents a much more detailed discussion on the product, its composition, hazards identification, first aid measures, firefighting measures, accidental release measures, handling and storage, personal protection and exposure control, physical and chemical properties, toxicological and ecological information, and disposal and transport information.

Types of wastes from construction activities

Solid Wastes
Solid wastes include office waste like papers, Busted Fluorescent Lamps (BFLs), containers, e-waste, etc.; construction equipment waste like containers, expired and used solvents etc.; and domestic waste like food waste, packaging materials, etc.

Liquid Wastes

Liquid waste will be the waste water generated from the process and cleaning of equipment, and domestic waste. All waste water shall be treated before discharge to environment.

B. Mechanical and Physical Hazards

Physical Factors

Other work-related hazards may come from the following activities:

- Working around heat and electric current
- Operation of power and hand tools
- Moving along ladders, walkways, and platforms
- Lifting of heavy objects
- Test-running a machine
- Working with batteries
- Working with any machine; and
- Welding and cutting

Possible hazards that may exist during work activities:

- Slips/falls on the level
- Falls of persons from heights
- Falls of tools, materials, etc., from heights
- Inadequate headroom
- Hazards associated with manual lifting/handling of tools, materials, etc..
- Hazards from machinery associated with operation, maintenance, modification, repair and dismantling
- Vehicle hazards, covering both site transport, and travel by road
- Fire and explosion
- Violence to staff
- Substances that may be inhaled
- Substances or agents that may damage the eye
- Substances that may cause harm by coming into contact with, or being absorbed through, the skin
- Substances that may cause harm by being ingested (i.e., entering the body via the mouth)
- Harmful energies (e.g., electricity, radiation, noise, vibration)
- Work-related upper limb disorders resulting from frequently repeated tasks
- Inadequate thermal environment, e.g. too hot
- Lighting levels
- Slippery, uneven ground/surfaces
- Inadequate guard rails or hand rails on stairs
- Contractors' activities

5.2 Risk Management

Safety Management Measures

The Proponent shall ensure safety within and outside the facility at all times. A risk management program shall supplement the environmental management program presented in the EIS.

As a safety measure, Management shall include in its policies a strict adherence to environment, health and safety not only for its workers but for all those that might be involved or affected by its operation.

As part of standard operating procedures, all measures to safeguard the plant shall be strictly observed. This includes but is not limited to prohibition of smoking in the whole plant site, prohibition of entry or use of private electrical devices (mobile phones, cameras, radios, etc.) in the plant site, and through sensors and alarm devices in all areas where carbon dioxide can accumulate.,

Management shall likewise encourage good housekeeping in all phases of operations and ensure provision of adequate lighting, ventilation and working space. Use of personal protective equipment (PPE) where needed, as well as the conduct of regular training on safety and first aid, proper operation of equipment, proper handling of toxic and hazardous materials, etc.

The Proponent shall appoint a Pollution Control Officer and Safety Officer who will be assigned and responsible for implementing mitigating measures to avert environmental damage, health and safety of workers and shall conduct audits to monitor operations to ensure that such measures are being implemented.

It is recommended that environmental safety concerns in all phases of the operations should be defined, spelled out, explained and adhered to by all workers and managers alike. Top management support shall always be visible in all these undertakings.

The Pollution Control Officer and Safety Officer must be authorized to conduct audits and recommend sanctions if needed.

Company Policy on Safety and Environment

The Proponent is committed to ensure that the construction activity is hazard-free as possible and the factors leading to an accident are minimized if not totally eliminated.

The protocols to be formulated and implemented shall be as follows:

a] Emergency Response Procedures Manual
b] Medical Emergency Response Strategy Manual
c] Plant Security Manual
d] Crisis Management Manual
e] Road Transport Safety Management System Manual
f] Material Safety Data Sheet database.

The following shall be strictly observed during construction activities:

- Encouragement of good housekeeping in all phases of operations
- Provision of adequate lighting, ventilation, and working space
- Safety devices/warning systems in place within the Power Plant and Bioethanol Plant should be maintained
- Provision of safety paraphernalia like safety shoes, goggles, and breathing masks for workers
- Conduct of regular training on safety and first-aid, appropriate operation of equipment, proper handling of toxic or hazardous materials
- Maintenance of a fire truck, fire extinguishers, and fire drums in strategic locations and creation of an Emergency Response Team (e.g. fire brigade).

- Personnel Training

The personnel shall be given adequate training in coping with possible emergencies. They shall be regularly updated and trained n safety and emergency measures. Basic training shall include Signages used for danger communication and the Emergency Warning System used by the company.

Section 6

ENVIRONMENTAL MANAGEMENT PLAN

6.0 ENVIRONMENTAL MANAGEMENT PLAN

6.1 Impact Management Plan

The environmental impacts associated with the activities during the construction and operational phase have taken into the account the existing environmental conditions. It is assumed that the proposed road and bridge constructions in the area meet the requirements of the project.

6.1.1 Impacts on Land

6.1.1.1 Impacts

a) Loss/Deterioration of Current Vegetation Cover

The project will require land clearing resulting to the removal of portions of remaining vegetation's to give way for the construction of road network. This entails to further disturbance of wildlife, loss of remaining habitats resulting to further decrease in biodiversity composition of the area. Trees in adjacent areas may either be damaged or removed.

During site preparation, clearing of the road ROW will result to the removal of an estimated tree above ground biomass (using large of trees with dbh of 10 cm and above, and pole size tress with $\geq$ 5 cm dbh to 9.5 cm) of 2.61 x 10^{-4} and 2.98 x 10^{-4} megaram per hectare, and with estimated Carbon stored value of 5.81 x 10^{-4} and 6.62 x 10^{-4} megagram per hectare, respectively. It was computed using the brown allometric equation.

b) Decrease/migration of faunal species

Further loss of vegetation cover as a result of land clearing may encourage movement/migration of wildlife species in the area aggravated by the loss of habitat and remaining sources of food for survival. Likewise, wildlife disturbance due to noise generated during construction brought about by the operation of heavy equipment's will force faunal species to migrate in other or nearby areas/habitat where disturbance is less.

c) Erosion/Siltation

The removal of vegetation cover will lead to the removal of topsoils resulting from excavation activities. Erosion and siltation of the river may occur due to occasional rains and during movement of heavy equipment passing over unpaved roads and soil stockpile sites. Similarly, alteration of land topography may result in heavy influx of surface run-off waters resulting to erosion in the uncovered surfaces and siltation downstream of the project site.

6.1.1.2 Recommended Mitigating Measures

a) Replacement of trees cut due to land clearing

Prior to project implementation the proponent will coordinate to the DENR and Philippine Coconut Authority (PCA) to seek clearance for the identification of required documents for the issuance of needed tree and coconut cutting permits (PD 705). Moreover, to compensate the loss of habitats, the proponent will replace the number of trees removed/cut and plant them in nearby areas or in accordance with the advice of the DENR. Species that will be used for the reforestation must be indigenous trees

and/or fruit bearing trees endemic in the place that can attract wildlife species. Planting of trees will help in sequestering carbon in the environment.

As per **DENR Memorandum Order no. 05 of 2012** mandated that "Uniform replacement ratio for cut or relocated trees" item 2.2 "For planted trees in private land and forest lands... tree replacement shall be 1:50 while naturally growing trees in the same area, including those affected by the project, shall be 1:100 ratio in support of the National Greening Program (NGP) and Climate Change Initiatives of the Government".

Under the **Joint Memorandum Circular No. 01 series of 2014** outline the "Guidelines for the implementation of the DPWH-DENR-DSWD Partnership on the Tree Replacement Project" states "The Tree Replacement Program ensures the planting of one hundred (100) seedlings/saplings/propagules as replacement for every tree cut within or along the RROW of all DPWH-administered infrastructure projects".

b) Prohibition of wildlife poaching/collection

The proponent should also ensure that its employees must be prohibited/warned/informed not to engage in any mode of wildlife collection and/or hunting for the conservation and protection of remaining wildlife species. Promote wildlife protection using innovative means such as putting up of warning signage's on strategic areas for public information and warning.

c) Sedimentation/Siltation Control

Proper phasing and/or scheduling of earthmoving activities and proper stockpiling of scrapped soils in the proposed project development areas should be observed, away from the bodies of water/river. Installation of barrier nets, engineering technology, silt traps or sedimentation basin leading to water bodies is encourage to minimize siltation.

d) Replacement of cut coconut palms and perennial crops

Prior to clearing of the proposed ROW of the project which involves cutting of coconut and other perennial crops, the DPWH ARMM shall secure a "cutting permits" separately that will be acquired from the Philippine Coconut Authority (PCA) office in the region. Compensation for affected coconut palms shall be based on Section 5 of Republic Act No. 8048, an act providing for the regulation of the cutting of coconut palms. Replacement ratio of cut coconut palms shall be 1:1. If the applicant failed to implement replanting, fees will be collected by the PCA and shall be used to fund the replanting activity as defined in Section 5 of Republic Act No. 8048. Compensation of high value crops such as banana, mango, durian, pomelo, mangosteen, papaya, rambutan, and lanzones shall be in accordance with the existing schedule of values from the City Agriculture Office (CAO).

e) Establishment of natural noise buffer/natural perimeter along the alignment using landscape species or fruit bearing trees

To consider in the planning the establishment of natural buffer perimeter within the project alignment using landscape or fruit bearing trees. This method could help provide a natural abode to some wildlife as well as source of food, and improve the ecological services of the entire road network during the operation phase. It is recommended that a 2 or 3-rows of tree plantation along roads shall be established in both side, avoiding electrical transmission lines as mandated under the the DPWH Order no. 15 series of 2015.

6.1.2 Increase Air Pollution

During the construction phase of the project, access roads and the operation of construction equipment and vehicles will be the main sources of pollution. Fugitive dust and combustion emissions will be generated. The primary sources of fugitive dust emissions will include construction activities such as land clearing, grading, excavation, and the transport and movement of construction material particularly the increased vehicle traffic on unpaved roads. The amount of dust generated will be a function of construction activities, soil type, moisture content, wind speed, frequency of precipitation, vehicle traffic, vehicle type, and roadway characteristics.

Installation of air pollution control device for the batching plant is necessary. It is a general practice to install the dust collector and cement dust filter on the top of the cement warehouse in order to reduce the dust pollution.

Fugitive emissions will be highest during drier periods in areas of fine-textured soils. During the dry season, dust suppression will be applied as needed (such as watering of disturbed or exposed areas). A dust control plan will be implemented and regular maintenance of vehicles and equipment will be carried out.

6.1.3 Increase Noise and Traffic during road/bridge construction

During construction, increased noise and traffic levels will be significant due to heavy construction vehicles moving to and from the site. Increased traffic will be a result of trucks to and from the site for construction material deliveries and site clearing. Noise that will be generated will be through site clearing activities using soil scrappers and construction workers on site including construction equipment's operation. Since there are residential areas in the immediate vicinity of the site, the impact is considered significant.

However, the impact will be managed through the implementation of the mitigation measures below.

6.1.3.1 Noise generating activities will be restricted to normal working hours, thus limiting noise levels at nighttime to minimize the effect on the residents in the affected areas.

6.1.3.2 Contractors shall be required to ensure that construction equipment and vehicles are in a good state of maintenance.

6.1.4 Increase in Solid Wastes

Solid Waste Management Plan will be established. Segregation will be done on daily basis. Re-cycling, re-use and recovery will be employed. Solid wastes that do not exhibit the criteria and properties of a hazardous waste are picked up by local accredited haulers of the municipality.

6.1.5 Hazardous Wastes

Hazardous wastes such as used oil, busted lamps, used batteries etc. shall be collected and stored onsite in approved facilities according to DENR standards. Hazardous wastes shall then be removed from the site by approved DENR accredited treatment and storage disposal (TSD`) facilities.

6.1.6 Impacts on People

6.1.6.1 Apprehension of Locals towards the Project during Pre-construction phase

During pre-construction phase, significant impact identified is the apprehension of locals towards project development. This may attribute to the loss of their land, crops and other properties that might possibly be affected by the implementation of the proposed project. Information dissemination in the community about the project through coordination with LGU's, PO's, NGO's, barangay officials and other concerned community groups should be conducted. This program will introduce the proposed project in the area and avert negative perception of people towards the project. It will also serve as an initial step in the formulation of Education and Information and Campaign (EIC) Plan.

6.1.6.2 Influx of Migration

The proposed project will employ a substantial number of workers during the construction phase. The migrant workers will definitely add to the existing population size within the project area, especially so if they bring in members of their family. If these migrant workers take temporary residence in the project area, these will add to the general population size. Some may be transient workers who will opt to commute daily and will therefore impact only on the day-time population size. Whichever case, demand for resources especially food and water at the minimum, and services attendant to these, will increase.

To avoid influx of migration in the area where the Project is located, qualified residents of Barangays that the project will traversed and other neighboring barangays/municipalities/cities near the project area must be given priority in the hiring of construction personnel. This must be coordinated with the LGU and barangay officials.

6.1.6.3 Increase in Business/Economic Activities

The construction work will create a multiple effect where various economic activities will either be created or the existing ones will experience growth. This will lead to the creation of more jobs. In relation to this, disposable income will also increase. The potential for economic opportunity and growth will arise, leading to the generation of more jobs. In effect, a growing cycle of economic growth and employment generation will arise.

The Project's purchases of supplies and materials from local establishments, together with expenditures by project workers typically result in increased business activity and employment in the local trade and service sectors.

6.1.6.4 Displacement of Residents/Loss of Land in the Project Site and Within Its Vicinity

The project will acquire lands and at the same time may affect settlements/properties located along the bridge alignment. This loss of land and properties to give way to project development will affect numbers of settlers/households in the area. Affected people are composed of private owners, tenants and informal settlers. In acquiring the land for project development, a just compensation package based on the fair market value should be implemented. In the case of the tenants, the final agreement should be done between the land

owner and the tenants. Informal settlers on the other hand have a different approach in settling this issue. The involvement of the concerned LGUs in this matter is very essential.

Upon the implementation of the project, a detailed Resettlement Action Plan or RAP will be formulated undertaking 100% inventory of affected people and properties including the compensation scheme. In addition, livelihood programs and trainings should be implemented with those directly affected people.

Formulation of an equitable compensation and acquisition scheme will be designed to ensure that affected people will have a just compensation for the land, crops and other properties that will be affected by the project.

Table 66 presents the Impact Management Plan and enhancement measures in each type of activity.

Table 66. Impact Management Plan

Project Phase	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
I. Pre-Construction Phase	This will be addressed during implementation of RAP as resettlement is expected to be done prior to project implementation or prior to construction.					
	The Land Geology	Ground Shaking: - The proximity of active faults to the proposed road alignment makes it susceptible to moderately strong to strong ground shaking.	• Conduct a site specific Probabilistic Seismic Hazard Assessment (PSHA) to quantify the rate (or probability) of exceeding various ground-motion levels. • Determine the Design Basis earthquake (DBE) and Maximum Credible Earthquake (MCE) to define the Peak Ground Acceleration (PGA) resulting from the movement of specific earthquake generator. • The ground acceleration within the study area is estimated to be 0.21g for bedrock and about 0.60g for soft soils, which should be considered in determining the seismic coefficient during the design of foundation of the proposed road project.	Proponent/ Contractors	Included in the Pre-Construction cost	ECC
II. Construction Phase						
Environmental Aspect # 1	The Land	Change in land use Destabilization of slope Removal of vegetation and habitat disturbance Soil erosion Increase run off	• Set-up temporary fence around the construction area • Conduct slope stability analysis and construct silt trap and spoils disposal area • Ensure solid waste management plan prior to mobilization of project; proper segregation and disposal shall be included in the program; Strictly require contractors and their	Proponent/ Contractors	Included in the Construction cost	ECC

			workers to observe proper waste disposal and sanitation • Cutting Permit will be secured if there are trees that will be affected during construction • Limit land clearing in designated sites only. • Establishment of a small nursery as source of planting materials using the endemic species and fruit-bearing trees found onsite for the replacement of trees to be cut or removed • Gradual clearing and removal of vegetation to provide sufficient time for wildlife species to transfer to the nearby habitat. Planting of naturally-grown species in the designated areas might encourage the wildlife species to return in the future.			
		Traffic congestion Landslide: - The study area has low to moderate susceptibility to landslide	• Preparation and implementation of traffic management scheme • Assess the stability of slope during construction and long-term conditions; • Study the effect of seismic loadings on the slope and road embankment.			
Environmental Aspect # 2	The Water	• Increase in run-off -Generation of domestic wastewater -Generation of wastewater from cleaning of construction	• Site clearing will be limited to areas needed and restricted to acceptable weather conditions • No clearance or establishment works will be undertaken along the riverbanks during high rainfall	Proponent/ Contractors	Included in the operating cost	ECC

		equipment, vehicles and regular watering activities • Contamination of surface water with oil and grease	conditions to reduce the risk of sediment loss to the environment • Set up adequate toilet facilities; ensure sufficient washrooms for workers • Installation of silt traps to contain inflow of muddy waters • Installation of oil traps and proper storage of used oil			
Environmental Aspect # 3	The Air	• Dust generation during clearing of the site • Dust generation associated with movement of vehicles and machinery • Exhaust fumes and noise from vehicles and equipment	• Roads will be watered especially during hot and dry weather. Regular water spraying by water sprinklers (road tank watering) during construction. • Regulate speed of delivery/ hauling trucks • Provide equipment with ear plugs, mufflers and proper scheduling of noise-generating activities especially during day time only	Proponent/ Contractors	Included in the operating cost	ECC
Environmental Aspect # 4	The People	• Increase in livelihood and business opportunities • Increase in revenues • Provide job opportunities for	• Alleviate economy and generation of income to hosts and nearby barangays • Increased LGU revenues resulting from the purchase of locally available materials and equipment for construction, translating to additional taxes. Business establishments should be properly registered and payment of the required taxes shall be monitored. • The construction of the project will generate employment opportunities for local residents as well as migrant workers. It will bring	Proponent	Included in the operating cost	ECC

		construction workers • Health Risk	increased income to those who will be employed. Local manpower may have to compete with migrant labor for employment. Employment of local residents during the construction stage shall be given priority, particularly those from families in the Direct Impact Area. • Use of appropriate PPE and proper training of workers			

Environmental Aspect #5	Solid and Hazardous Wastes	Used oil, paint wastes, scrap metals, busted lamps, and spent fuels	• Ensure a Solid Waste Management Plan to cover proper segregation, waste handling, waste storage and a waste disposal system. • Employ waste management strategies on reduce, re-use and recycle programs - Reduce – Reduction of waste through less packaging by promoting bulk purchasing without packaging; less single-use devices - Reuse – Choose water supply, office supplies that are re-usable, e.g. use printer inks that are refillable - Recycle – Sent cartons, steels and other recyclable materials to recyclers -Waste receptacles/bins shall be provided in strategic locations within the work areas. There shall be an identified designated area for the temporary disposal of domestic and construction wastes -Proper handling, transport and storage of chemicals such as used oil, used batteries, busted lamps etc. must comply with local regulations -Selling of scrap metals and used oil will adhere to local regulations • Safety Data Sheet will be in place • Climate Change Adaptation: - Reduction of greenhouse emissions from energy used in	Proponent/ Operator / Contractors	Included in the Operating cost	ECC

			offices by using green energy power or use of lighting that is environment friendly such as LED lights. - Implementation of rain water harvesting - Recycle office paper, newspapers, beverage containers, electronic equipment and batteries. Reducing, reusing and recycling in the office helps conserve energy, and reduce pollution and greenhouse gases from resource extraction, manufacturing, and disposal. Reduce, reuse, and recycle in the office can be done by using two-sided printing and copying, buying supplies made with recycled content, and recycling used printer cartridges. For old electronics, donate used equipment to other organizations or sold to accredited scrap buyers.			

III. Operation Phase -A positive impact is foreseen which will boost economic development, business opportunities, peace and order, fast travel to other municipalities etc. Expect more productive land use and utilization of local resources. -Noise barrier along residential areas will be installed if necessary to minimize noise generated from vehicle passing.						
IV. Abandonment Phase						
	The Land	• Land degradation • Loss of livelihood	• Preparation and implementation of comprehensive abandonment management plan • Proper clean-up and decontamination of affected site • Proper demolition of temporary construction yard and facilities • Disposal of hazardous waste • Provision of alternative livelihood	Proponent	Included in operating cost	ECC

Section 7

SOCIAL DEVELOPMENT PLAN (SDP), AND INFORMATION, EDUCATION AND COMMUNICATION (IEC)

7.1 STAKEHOLDERS MEETING/PUBLIC PARTICIPATION

A total of 5 stakeholders' meetings were held for SP 8. The first three stakeholders' meetings/ public consultations are the Information, Education and Communication (IEC) based on the Philippine EIA guidelines held in the municipal conference of Parang with the affected stakeholders, barangay and municipal officials, and concerned LGU offices such as Assessors, MPDC as shown in **Table 67**. These meetings were attended by a total of 141 participants (male – 66 and female – 7).

The major opinions of the participants are the rerouting of the proposed sub-project 8, the process of compensation of the affected landowners, determination of amount of the affected land and properties, and land under military camp. All questions, comments and suggestions are answered by DPWH ARMM, JICA Cotabato, RAP, and EIA Study team as shown in **Table 68** and summarized below.

1st Public Consultation

a. What will happen to the landowner without land titles and proof of ownership;
b. What will happen to the land under military reservation;
c. Realignment of proposed road to avoid the Muslim Cemetery and less affected households;
d. Road alignment should consider the PWD with signage;
e. Final alignment of proposed road;
f. Who will compensate the affected land, crops, and other structures;
g. What will happen to the household that depends their income to the affected land and crops;
h. What happen to the affected land, properties, tress and fruit bearings; and
i. Necessary documents for claims and compensations.

2nd Public Consultation

a. Realignment to lessen the affected people
b. Prioritization of local hire

During the 1st public consultations, the women emphasized the importance of proper compensation for the affected landowners and livelihood programs for extra income such as selling of food and drinks. As stated earlier, two group of consultations were conducted.

Overall, the proposed sub-project No.8 is socially acceptable based on the responses and feedbacks of the stakeholders. They are willing to negotiated and compensated, and suggested to implement the project early from schedule.

The EIA team conducted the 2nd public consultation held on February 27, 2018, 1:00 pm to 4:00 pm in the municipality affected by the proposed road sections. Basic information such as date/time/venue, barangays included and participant compositions were captured, and typical question and answer, were recorded during the said consultation. It was attended by 45 Males and 13 Females from LGUs & Brgy officials, landowners, possible PAP, farmers, etc.

The participants were introduced by Ms. Anne Leah Pilayre while the overview on the conduct of the public consultation and target objectives/outcomes of the Environmental Impact Assessment (EIA) were presented by Mr. Ricardo Capule, Mr. Randy Hugo and Mr. Abelardo Angadol.

Table 67. CONTENTS OF STAKEHOLDER MEETING MUNICIPAL LEVEL

Date (venues)	Objectives of the meeting	Major Agenda	Participants	No. of Participants
Dec. 7, 2017 1. Parang Municipal Conference Room	Information Education and Communication (IEC) in accordance with Philippines EIA Guidelines	1. Inform and generate awareness and understanding of the concerned public about the project; 2. Provide the stakeholders and avenue to ventilate salient issues and concerns regarding the project; 3. Give an opportunity to the stakeholders to have an open discussion with the Preparers, Proponents and LGU about the project; 4. Educate the stakeholders of their rights and privileges; and 5. Enable the stakeholders to effectively participate and make informed and guided decisions.	Municipal Officials, Project-Affected Persons (PAPs) and Barangay Officials, DPWH, RAP and JICA Study Team	Parang Male – 66 Female – 8
February 27, 2018 1. Parang Municipal Conference Room	Information Education and Communication (IEC) in accordance with Philippines EIA Guidelines	To present and validate the results of environmental impact assessment	Municipal Officials, Project-Affected Persons (PAPs) and Barangay Officials, DPWH, and JICA Study Team	Parang Male 45, Female-13

Table 68. MAJOR OPINIONS IN STAKEHOLDER MEETINGS MUNICIPAL LEVEL

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
Dec. 7, 2017 Information Education and Communication (IEC) in accordance with Philippines EIA Guidelines	1. Introduce the project and discuss the project objectives and the benefits that can be derived. 2. EIA and RAP Process 3. Tentative Schedules 4. Solicit queries, comments, concerns and suggestions on the project	Land	Properties	1. (Parang) Are the trees also included in the compensation? Is the fruit-bearing trees included to be paid or compensated?	1. Yes, they will be compensated as long as included in the inventory or during cut offs. All trees that will be affected with the project will be paid or compensated especially the fruit-bearing trees. DPWH will pay the trees based on their guidelines. It depends on the size, and height of the trees.
			Land Use	2. (Parang) What will happen to the land under military reservation?	2. The alignment of the project is not yet final. We will provide a copy of the results of the inventory per Barangay level for their information and confirmation.

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
		Socio/The People	Properties	3. (Parang) What will happen to land owners without land title?	3. Based on the discussion with JICA during our meeting in Manila last November 2017, DPWH will compensate the affected land owners. However, in the absence of land/lot title and other supporting documents, DPWH will review and validate whatever just and fair to affected people. Land owners should secure proper documents. We strictly follow the guidelines of DPWH.
				4. (Parang) What are the needed documents for claims?	4. You need to secure certificate of land title or tax declaration.
				5. (Parang) Who will pay for all the structures like houses that will be affected by the project?	5. DPWH will be the implementing agency and will pay the acquisition of all affected land, structures

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
					after the inventory of RAP team.
			Livelihood	6. (Parang) What will happen to our families if almost all of the land area will be acquired? How can the project help us if we lose our property and livelihood?	6. DPWH along with the LGU will negotiate and help those who will be affected.
			Infrastructure (Alignment)	7. (Parang) Can we request that the alignment avoid the cemetery of Muslim?	7. We will always considered and respect the heritage area for the benefit of the culture of the affected community. We need your cooperation during the survey in your community. Please provide us the right information so that we will not encounter any problem during the project implementation.
				8. (Parang) Affected people/areas are requesting for the possibility to move the alignment to avoid them or move to an area where there will be less affected.	8. We will request to the proponent to provide the affected community the final road alignment.

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
				9. (Parang) Is there any way to realign the road to another area?	9. For now this is a proposed or under the feasibility study stage. There are proposed alternatives and best alignment. This consultation meeting is part of the study to discuss or confirm you if you are in favor on the proposed project. We need this road for easier access and to avoid traffic.
				10. (Parang) Where is the exact alignment of the project?	10. There are alternative options for the road alignment. The presented alignment is the feasible and will be finalized after the RAP inventory.

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
			Vulnerable People	11. (Parang) What is the design of the road? Is it accessible to all, with signage and Person With Disability (PWD) friendly?	11. The road will follow the design road guidelines of DPWH. It includes the signage and pedestrians especially for schools. We will always considered the needs of our PWD but there always a limitations.
February 27, 2018 Information Education and Communication (IEC) in accordance with Philippines EIA Guidelines	To present and validate the results of environmental impact assessment	Land	Crops/Trees	1. (Parang) Requested to hire the community on cutting the trees affected	1. This depends to DENR. They have processes regarding tree cutting but we will take note for consideration.
		Socio/The People	Infrastructures (Alignment)	2. (Parang) Requested that the diversion road in Making going to Macasandag can be transferred or realigned to upper side because original alignment will affect more people and structures	2. The team stated that their concerns and requests were noted and informed them that this will be recommended to the proponent

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (DPWH, RAP, and JICA Survey Team's answers has been accepted and understood basically)
				3. (Parang) Requested for the realignment of the road project. If possible to realign from Sitio Nabunturan, Making to Brgy. Gumagadong Calawag.	3. The team stated that their concerns and requests were noted and informed them that this will be recommended to the proponent. The team advised them to provide a resolution signed by the Brgy officials and Municipal Mayor

Pictures and attendance sheets are hereto attached in Annex 13.6.1

7.2 SOCIAL DEVELOPMENT PLAN AND IEC FRAMEWORK IMPLEMENTATION

The indicative Social Development Framework (SDF) of the project is aligned with the Proponent's vision to support the affected barangays and the local government units so as to help improve the economic status and quality of life of its constituents.

The construction, operation and management of the road network project shall comply with both local and International standards on safety and environmental regulations.

The indicative SDF of the company is anchored and aligned with the Host Barangays' framework for social development. It is the company vision to support the community by complementing barangay efforts and resources in improving the delivery of services to its residents.

7.2.1 Social Development Plan

7.2.1.1 Objective

The purpose of the SDF is to identify the doable supports of the Project to the Host Barangays subject to the company's policy on community services and according to the priorities within the Project's vicinity. It shall cover the construction, operation and abandonment phase of the project.

Below is a summary of DPWH's community relations and development programs. **Table 69** details the SDMP Plan/Framework pursuant to DENR AO 2003-30.

7.2.1.2 Programs

a] Information Education Campaigns
b] Community Development Projects and Community Relations Programs
c] Health
d] Donations
e] Baseline study

Table 69. Cost Estimates for SDMP Framework

Item	*Amount (PhP)*
Municipality & Barangay Development Funds	3,000,000.00
Medical Mission, Health Programs, Clinic	1,000,000.00
Infrastructure (community projects)	2,000,000.00
Livelihood Programs (farming, etc.)	1,000,000.00
Socio-cultural, Clean & Green Activities	500,000.00
Donations	500,000.00
TOTAL	8,000,000.00

7.2.1.3 Project/Activity Implementation

To ensure that it meets, and wherever possible, surpasses its legal, environmental and social obligations, DPWH will observe the following corporate policies:

a] Sustainability policy
b] Environment policy
c] Community relations policy

DPWH Management will actively work with the local community and the Local Government Units (LGUs) to establish formal policies, systems and procedures for managing the SDMP programs, projects and activities. Projects are typically generated through a Memorandum of Agreement (MOA), such as the Community MOA wherein programs to promote local social development shall include, among others
a] Human resource development and institution building
b] Enterprise development and networking.

Each project/program will be submitted to DPWH for approval as part of detailed annual barangay development plan and implemented through a monthly program. DPWH will monitor the progress/projects on a daily and weekly basis. The community and the Local Government Units (LGUs) are responsible for implementing the programs/projects with DPWH support.

The MOA will stipulate that a minimum of 80% of the funds to be provided are used on the project/program and that only not more than 20% may be used for administration. No funds are to be used for honoraria to community members unless they hold a working position in implementing the program/project.

7.2.1.4 Monitoring of Programs / Projects / Activities

Key Performance Indicators

DPWH will require each program/project to agree or comply with a series of Key Performance Indicators (KPIs) prior to inception of each program. These indicators will be used to establish agreed points of success, goals or milestones throughout each program. This will ensure that each program/project has clearly identified goals and targets and that money spent will be well directed.

Table 70 presents the summary of DPWH's SDF plans and framework.

Table 70. Social Development Plan (SDP) /Framework for Road Network Development Project

Concern	Responsible /Community Member/Beneficiary	Government Agency/NGO/and Services	Proponent	Indicative Timeline	Source of Fund
1. Relocation Land Purchase/ Resettlement	1. Barangay Chairman 2. Project's affected tenants 3. Land Owner	*LGU Municipal Assessor based on cadastral surveys *Municipal Planning and Development Office *DSWD *DPWH (facilitating demolition of structures and transfer of affected families)	DPWH through Property Owner Community Relations Officer; Resettlement Specialist	Pre-construction	DPWH
2. Gender, Responsive Livelihood / Employment for Men, Women, Youth & the Elderly livelihood skills a] High-value crops for farmers b] Employment - Job priority skills training for qualified workers	1. Association Chairperson 2. Qualified Project affected men, women, youth and elderly	1. LGU Municipality Planning Office 2. LGU Municipality Social Welfare & Dev. Office TESDA/TLRC - Various skills training courses DA/BFAR ▪ Technical training farming methods	Community Relations Officer (CRO)	Operation	LGU / DPWH (according to the budget in table 7.1)
3. Health and Safety a] Improvement/ Renovation of Brgy. Health Center	1. Barangay Kagawad for Health 2. Project's affected community	1. Municipal Health Officer 2. Barangay Disaster Management Committee	Community Relations Officer (CRO)	Operation	LGU/ DPWH (according to the budget in table)

b] Health services c] Potable water (bio-sand filter project) d] Supplemental feeding program for malnourished children e] Assistance to senior citizens and persons with disability					
4. Education & Recreation	1. Barangay Kagawad for Education/SK; Barangay PTA 2. Project affected families	Department of Education ▪ Scholarship program for qualified students ▪ Literacy programs & non-formal education programs Municipal Engineer's Office ▪ Identification of appropriate project site, design, provide funding support, organize & implement related educational and recreation activities	Community Relations Officer (CRO)	Construction Operation	LGU/ DPWH NGAs NGOs/ POs (according to the budget in table)
5. Environment & Sanitation ▪ Brgy. Solid Waste Management Plan ▪ Bio-sand water filters	1. Barangay Kagawad for Environment 2. Project's affected community	MENRO ENRO /MHO 1. Formulate training in SWM 2. Reforestation (tree planting) 3. Establishment of forest nurseries 4. Environmental monitoring 5. Health programs 6. Provide bio-sand water filters CHO and/or DOH	Community Relations Officer (CRO)	Pre-construction Construction Operation	LGU/ DPWH/ NGAs/ NGOs/ POs (according to the budget in table)

6. Peace & Order	1. Barangay Kagawad for Peace & Order 2. Project's affected community	LGU PNP - Capacity-building & strengthening of barangay tanods in peacekeeping - Maintenance of peace and order and respond to security concerns	Chief Security Officer	Pre-construction Construction Operation	LGU/ DPWH (according to the budget in table)
7. Spiritual	Barangay Assigned Catholic priest, or pastor of different denomination	Parish Priest for Catholics or Pastor for Non-Catholics and Non-Muslims	Community Relations Officer (CRO)	Construction Operation	LGU/ DPWH (according to the budget in table)
8. Infrastructure	*LGU: City and Barangays * Barangay Kagawad for Infrastructure * MPDO	* DPWH/ Municipal Engineer's Office * MPDO * LGU: Municipal and Barangays * Repair/Improvement /Expansion of Barangay Road	Community Relations Officer (CRO)	Pre-construction Construction Operation	LGU/ DPWH (according to the budget in table)

7.3 INFORMATION, EDUCATION AND COMMUNICATION PLAN FRAMEWORK

The Information, Education, and Communication Plan of DPWH shall focus on the Project's information dissemination, predicted impacts of activities to the environment particularly to the people and their inherent resources, the benefits that the community and the people may derive, and the cost and benefit analysis of the operations with regards to environmental protection, and the future of the community after the abandonment of the project.

The proposed IEC will include public consultations which will allow DPWH to report on its environmental performance and at the same time solicit feedback and suggestions from community members on how to improve and enhance its environmental protection and enhancement activities. **Table 71** describes the IEC Plan/Framework of the company.

Table 71. IEC Plan/Framework of DPWH

Target Sector Identified as Needing Project IEC	Major Topic/s of Concern in relation to Project	IEC Scheme/ Strategy/ Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
1. Directly and indirectly affected population: LGUs with focus on Barangays affected	-The EIA process -The construction of the project The renumeration for identified land areas to be used by the project -The consequential impacts on the residents of the community 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 IEC Proposed Corporate Social Responsibility Programs and Projects such as farming, skills and other livelihood trainings, terrestrial protection and management	-Barangay Assemblies -FGD -Public consultations; -Information desk -Community meetings	1 Illustrative Primer/ Brochure (pictograms) about the Project - The EIA's process illustrated and simplified in the language of the affected community This includes ▪ The project description ▪ A graphic illustration about the operation and the mitigating measures ▪ Major process activities, the structural, supporting and non-structural measures for the successful implementation of the project; ▪ Location map indicating the exact location of the major activities ▪ Frequently Asked Questions (FAQs) about the project; the identified impacts and mitigations; health and safety measures related to construction and operation of the project and correct behavior in relation to the Project ▪ The residents who will be affected by the Project's activities showing their right to complain for violations of ECC conditions	-Prior to start of project construction -Continuing Regularly or as needed; at least on an annual basis	The cost includes meals, venue, IEC materials, transport, design, layout, printing cost salaries, honoraria etc. Project cost is estimated at **PhP 1,000,000 per annum**

			a] Group discussions for the identified tenants regarding their rights and responsibilities in relation to land purchase c/o the land owner and prior to land acquisition b] Group discussions with sectorial groups which will be affected with the activities, the legal processes with the application of priority job placement, and other benefits 2. Workshops to cover the preparation of IEC materials and campaigns		
			3. Posters and pictograms on EIA in local language		

Section 8

ENVIRONMENTAL MONITORING PLAN

8.0 Environmental Monitoring Plan (EMoP)

The Environmental Compliance Monitoring Plan is prepared to ensure the company's compliance to environmental regulations, thereby minimizing adverse effects of the Project to its immediate surroundings and protecting the health of the affected public.

The proposed Environmental Monitoring Plan with Environmental Quality Performance Levels (EQPLs) is shown **in Table 72** using the recommended format in Annex 2-20 of RPM DAO 2003-30. However, this will be finalized once the ECC has been issued.

Objectives:

1. Ensure that all emissions, effluent and other wastes generated as a result of the Flood Mitigation Project are in accordance with DENR Rules and Regulations which include, but is not limited to, Presidential Decree 1586 (the *Philippine Environmental Impact Statement System*), Republic Act 8749 (*Clean Air Act*), RA 9275 (*Clean Water Act*), RA 9003 (*Ecological Solid Waste Management Act*), RA 6969 (*Philippine Chemical & Chemical Substances and Hazardous & Nuclear Waste Control Act*), PD 984 (*Pollution Control Act*)
2. Define monitoring mechanisms and identify monitoring parameters
3. Validate the changes in the various environmental media as discussed in the Impact Assessment Plan
4. Provide mitigation measures and performance levels
5. Provide early warning on any unacceptable environmental conditions.

8.1 ECC Compliance Reporting

After the issuance of the ECC, the company through its Pollution Control Officer will ensure that regular reporting of compliance to DENR standards and other regulatory industries will be undertaken. The Self-Monitoring Reports (SMR) detailing status of compliance with ECC and other environmental regulation shall be submitted quarterly to DENR-ARMM.

Table 72. – Environmental Monitoring Plan (EMoP) with Environmental Quality Performance Levels (EQPLs)

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost (PhP)	EQPL MANAGEMENT SCHEME					
								EQPL Range			Mgt. Measures		
			METHOD	FREQUENCY	LOCATION			Alert	Action	Limit	Alert	Action	Limit
CONSTRUCTION PHASE													
Environmental Aspect	Fresh Surface Water Quality Stations: Major tributaries	Surface Water Total Suspended Solids (TSS), pH, BOD, DO, Oil & Grease, Color, turbidity	Grab Sampling RA 9275	Quarterly	Upstream; midstream and downstream -	PCO	50,000	Siltation Surface Water: TSS- 75 mg/L pH: 6.4-8.9 BOD:6.5mg/L DO: 4.9 mg/L Oil & Grease: 1.9 mg/L Color: 70 TCU	Siltation Surface Water: TSS- 80 mg/L pH:6.5-9.0 BOD: 7 mg/L DO: ≥5.0 mg/L O/G: 2.0 mg/L Color: 75 TCU; no standard for turbidity	DAO 2016-08 Class C TSS: 80mg/L pH: 6.5-9.0 BOD: 7 mg/L DO: ≥5.0 mg/L O/G: 2.0 mg/L Color: 75 TCU; no standard for turbidity			RA 9275/ DAO 2016-08
	Riverbed Sediments	-Heavy metals (As, Ba, Cd, Cr, Cu, Pb, Hg,Se,F),	RA 6969	Semi-annual	Same stations with fresh surface water quality								RA 6969
	Air Quality Proposed site locations Upwind, downwind	Total Suspended Particulates (TSP)	1-hr Sampling per RA 8749	Monthly	Upwind; downwind; NSEW direction	PCO	250,000	Fugitive dust		RA 8749		Regular sprinkling activities	RA 8749
	Noise Quality Same as Air Stns (preferably with many receptors)	Ambient Noise (especially during drilling activities)	Grab sampling	Monthly/ Weekly during drilling	Upwind; downwind; NSEW direction	PCO	150,000	Intermittent noise		NPCC 1978		Ear plugs/ ear muffs as necessary	NPCC 1978
	Solid Wastes	Construction debris, papers, plastics, biodegradable wastes		Daily	Construction site / SW storage area	PCO	600,000			RA 9003			RA 9003

	Wastewater (domestic)	TSS, BOD, pH, Oil & Grease (canteen)	Grab Sampling RA 9275	As necessary	Common septic tanks for toilets & canteens	PCO	25,000	Wastewater from toilets, washings		RA 9275		Ensure portalets & septic tanks are in placed	RA 9275
	Chemicals & Hazardous Wastes	Used oil, busted lamps Used paints, spent solvents	Individual segregation & collection		Storage Area/ Motorpool	PCO		Oil spills		RA 6969		Instigate measures per regulatory requirement	RA 6969
	Socio-economic	Displacement of informal settlers; relocation Recruitment/hiring for manual labor & other skills available within the Host Barangay & nearby communities			Project location	CRO						Relocation Job opportuni-ties	
	Terrestrial Flora & fauna Impacts	Flora- species dominance within quadrants in terms of total cover, relative ground cover, absolute density, absolute frequency, relative density and relative frequency of individual species Fauna – species diversity index, dominance index, and evenness index Soil Nutrients, Plant Tissue Nutrients	Line transect/ quadrat / trap	Annual	Within project vicinity and its affected barangays	PCO	200,000 (as necessary)						Other applic able local & interna tional standa rds

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost (PhP)	EQPL MANAGEMENT SCHEME					
			METHOD	FREQUENCY	LOCATION			EQPL Range			Mgt. Measures		
								Alert	Action	Limit	Alert	Action	Limit
OPERATION PHASE During this phase, environmental monitoring in air, water, noise and other compartments of the environment may not be applicable. The LGU should ensure the environmental monitoring is in placed in their EMP program.													
DECOMMISSIONING/ABANDONMENT PHASE (IMMEDIATE AFTER CONSTRUCTION)													
Environmental Aspect	Land Clearing of construction debris; removal of construction equipment	-Heavy metals (As, Ba, Cd, Cr, Cu, Pb, Hg,Se,F)	Systematic sampling: Several Grab and composite Sampling	As prescribed	Contaminated sites (if any)	PCO	500,000	TCLP Metals: As, 0.8 ppm Ba, 65 ppm Cd, 0.2 ppm Cr, 4 ppm Pb, 0.8 ppm Hg, 0.08 ppm Se, 0.08 ppm F, 95 ppm	TCLP Metals: As, 1 ppm Ba, 70ppm Cd, 0.3 ppm Cr, 5 ppm Pb, 1 ppm Hg, 1 ppm Se, 1 ppm F, 100 ppm	TCLP Metals: As, >1 ppm Ba,>70ppm Cd,>0.3ppm Cr, >5 ppm Pb, >1 ppm Hg,>0.1 ppm Se, >1 ppm F,>100ppm		Reme-diate/ clean up the contami-nated area	RA 6969

Section 9

EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

9.0 Emergency Response Policy and Generic Guidelines

9.1 Contingency/Emergency Response Plan

DPWH/Contractor will prepare an Emergency Response and Disaster Plan which describes programs and actions in response to various major events such as disasters and catastrophes like earthquakes, flash floods, fires, explosion regardless of cause and landslides.

The Emergency Response & Disaster Plan describes policies, the members of the response team, its roles and responsibilities, operating procedures, personnel safety, property protection, sampling and monitoring. Audit and inspection reports are included in the plan. Trainings on emergency response and safety are programmed annually. Identification of risk assessment in case of natural disaster is also planned.

An environmentally-sound and safe workplace is ensured by supporting the education of staff and supporting healthy implementation of safety management practices. A Safety & Health Program in accordance with existing occupational safety rules and regulations will be formulated and strictly enforced among all workers. Safety Officers and Engineers will be appointed during construction and decommissioning/abandonment phases to oversee and implement the programs. Periodic monitoring and inspection is conducted; reports of incidents and accidents are communicated and reported to the Administration for appropriate action.

9.2 CONSTRUCTION PHASE

DPWH will make sure that all contractors have an approved Construction Safety & Health Program (CSHP) by the Bureau of Working Conditions (BWC) of the Department of Labor & Employment (DOLE).

The following are the important components of the CSHP applicable to the proposed Project:

9.2.1 Company Safety and Health Policy

A company Safety Policy will be formulated to serve as the guiding principle in the implementation of safety and health programs onsite. The policy shall be signed by the highest company official or his duly authorized representative and should include the Contractor's policies on occupational safety, worker's welfare, and health and environment.

The Safety Policy will include the commitment of the General Planner and the Contractor(s) to comply with the DOLE's minimum safety requirements, reporting requirements under Occupational Health & Safety Standards (OSHS) regulations and other relevant DOLE issuances. These are:

a] Registration (Rule 1020 and D.O. 18-02)
b] Report of Safety Committee Organization (Rule 1040)
c] Notification of Accidents and Occupational Illnesses (Rule 1050)
d] Annual Work Accident/Illness Exposure Data Report (Rule 1050)
e] Annual Medical Report (Rule 1060)

9.2.2 Specific Construction Safety & Health Program

The General Planner as well as every contractor shall be required to submit its Construction Safety & Health Program. The company shall likewise institute its own Construction Safety & Health Program.

9.2.3 Construction Safety and Health Committee

The structure and membership is consistent with the requirements of Section 11 of D.O. 13, series of 1998.

9.2.4 Safety and Health Personnel

Requirements for personnel in charge of health and safety shall be complied with, as follows:

a] First Aid personnel should be certified by the Philippine National Red Cross (PNRC) with valid PNRC ID Card
b] Safety Officer must complete the 40-hour BWC prescribed safety and health course as required by Rule 1030 of the OSHS, as amended by D.O. 16. Safety officer shall be accredited by the BWC pursuant to D.O. 16
c] External physicians and nurses must complete the BWC-DOLE prescribed Occupational Safety & Health Course pursuant to Rule 1060 of the OSHS.

9.2.5 Specific Duties and Responsibilities of the Safety Officer

Specific duties and responsibilities shall be as outlined in Rule 1047 of OSHS.

9.2.6 Applicable In-house Safety & Health Promotion and Continuing Information Dissemination

a] Information dissemination or advisories to new employees prior to on-site assignment, e.g. orientation on Company Health &Safety policies and measures, hazards related to the job, and safe work procedures

b] Continuing education program, such as first aid training and its refresher course, refresher course on toolbox handling, construction safety training

c] Activities to convey information on safety and health IEC materials such as posters, pictograms, flyers, safety signage, handbooks, manuals, and bulletin boards

d] Arrangements for setting up of committees on safety and health if necessary

e] Schedule of safety-related activities, e.g. toolbox meeting, Health & Safety committee meeting.

9.2.7 Accident & Incident Investigation, Recording & Reporting

a] Investigation and Recording of all Accidents & Incidents
b] Notification to the appropriate DOLE Regional Office within 24 hours in case of fatal accidents.

9.2.8 Provisions for the Protection of the General Public within the Vicinity of the Company's Premises during Construction and Demolition.

Measures to ensure the safety of the general public, according to appropriate Provisions and Rules of the OSHS shall be strictly observed, as follows:

a] Rule 1412.09 Protection of the Public
b] Rule 1412.12 Protection against Collapse Structure
c] Rule 1412.16 Traffic Control

d] Rule 1413 Excavation
e] Rule 1060 Premises of Establishments
f] DO 13 Sec. 9 Construction Safety

9.2.9 General Safety within Construction Premises

Danger signs, barricades, safety instructions for workers, employees, general public and visitors shall be provided for such as housekeeping, walkway surfaces, means of access i.e. stairs, ramps, floor openings, elevated walkways, runways and platforms and lighting.

9.2.10 Environmental Control (Rule of 1070 of the OSHS)

The following shall be faithfully complied with:

a] Monitoring and control of hazardous noise, vibration and airborne contaminants such as gases, fumes, mists and vapors.
b] Provisions to comply with minimum requirements for lighting, ventilation and air movement.

9.2.11 Guarding of Hazardous Machinery (Rule 1200 of the OSHS)

The following shall be strictly observed:

a] Provision for installation/ design of built-in machine guards
b] Provision for built-in safety in case of machine failure
c] Provisions for guarding of exposed walkways, access ways, and working platforms.

9.2.12 Provision for Use of Personal Protective Equipment (PPE) (Rule 1080 of the OSHS)

a] Appropriate types and duly-tested PPEs shall be used by workers after the required training on their use
b] Provision for maintenance, inspection and replacement of PPEs.

The basic PPE required for all types of construction projects are helmets, safety shoes and working gloves. Other PPEs shall be required depending on the type of work and hazards.

9.2.13 General Materials Handling &Storage Procedures (Rule 1150 of OSHS)

This will include, but will not be limited to:

a] Safe use of mechanical materials handling equipment
b] Secure and safe storage facilities
c] Regular housekeeping
d] Clearly-marked clearance limits
e] Proper area guarding of storage facilities.

9.2.14 Installation, Use and Dismantling of Hoist and Elevators (Rule 1415.10**of OSHS**)

a] Testing and Examination of Lifting Appliances shall be complied with, in accordance with Rule 1220 on Elevators and Related Equipment.

b] Provisions to ensure safe installation, use and dismantling of hoists and elevators, including periodic inspection of hoists and elevators.

9.2.15 Testing and Inspection of Electrical and Mechanical Facilities and Equipment.

The following rules of the OSHS apply and be strictly observed:

a] Rule 1210 Electrical Safety
b] Rule 1220 Elevators and Related Equipment
c] Rule 1410 Construction Safety
d] Rule 1415.10 Training and Examination of Lifting Appliances.

9.2.16 Worker Skills and Certification

a] Provisions to ensure that workers are qualified to perform the work safely
b] Provisions to ensure that only qualified operators are authorized to use and operate electrical and mechanical equipment.

9.2.17 Provisions for Emergency Facilities for Workers

Rule 1963.02 of OSHS-Emergency Medical Services Applies

9.2.18 Fire Protection Facilities and Equipment

a] Fire Protection facilities and equipment as required under Rule 1940 of the OSHS shall be provided.
b] Proposed structure and membership of cooperation with fire brigade shall be determined
c] Provision for training on emergency preparedness.

9.2.19 First Aid and Healthcare Medicines, Equipment and Facilities

a] Identification of the proposed first aid and healthcare facilities that the Contractor will provide to meet the minimum requirements of OSHS

b] Identification of the medical and health supplies such as medicines and equipment to be provided

c] Mandatory provision of first aid medicines and emergency treatment.

In the absence of the required onsite healthcare facilities, the company shall attach a copy of a written contract with a recognized emergency health provider as required under OSHS.

9.2.20 Workers Welfare Facilities

a] Provision for toilet and sanitary facilities
b] Provision of shower and washing facilities
c] Provision to supply food and meals (optional)
d] Provision of potable water for drinking and washing
e] Provision of locker rooms, storing and changing of clothes for workers.

9.2.21 Proposed Hours of Work and Rest Breaks

a] Work schedules, working hours, shifting schedules shall be specified
b] Frequency and length of meals and breaks shall likewise be allotted
c] Schedule of rest periods shall also be provided.

9.2.22 Waste Disposal

Method of waste management will be provided in accordance with government-mandated laws and regulations.

9.2.23 Disaster & Emergency Preparedness Contingency

Guidelines for the following will be prepared:

a] Emergency preparedness and response on vehicular or site- road accidents
b] Response to bomb threats
c] Preparedness and response for severe weather conditions
d] Preparedness and response to fire and explosion
e] Preparedness and response to earthquake, tsunami, and storm surge
f] Oil spill contingency
g] Preparedness and response for accidents in workplace.

9.2.24 Safety Program

Specific standard work procedures should be provided for the following activities:

a] Site Clearing
b] Excavation
c] Use, erection and dismantling of scaffoldings and other temporary working platforms
d] Temporary electrical connections/installations
e] Work at unprotected elevated working platforms or surfaces
f] Use of power tools and equipment
g] Gas and electric welding and cutting operations
h] Working in confined spaces
i] Use of hand tools
j] Use of mechanized lifting appliances for movement of materials
k] Use of construction heavy equipment.

9.3 HEALTH AND SAFETY AND ENVIRONMENTAL PLANNING

An HSE Meeting shall be held at least once a month.

A Health & Safety Plan shall be prepared to cover Construction and Operation phases. The plan shall be based on Health Safety & Environmental (HSE) Guidance Notes. These documents collectively describe the arrangements for securing the health and safety of everyone carrying out the work and others that may be affected by it.
The health and safety plan (HSP) shall be regularly reviewed and periodically updated.

The following list the HSP contents but shall not be limited to these scopes:

HEALTH AND SAFETY PLAN CONTENTS

9.3.1 Management
9.3.2 Standard Setting

9.3.3 Occupational health and environmental control
9.3.3.1 Physical Hazards
9.3.3.1.1 Ventilation
9.3.3.1.2 Occupational Noise Exposure

9.3.3.2 Chemical Hazards
9.3.3.3 Biological Hazards

9.3.4 Hazardous Materials
9.3.4.1 Gases
9.3.4.2 Flammable Liquids and Combustible Materials
9.3.4.3 Solvents
9.3.4.4 Process Safety Management of Highly Hazardous Chemicals

9.3.5 Toxic and Hazardous Substances
9.3.6 Air Contaminants
9.3.7 Personal Protective Equipment
9.3.8 Hazard Communication
9.3.9 Hazardous Waste Operations and Emergency Response Procedures
9.3.10 Materials Handling and Storage
9.3.11 Medical and First Aid
9.3.12 Fire Protection
9.3.13 Electrical Safety
9.3.14 Mechanical and Machineries Safety
9.3.15 Training
9.3.16 Welfare
9.3.17 Information and Training for People Onsite
9.3.18 Consultation with People Onsite
9.3.19 Site Rules
9.3.20 Reporting of Accident Information
9.3.21 Safety Audit
9.3.22 Health and Safety Records
9.3.23 Information for Sub-contractors
9.3.24 Arrangements for Monitoring.

9.4 INFORMATION FOR SUBCONTRACTORS

Prior to commencing work on site, this is to describe in the first and third paragraphs on Management:

a] Post Commencement on Site

Safety induction training will be given to all personnel entering the site. This induction training will inform the subcontractor(s) and their personnel of specific safety risks and hazards onsite. It will also inform them of site procedures and dress code, personal protective equipment (PPE) requirements, as well as welfare and first aid arrangements and emergency procedures.

b] Instruction regarding health and safety that require direct/ immediate action will be conveyed verbally, followed up by instructions in writing when applicable.

c] Toolbox talks will be given.

Any design information that is revised will be issued to the Subcontractor(s) using standard proformas from the company management system or others as applicable. Any procedural changes or revision to the Health & Safety Plan will be issued in writing.

d] Contractors will be informed about risks to their health and safety at regular subcontractor safety meetings.

9.5 HEALTH, SAFETY AND ENVIRONMENT PROCEDURES

DPWH shall develop and implement a written Safety & Health Program for its employees involved in operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response during operations.

The written Safety & Health Program shall incorporate the following:

9.5.1 An Organizational Structure

The organizational structure part of the Safety & Health Program shall establish the specific chain of command and the overall responsibilities of supervisors and employees. It shall include, at a minimum, the following elements:

a] A General Supervisor who has the responsibility and authority to direct all process operations.
b] A Site Safety and Health Supervisor with the responsibility and authority to develop and implement the site Safety & Health Plan and verify compliance
c] All other personnel needed for process operations and emergency response and their general functions and responsibilities
d] The lines of authority, responsibility, and communication

The organizational structure shall be reviewed and updated as necessary to reflect the current status of operations.

9.5.2 A Comprehensive Work Plan

The comprehensive work plan part of the Safety & Health Plan shall

a] Address the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives

b] Address anticipated clean-up activities as well as normal operating procedures which need not repeat the employer's procedures available elsewhere

c] Define work tasks and objectives and identify the methods for accomplishing those tasks and objectives

d] Establish personnel requirements for implementing the plan
e] Provide for the implementation of the training
f] Provide for the implementation of the required informational programs
g] Provide for the implementation of the medical surveillance program.

A site-specific Safety & Health Plan shall also be designed, which need not repeat the employer's standard operating procedures and Safety & Health Training Program;

Program Availability

The written Safety & Health Program shall be made available to any contractor or subcontractor or their representative who will be involved with process operations, to employees, to employee-designated representatives, and to regulatory agencies.

The site Safety & Health Program, which must be kept onsite, shall address the safety and health hazards of each phase of operation and include the requirements and procedures for employee protection.

The site Safety & Health Plan, as a minimum, shall address the following:

a] A safety and health risk or hazard analysis for each site task and operation found in the work plan
b] Employee training assignments to assure compliance
c] Personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment (PPE)
d] Medical surveillance requirements in accordance with the program
e] Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.
f] Site control measures in accordance with the site control program
g] Decontamination procedures
h] An Emergency Response Plan Meeting for safe and effective responses to emergencies, including the necessary PPE and other equipment
i] Confined Space entry procedures
j] A spill containment program meeting.

9.5.2.1 Pre-entry Briefing

The site-specific Safety & Health Plan shall provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the site Safety & Health Plan and that this plan is being followed. The information and data obtained from site characterization and analysis work shall be used to prepare and update the site Safety & Health Plan.

9.5.2.2 Effectiveness of Site Safety & Health Plan

Inspections shall be conducted by the site Safety & Health Supervisor or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health, acting on behalf of the Employer as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site Safety & Health Plan shall be corrected by the employer.

9.5.2.3 Site Characterization and Analysis

Operations shall be evaluated in accordance with local regulations to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.

9.5.2.4 Preliminary Evaluation

A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a qualified person in order to aid in the selection of appropriate employee protection methods. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a qualified person in order to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

9.5.2.5 Hazard Identification

All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that may cause death or serious harm shall be identified during the preliminary survey and evaluated during the detailed survey.

Examples of such hazards include, but are not limited to: confined space entry, potentially explosive or flammable situations, visible vapor clouds or areas where biological indicators such as dead animals or vegetation are located.

The following information, to the extent available, shall be obtained by the employer prior to allowing employees to enter a site:

a] Location and approximate size of the site.
b] Description of the response activity and/or the job/task to be performed
c] Duration of the planned employee activity
d] Site topography and accessibility by air and roads
e] Safety and health hazards expected at the site
f] Pathways for hazardous substance dispersion
g] Present status and capabilities of emergency response teams that would provide assistance to onsite employees at the time of an emergency
h] Hazardous substances and health hazards involved or expected at the site and their chemical and physical properties.

9.5.2.6 Personal Protective Equipment (PPE)

A Personal Protective Equipment Program, which is part of the employer's Safety & Health Plan and which is also a part of the site-specific Safety & Health Plan shall be established.

The PPE program shall address the elements listed below. When elements, such as donning and doffing procedures, are provided by the manufacturer of a piece of equipment and are attached to the Plan, they need not be rewritten into the plan as long as they adequately address the procedure or element.

a] PPE selection based upon site hazards
b] PPE use and limitations of the equipment
c] Work mission duration
d] PPE maintenance and storage
e] PPE decontamination and disposal
f] PPE training and proper fittings
g] PPE donning and doffing procedures
h] PPE inspection procedures prior to, during, and after use
i] Evaluation of the effectiveness of the PPE program
j] Limitations during temperature extremes, heat stress, and other appropriate medical considerations.

Personal Protective Equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.

PPE equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:

a] Based on the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards and which will provide

protection against other known and suspected hazards identified during the preliminary site evaluation.

If there is no permissible exposure limit or published exposure level, the employer may use other published studies and information as a guide to appropriate PPE.

b] Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

c] If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least five (5)-minute duration shall be carried by employees during initial site entry.

d] If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing equivalent to Level-B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions.

e] Once the hazards of the site have been identified, the appropriate PPE shall be selected and used.

f] The level of protection provided by PPE selection shall be increased when additional information or site conditions show that increased protection is necessary to reduce employee exposures below permissible exposure limits and published exposure levels for hazardous substances and health hazards.

9.5.2.7 Risk Identification

Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified.

Risks to consider include, but are not limited to:

a] Exposures exceeding the permissible exposure limits and published exposure levels
b] IDLH Concentrations
c] Potential Skin Absorption and Irritation Sources
d] Potential Eye Irritation Sources
e] Explosion Sensitivity and Flammability Ranges
f] Oxygen deficiency.

9.5.2.8 Employee Notification

Any information concerning the chemical, physical, and toxicological properties of each substance known or expected to be present onsite that is available to the employer and relevant to the duties an employee is expected to perform

shall be made available to the affected employees prior to the commencement of their work activities. The employer may utilize information developed for the hazard communication standard.

9.5.2.9 Training

All employees working onsite (such as, but not limited, to equipment operators, general labourers and others) exposed to health hazards, or safety hazards and their supervisors and management responsible for the site shall receive training to meet the requirements of this paragraph before they are permitted to engage in operations that could expose them to hazardous substances, safety, or health hazards, and they shall receive review training.

Employees shall not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility.

The training shall thoroughly cover the following:

a] Names of personnel and alternates responsible for site safety and health
b] Safety, health and other hazards present on the site
c] Use of personal protective equipment (PPE)
d] Work practices by which the employee can minimize risks from hazards
e] Safe use of engineering controls and equipment on the site
f] Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards.

9.5.2.9.1 Initial Training

a] General site workers (such as equipment operators, general labourers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three (3) days actual field experience under the direct supervision of a trained and experienced supervisor.

b] Workers onsite only occasionally used for a specific limited task (such as, but not limited to, water monitoring, process operations, or air monitoring) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of instruction off the site, and the minimum of one (1) day actual field experience under the direct supervision of a trained, experienced supervisor.

c] Workers regularly onsite who work in areas which have been monitored and fully characterized indicating that exposures are under permissible exposure limits and published exposure limits where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site, and the minimum of one (1) day actual field experience under the direct supervision of a trained, experienced supervisor.

d] Workers with 24 hours of training, who become general site workers or who are required to wear respirators as necessary, shall have the additional 16 hours and two (2) days of training necessary to total the training

9.5.2.9.2 Management and Supervisor Training

Onsite management and supervisors directly responsible for, or who supervise employees engaged in, hazardous waste operations, shall receive 40 hours initial training and three (3) days of supervised field experience (the training may be reduced to 24 hours and one (1) day if the only area of their responsibility is and at least eight (8) additional hours of specialized training at the time of job assignment on such topics as, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment (PPE) program, spill containment program, and health hazard monitoring procedure and techniques.

9.5.2.10 Recordkeeping

An accurate record of the medical surveillance shall be retained. This record shall be retained for the period specified and meet the criteria.

The record shall include at least the following information:

a] The name and social security number of the employee
b] Physicians' written opinions, recommended limitations and results of examinations and tests
c] Any employee medical complaints related to exposure to hazardous substances
d] A copy of the information provided to the examining physician by the employer, with the exception of the standard and its appendices.

9.6 EMERGENCY RESPONSE PLAN

An Emergency Response Plan shall be developed and implemented by the company to handle anticipated emergencies, prior to the commencement of hazardous operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, OSHC-DOLE personnel, and other governmental agencies with relevant responsibilities.

Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an Emergency Response Plan complying with local regulations.

DPWH shall develop an Emergency Response Plan for emergencies which shall address, as a minimum, the following:

a] Pre-emergency planning
b] Personnel roles, lines of authority, training, and communication
c] Emergency recognition and prevention
d] Safe distances and places of refuge
e] Site security and control
f] Evacuation routes and procedures

g] Decontamination procedures which are not covered by the site Safety & Health Plan
h] Emergency medical treatment and first aid
i] Emergency alerting and response procedures
j] Critique of response and follow-up
k] PPE and emergency equipment.

Procedures for Handling Emergency Incidents

In addition to the elements in the emergency response plan, the following elements shall be included for Emergency Response Plan:

a] Site topography, layout, and prevailing weather conditions
b] Procedures for reporting incidents to local, provincial, and national governmental agencies
c] The emergency response plan shall be a separate section of the Site Safety and Health Plan.
d] The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

The Emergency Response Plan shall be rehearsed regularly as part of the overall training program for site operations.

The site Emergency Response Plan shall be reviewed periodically and, as necessary, shall be amended to keep it current with new or changing site conditions or information.

An employee alarm system shall be installed to notify employees of an emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication, and to begin emergency procedures.

Based on the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site Emergency Response Plan.

9.7 SANITATION AT TEMPORARY WORKPLACES

9.7.1 Potable Water

a] An adequate supply of potable water shall be provided at the site.

b] Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.

c] Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

d] Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

9.7.2 Non-potable Water

a] Outlets for non-potable water, such as water for firefighting purposes, shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes

b] There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing non-potable water.

9.7.3 Toilet Facilities

Under temporary field conditions, provisions shall be made to assure not less than one (1) portalet toilet is available.

9.7.4 Food handling

All food service facilities and operations for workers shall meet the applicable laws, ordinances and regulations of the Municipal and Barangay where the construction sites are located.

9.7.5 Temporary Sleeping Quarters

When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

9.7.6 Washing Facilities

The company shall provide adequate washing facilities for workers engaged in operations where hazardous substances may be harmful to workers. Such facilities shall be in near proximity to the worksite; in areas where exposures are below permissible exposure limits and which are under the control of the company; and shall be so equipped as to enable employees to remove hazardous substances from themselves.

Section 10

ABANDONMENT, DECOMMISSIONING, REHABILITATION POLICY

10. ABANDONMENT, DECOMMISSIONING AND REHABILITATION POLICY

The final Abandonment/Decommissioning and Rehabilitation plan will include:

1. Land and soil restoration, decontamination and remediation
2. Strategies and methods for final rehabilitation of the environment disturbed by the project
3. Land use suitability of the various land disturbances.

The proposed activities and components of the Plan in the event of the Project Decommissioning are presented as follows:

- Procedures for decommissioning of the project components
- Personnel Decommissioning Program
- Retrenchment Packages, separation fees as per DOLE requirements
- On-site inspections
    a. Project site
    b. Construction camp
    c. Temporary field offices
    d. Equipment and support facilities
    e. Waste disposal and storage areas
    f. Potable Wastewater treatment facility
- Secure necessary permits and clearances
        a. DENR-EMB permits
        b. Safety permits
        c. LGU permits
        d. Others
- Disassembly and crating/packaging
- Disassembly and disposal of mechanical and electrical systems
- Dismantling of structures and facilities
- Dewatering and backfilling
- Disposal of construction materials
- Loading supervision of the shipment of the following:
        a. Unused fuels and consumables
        b. Scrap materials, spare parts and equipment
- Clearing and leveling
- Remediation of contaminated soil and water resources due to spill and leakages of oils and other materials used in the construction.
- Transport and disposal of equipment, waste and other materials used or generated in the project;
- Alternative for future use of abandoned area.

Section 11

INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

11.0 Institutional Plan for EMP Implementation

The Institutional Plan is the establishment of a body that will implement the proposed Environmental Management Plan (EMP) whose main thrust is to ensure that environmental, socio-economic, political and public health issues are properly address in a timely manner. It provides necessary mechanism that will strengthen the organizational relationship of the proponent with the host community, concern government agencies and other stakeholders.

11.1 DPWH's Environmental Unit

DPWH thru the Unified Project Management Office (UPMO), being the proponent shall coordinate with the Environmental Unit of DPWH. The project engineers of the UPMOs shall be responsible in the monitoring of the project in coordination with the DPWH - Environmental and Social Safeguards Division (ESSD), under the Planning Service. Enough resources/budget shall be appropriated to support the different environmental programs.

The UPMO shall designate an acting pollution control officer among the project engineers who shall have the following functions:

Plan and implement the environmental management plan;

- Monitor compliance of contractors implementation of the EMP;
- Identify sources of pollution;
- Monitor and evaluate the effectiveness of mitigating/enhancement measures;
- Plan, propose, and implement modifications, or additional environmental measures that are deemed necessary to more effectively protect the environment;
- Coordinate with relevant oversight agencies and other stakeholders including the local government and the community to ensure their effective participation in the implementation of the environmental management plan.

DPWH may designate a separate Health and Safety Officer or PCO may act concurrently as the Health & Safety Officer.

The PCO and Safety Officer shall report directly to the UPMO's head, while the head shall coordinate with the ESSD. The head shall be responsible for the overall environmental management program. The PCO should be given enough authority and competence on decision-making with reference to environmental management. The PCO shall be responsible for LAND, AIR, WATER, SOLID and HAZARDOUS WASTE components. The Safety Officer shall be responsible for the health and safety component, while the Security Officer shall be in-charge of Peace and order to include security risk management and emergency responses. The Community Relations Officer (Comrel) who will be designated from among the project engineers, shall handle the PEOPLE and shall be responsible for plans and implementation of social development programs, IEC activities and implementation and monitoring of RAP.

The Manager, PCO, Safety Officer, Comrel and Security Officer shall have appropriate educational background and/or experience and training on environmental, community organization and development, health and safety and security risk regulations and practices. **Figure 74** shows the organizational chart of environmental and social team.

11.2 Health and Safety

The company shall subscribe to an active program of pursuing a health, safe and environment-friendly operation. It shall push for the adoption of industrial hygiene programs to ensure a work environment that is consistent with internationally-accepted norms of industrial operations.

A Loss Control Program, allied to the pursuit of the safety program, shall also be implemented and overseen by the Safety Officer. A Safety Officer shall be designated and together with the Pollution Control Officer (PCO) as well as UPMO's Manager shall undergo health and safety training programs.

Company guidelines on health and safety programs will be made clear to contractors and all employees during construction. Strict compliance with these guidelines will be part of the Employee's Code of Conduct; sanctions will be imposed upon violators. Regular program of safety evaluation within the construction area will be conducted with the aim of continuously improving safety conditions. Provisions for first-aid shall be available at the site.

11.3 Contractor's Accountability

Since the construction of the project will rely on the contractors, DPWH shall ensures that the contractors be bound by rules of conduct, practice, and accountabilities, which carry the different Environmental and Safety program of the project.

The accountabilities of contractors must include:
• Full disclosure of product information relating to safety and environmental impact;
• Safe transport and delivery of materials;
• Minimum pollution and risks in the delivery of materials and services; and
• Immediate response to environmental incidents.

The DPWH shall ensure that the contractors shall be legally and financially liable to the Environmental Management Plan. The DPWH and the contractors shall be accountable for any damages that may occur to human beings, property, and or environment caused by their operations. The contract may be terminated and or the contractor will be included in the blacklist once taken the penalty for negligence, bad housekeeping, disregard the environmental policy of the company, and unsound practice.

The essential knowledge and awareness of the contractors regarding their responsibilities and accountabilities must be assured and incorporated in the contract signed by both the DPWH and contractor for every activity.

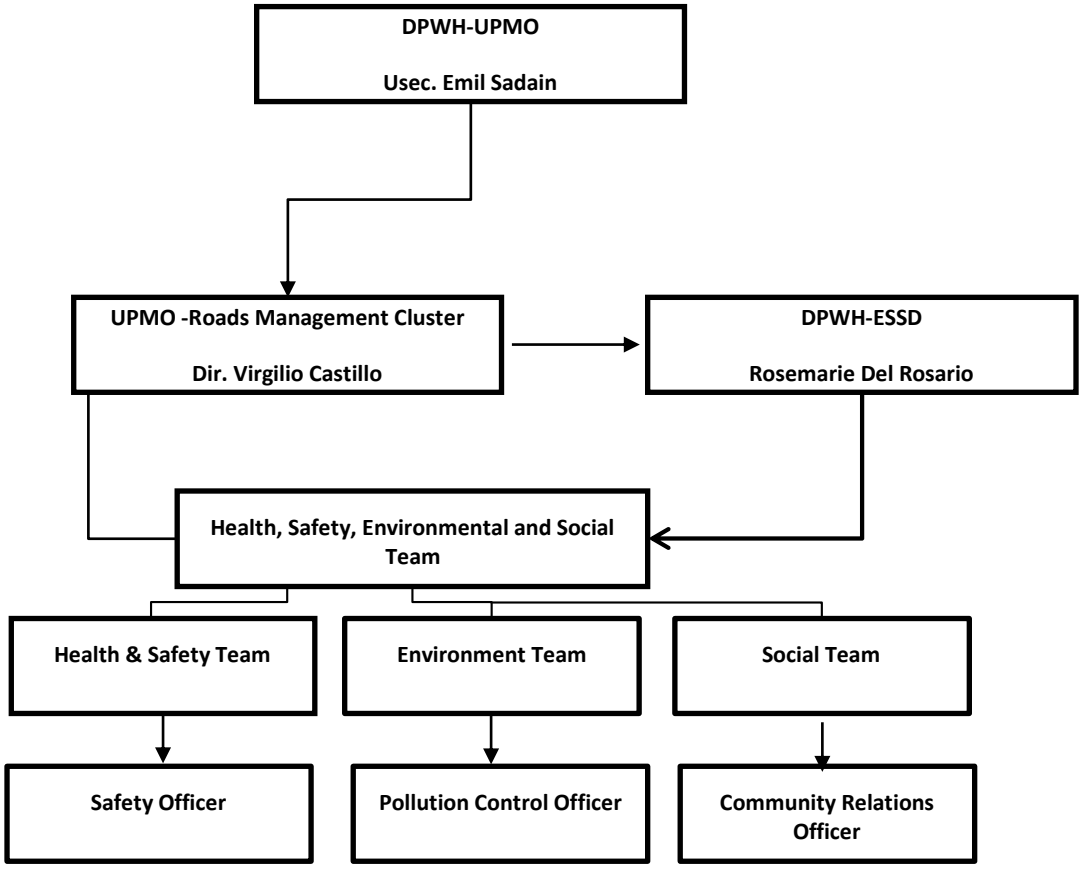

Figure 74. Organizational Chart of Environment & Social Team

Section 12

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