REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

ROAD NETWORK DEVELOPMENT PROJECT IN CONFLICT – AFFECTED AREAS IN MINDANAO

(MANUANGAN-PARANG ROAD)

INITIAL ENVIRONMENTAL EXAMINATION (IEE) 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** **Manuangan-Parang Road**
PROJECT LOCATION	**Municipality of Sultan Kudarat, Sultan Mastura, Parang, Maguindanao and Pigcawayan, Cotabato**
ROAD WIDTH	**6.7 meters**
ROAD LENGTH (TOTAL)	**16.8 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 & Undersecretary for Technical Services** **In Partnership with:** **CTI Engineering International Co. Ltd.**
OFFICE ADDRESS	**DPWH, Manila, Philippines**
CONTACT PERSON & CONTACT NUMBERS	**Mr. Mitsuo Kiuchi** E-mail: kiuchi.mitsuo67@gmail.com; kiuchi@ctii.co.jp
For ECC matters:	**KRC Environmental Services** Ricardo A. Capule Phone: (02) 5061409; (0917)713-2629 Email: racapule@yahoo.com Maria Carmela Q. Capule Phone: (917)527-6352 Email: cqcapule@yahoo.com Marilou P. Avenido Phone: (0917)510-9892 Email: alot_avenido@yahoo.com

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.

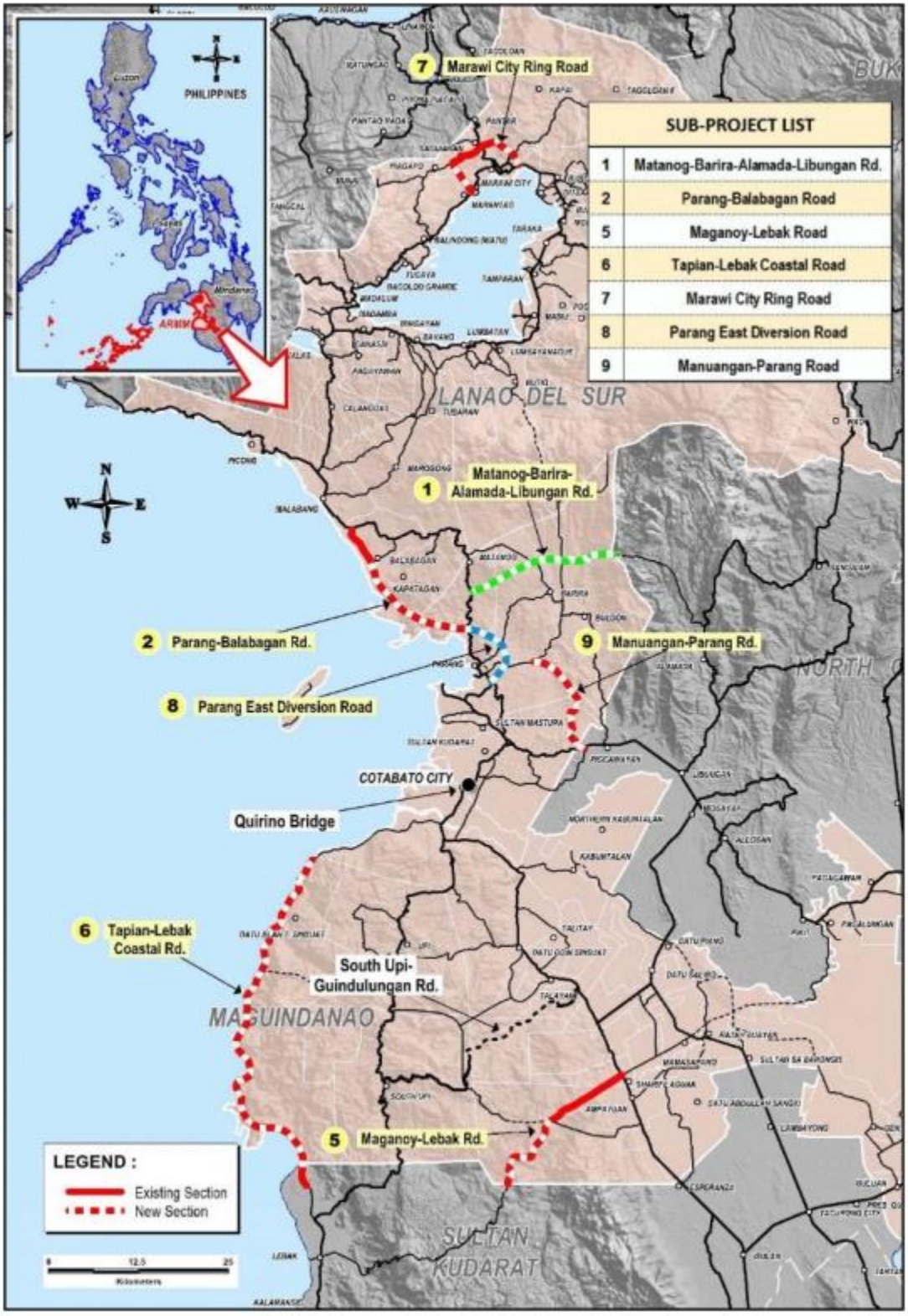
The project area has favorable natural conditions for agriculture –i.e. high temperature, plenty of rainfalls distributed throughout a year, dominant fertile soil and outside of the typhoon belt.

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

TABLE OF CONTENTS

List of Figures

Page

No. Title

List of Tables

Page

No. Title

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
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** **Manuangan-Parang Road**
Project Location	**Municipality of Parang, Sultan Mastura, Sultan Kudarat, Maguindanao and Pigcawayan, Cotabato**
Project Size	**Width: 6.7 meters** **Length: 16.8 kilometers**
Project Component	Road with total length of 16. 8km (Road length: 16,312m, Bridge length: 460m) 3 Bridges: Bridge No.1 L=270m, St.9+235 - +505 Bridge No.2 L=150m, St.11+345 - +495 Bridge No.3 L=40m, St.11+659 - +699 Farm-to-market road Drainage & slope protection: - RCPC(910mmR 55places)960m, RCBC(3.0mx2.75m 1place) 16m, Grout Riprap 665m^3, Stone masonry 872m^3, Hand Laid Rock Embankment 92m^3 Miscellaneous work - Guardrail 11,475m, Chevron Signs 729ea, Road markings 9,225m^2, Coco-net 62,772m^2 North segment – Total 9.0km, Beside Parang East Side as branch office South segment - Total 7.8km, Bridge No.1 – No.3 (L= 460m); Pigcawayan main office Temporary Camp & facilities
Project Cost	**Mil PhP 1,535.60**
Man Power	**1,937 man-month (skilled)** **4,264 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 & Undersecretary for 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

In Charge of ECC Application

Company Consultants with Contact Details	KRC ENVIRONMENTAL SERVICES Ricardo A. Capule (02) 5061409; (0917)713-2629 racapule@yahoo.com Marilou P. Avenido

	(0917)5109892 alot_avenido@yahoo.com Maria Carmela Q. Capule (917)527-6352 cqcapule@yahoo.com

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 were held on February and March 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 Gadungan, Orandang and Cabuan of Parang, Nekitan, Matengen and Olas of Sultan Kudarat, Bungabong of Sultan Mastura and Kulasi, South Manuangan and North Manuangan of Pigcawayan, Cotabato 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 17 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	Floristic composition of the alignment relatively low comprised of 64 species dominated by trees. Recorded species are common and naturally growing in the area. Conservation status of recorded species showed that one (1) species is critically endangered and three (3) species are vulnerable in the category listing of the IUCN.
Fauna	Faunal composition of the alignment is nominal with only 29 species recorded dominated by avifauna. Most of the species are common and locally sited in different ecosystems including the agricultural areas, shrubland, grassland and settlements areas. These species also thrive even in highly disturb areas including cities. *Three* (3) species are endemic in the study area dominated by Aves. Two (2) species is vulnerable in the category of the IUCN.
WATER	
Hydrology/Hydrogeology	The river systems that affect the proposed road alignment are tributaries of the Simuay River**.** 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 November 15, 2017 on a sunny to cloudy weather. Surface water samples were collected at Matengen Creek and Simuay River. 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 27.8°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.
Ambient Air Quality	Air Samples were collected on December 10-11 & 16-17, 2017 at Brgy. Orandang, Parang, Maguindanao and North Manuangan, Pigcawayan, Cotabato. 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, sounds from insects such as crickets etc. and passing of vehicles 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, Sultan Kudarat has a total population of 95, 201, the largest population of which is 2,465 in Matengen. While the smallest population is 700 in Nekitan of the same municipality. Sultan Mastura doesn't have existing records of population in PSA from 1960-2000 since its corporate existence as municipality started only in 2003. As of 2015, the municipality has a total population of 22,261. Pigcawayan, Cotabato has a total population of 5,645 among the three barangays.
Affected Families and Persons	Based on RAP report, the total number of households to be affected by alignment is 44 and total PAPs is 248.

SUMMARY OF PUBLIC PARTICIPATION

A total of 18 stakeholders' meetings were held for SP 9 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, Sultan Mastura, Sultan Kudarat, and Pigcawayan with the affected stakeholders, barangay and municipal officials, and concerned LGU offices such as Assessors, MPDC. Public consultations were attended attended by a total of 346 participants (Male-259 and Female-87) while barangay's scoping were attended by 119 male and 33 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, coconut, African oil, among others 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.
Suggestion to be included in the alignment (Sultan Mastura)	They said that their concerns and requests were noted and informed them that this will be recommended to the proponent for future projects
Hazard assessment	Landslide will be included in our study, we gathered data from MGB and study on the slope and other factors that will be affected by the road alignment. This will be submitted to DPWH and JICA. We are doing a comprehensive study on this road project such as flora and fauna that will be seen during the survey. All of this will be included in the EIA study. We have experts for geology, hydrology, and marines for the coastal areas. The geohazard aspects and slope protection will be part of the study; drainage canal will be included in the environmental management plan that will be recommended so that the implementing agency (DPWH) will conduct a geotechnical investigation to know the classification of the soil. Definitely engineering measures will be done before the construction stage to prevent the precious incident like in Baguio City. Further study for geotechnology for landslide prone areas will be implemented by DPWH. We will take note all of the suggestions.
If the owner of the affected property or land will not issue clearance to the project	We are hoping that this will be prevented, because JICA as much as possible to avoid any problems in ROW and the possibility that this project will not be implemented.
Livelihood for women	Yes, because during construction, many job or business opportunities will come in. Such as canteen because the laborers will also need this.

Requested Farm to Market Road	The team are thankful for the support of the LGU to this study. They said that their concerns and requests were noted and informed them that this will be recommended to the proponent
Request for widening of barangay road	It is not part of the project but will be noted for considerations. The barangay officials can submit a resolution to Municipal Officials for endorsement to DPWH
Coordination with LGU, MILF and MNLF for security	Yes, we will informed the proponent to closely coordinate with the LGU and the MNLF/MILF for smooth implementation of the project
Pawned land/lot	The owner should settle first the required documents to be legible for compensation.
Compensation prior to construction	This will be noted. Private property owners are advised to prepare proof of ownership such as titles, certifications or declarations for them to be compensated
Safety to pass the road (From terrorist)	Security will be tightened when project will be implemented. The government will not allow this terrorism to happen.
Informing the PAPs during the inventory	The team will coordinate to RAP team for proper coordination and information dissemination to the affected families. The RAP team will present the detail and results of their assessment.
Source of fund to be used in the road implementation.	They were informed that it is the JICA that will fund the project and DPWH is the implementing agency
If the road already constructed, is it the same from Metro Manila that they will collect a toll fee to the cars passed by the road	For now, it is not included in the plan. It is a government project.
Requested for water system	This is not part of the project but will be noted for considerations on future plans/projects of JICA
Brgy. Matengen have a source of sand, to consider them as source	This will be noted for considerations of DPWH and JICA.

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

Photo 7: Vice Mayor Julhani Tumibas Jr. of Municipality of Sultan Mastura expressed his full support to the project and he sees that it will provide development to their constiuent although they are not covered by the project

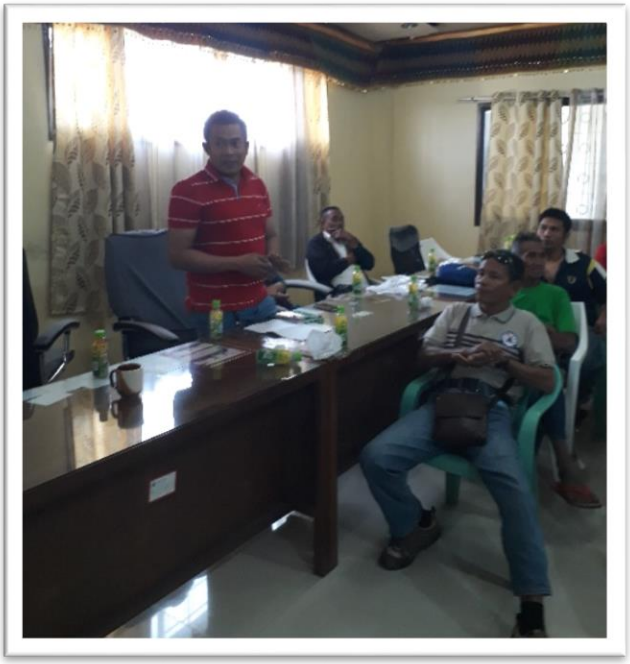


Photo 8: Mr. Mohammad Abdullah, MPDC of Mun. of Sultan Mastura expressed that the project will pushed through and inquires the possibility of construction of farm to market road

Photo 9: Residents from Brgy. Matengen expressed his full support to the project

Photo 10: Mr. Bacer Aro of Brgy. Matengen inquires the possibility to consider the concreting of the road from farm to market road

Photo 11: Ms. Jeanny Plado Brgy. Kgwd. Of Brgy. South Manuangan inquires if they get the trees affected during the construction

Photo 12: Brgy. Captain Rodolfo Martizano of Brgy. New Culasi sees that the affected families should be compensated first before construction

Photo 13: Mr. Zaldy Balofinos MPDC of Mun. of Pigcawayan discussed to the participants to cooperate and participate for smooth implementation of the project

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;
	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	• 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 • 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 (44 Affected HHs, 248 PAPs, 11 residential Structures, 2 mosques)	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	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;

	supply of other goods and services			• 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			Project location	CRO

		labor & other skills available within the Host Barangay & nearby communities				
	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

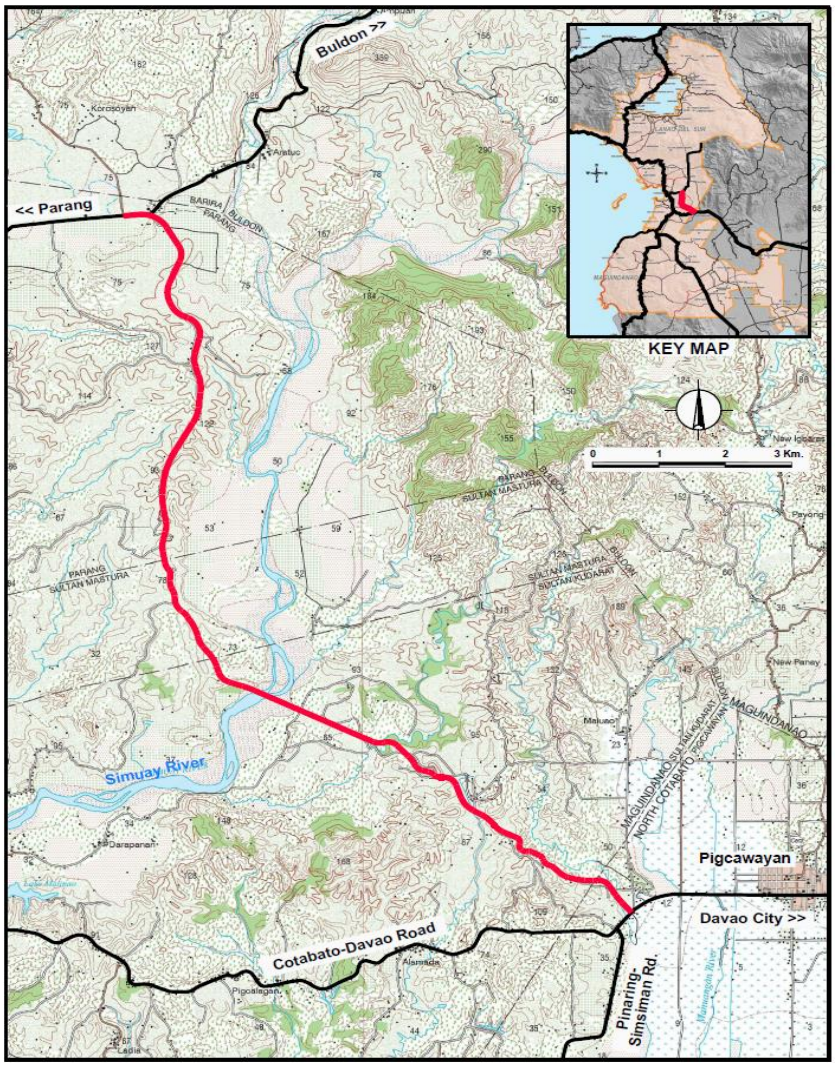
Section 1

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.



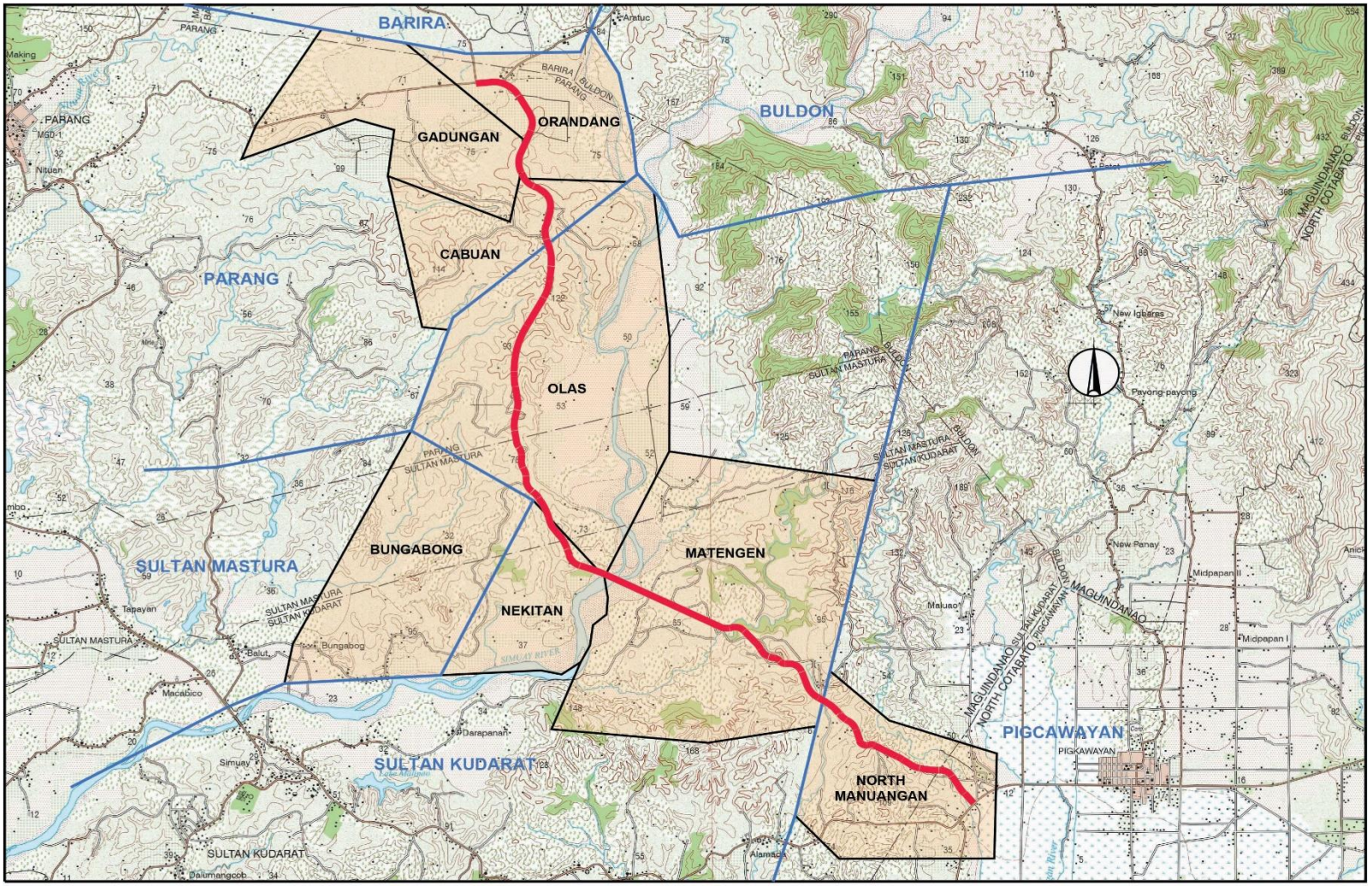
Source: JICA Study Team

Figure 1. Location Map Showing the study area

Table 1. Manuangan-Parang Road

Municipality	Name of Barangay
Parang	Gadungan
	Orandang
	Cabuan
Sultan Mastura	Bungabong
Sultan Kudarat	Nekitan
	Olas
	Matengen
Pigcawayan	North Manuangan
	South Manuangan
	Kulasi

Figure 2 shows the map of affected Barangays traversing the road alignment along the Municipality of Sultan Kudarat, Sultan Mastura, Parang, Maguindanao and Pigcawayan, Cotabato.



Source: JICA Study Team

Figure-2. Map Showing the Affected Barangays at Sub-Project 9

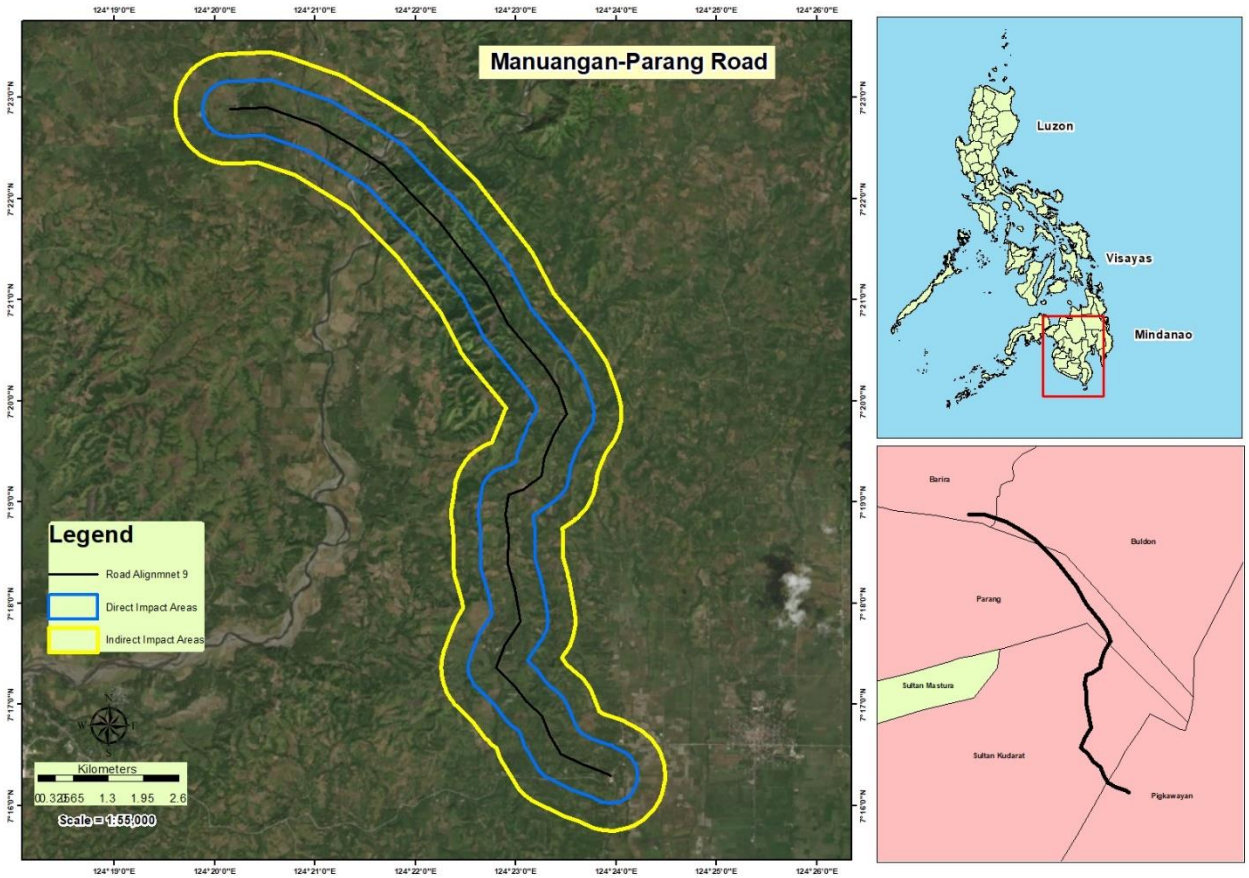
.

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

1.2.1 National

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 9, Manuangan-Parang 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.

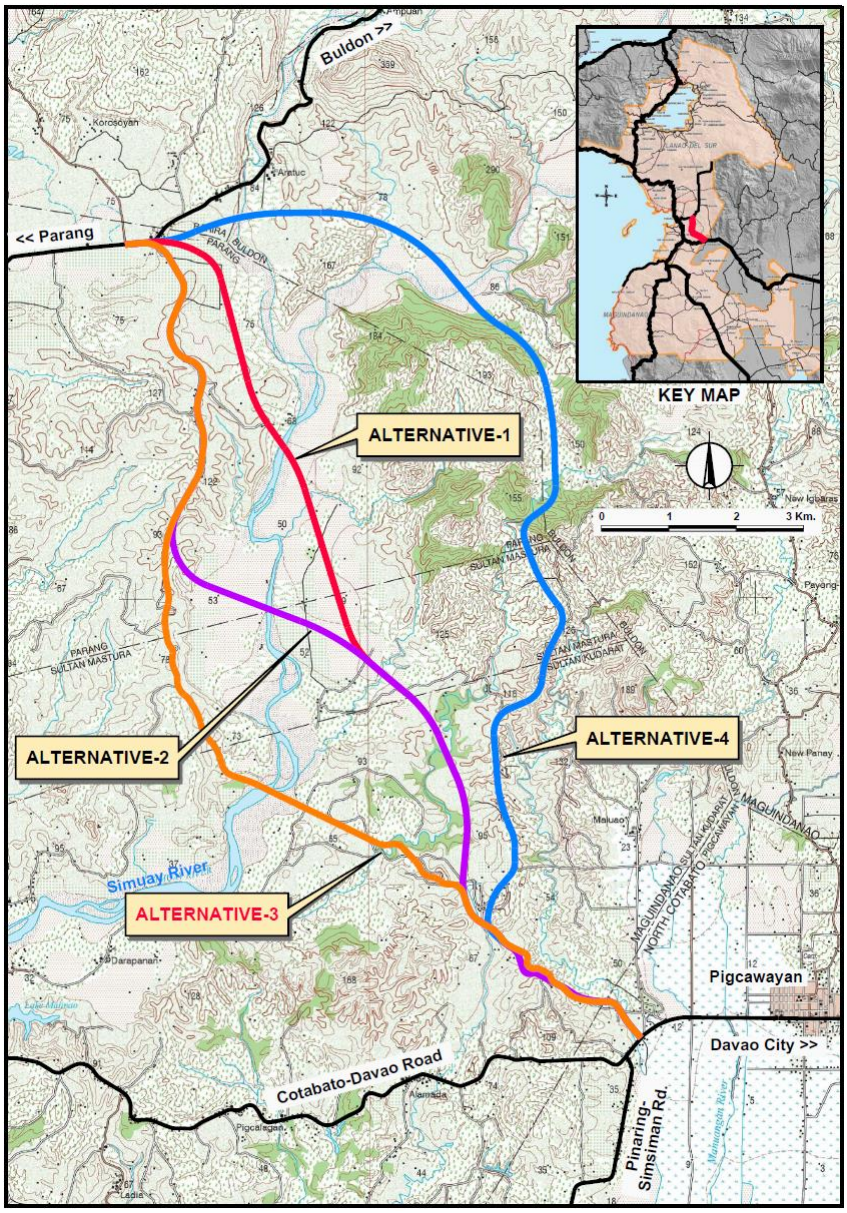
1.3 Project Alternatives

1.3.1 Design Criteria and Standards

No alternative for design criteria and standards as the constructions of road and bridges need to comply with design criteria and standards set forth by DPWH and JICA requirements.

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. 9.



Source: JICA Study Team

Figure 4. Alternative Alignments for Manuangan-Parang 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		ALT-3		ALT-4	
Cost, Consruction Period	Total Road Length		km	17.0	○	17.0	○	15.9	○	19.9	×
	Utilization of Existing Road/Trail		km	11.1	○	8.8	×	3.0	×	3.0	×
	New construction road length		km	5.9	-	8.2	-	12.9	-	16.9	-
	No. of bridges		nos	3	-	4	-	4	-	5	-
	Total length of bridges		m	950	○	1,050	△	2,050	×	1,450	×
	No. of box culverts		nos	10	-	10	-	9	–	8	-
Economic Impact	No. of Direct Beneficiaries		persons	22,021	○	18,100	×	17,632	×	16,509	×
	Agricultural land areas to be served		km	0.50	×	2.83	×	3.72	○	0.98	×
Environmental Impact	High-filling section length (H= 10m or more)		m	1,593	×	1,109	△	978	○	1,909	×
	High-cutting section length (H= 10m or more)		m	999	×	1,290	×	808	○	1,221	×
	Number of houses/buildings affected		nos	20	×	15	○	21	×	53	×
Technical Features	Alignment	Total no. of curves	nos	13	–	15	-	12	-	22	-
		No. of curve radius < 300m	nos	0	○	0	○	0	○	0	○
		Length of vertical grade ≧ 5%	m	0	○	0	○	0	○	500	×
	River stabilities		-	Pass through the section where the river channel is stable	○	Pass through the section where the river channel is unstable	×	Pass through the section where the river channel is unstable	×	Has a possibility of erosion because it is located at the rapid flow section	×
Evaluation				○ = 7 △ = 0 × = 4		○ = 4 △ = 2 × = 4		○ = 6 △ = 0 × = 5		○ = 1 △ = 0 × = 10	
Recommendation				Recommended		-		-		-	

Source: JICA Study Team

1.4 PROJECT COMPONENTS

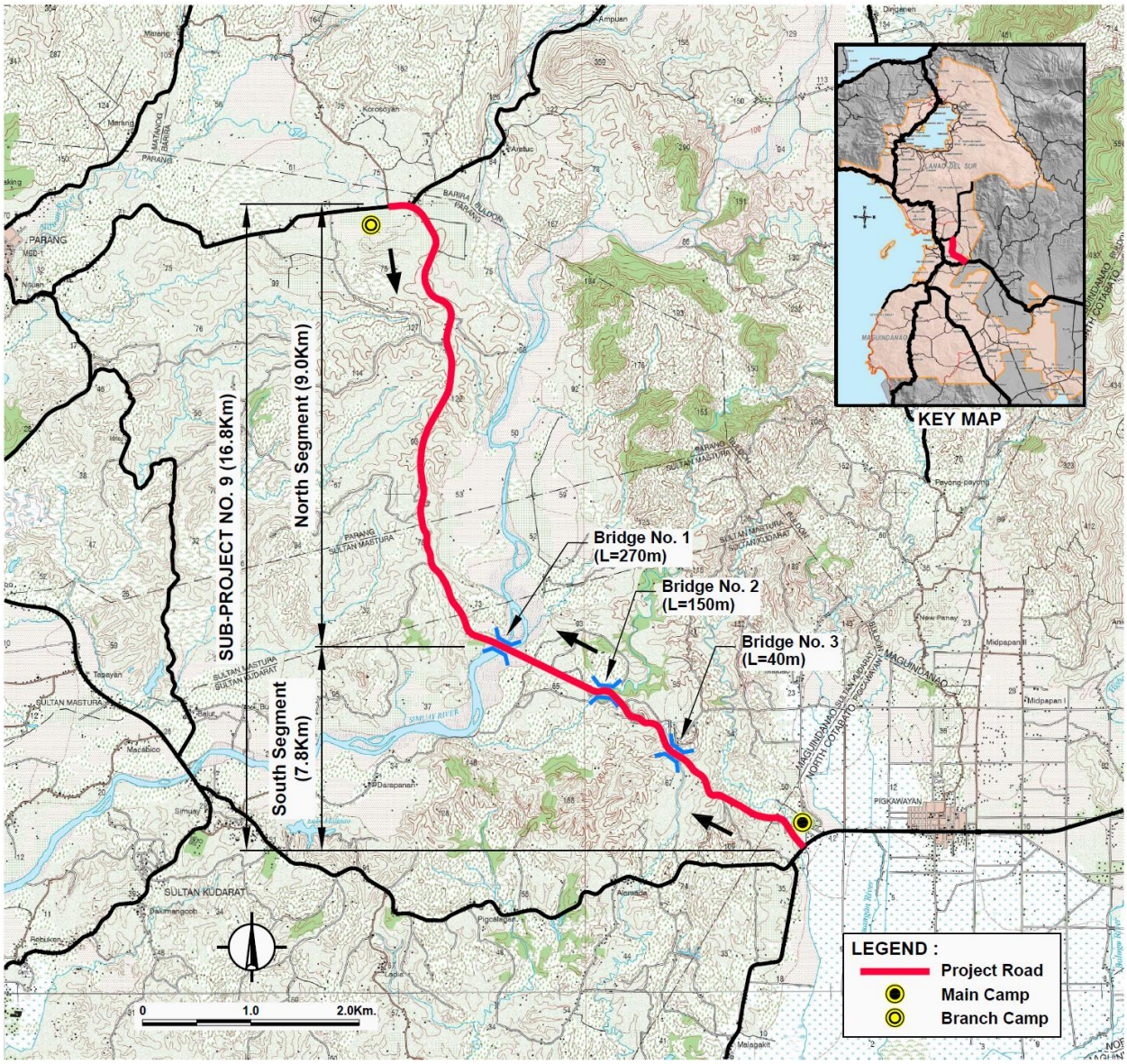
The proposed Manuangan-Parang Road with total length of 16.80 Km is planned as a short-cut road to connect the existing Pigcawayan-Sultan Kudarat-Sultan Mastura-Parang National Highway (AH26). The proposed road will also provide access to the productive agricultural areas of the hinterland barangays of the municipalities of Sultan Kudarat, Sultan Mastura and Parang, all in the province of Maguindanao and inner barangays of Pigcawayan, North Cotabato. The alignment crosses a wide river of Simual River**. Figure 5** shows the construction plan.

To shorten the construction period, the construction work is divided into two segments, North segment (9.0km) and South segment (7.8km).

Manuangan-Parang road is positioned for bypass road of National High Way (AH26) from Manuangan to Parang area especially heavy traffic. **Table 3** presents the proposed Subproject 9 project components.

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.



Source: JICA Study Team

Figure 5. Construction Site and Packages

Table 3. Components of the Construction Plan

Item	Contents
Road length	16.8km(Road length: 16,312m, Bridge length: 460m)
Earth work	Clearing 38.9ha, Roadway Excavation 56,000m^3, Embankment from Roadway 227,000m^3, Embankment from Borrow 32,000m^3
Pavement work	PCCP(280mm) 119,618m^2,
Road shoulder work	PCCP shoulder(150mm) 19,800m^2, Gravel surface shoulder 5,961m^3
Bridge	Bridge No.1 L=270m, St.9+235 - +505 Bridge No.2 L=150m, St.11+345 - +495 Bridge No.3 L=40m, St.11+659 - +699
Drainage & slope protection work	RCPC(910mmR 55places)960m, RCBC(3.0mx2.75m 1place) 16m, Grout Riprap 665m^3, Stone masonry 872m^3, Hand Laid Rock Embankment 92m^3
Miscellaneous work	Guardrail 11,475m, Chevron Signs 729ea, Road markings 9,225m^2, Coco-net 62,772m^2

Segment Information North Segment	
Item	Contents
North segment	St.0 – St.9+000, Total 9.0km,
Branch office	Parang east side (St.6+200)
South Segment	
Item	Contents
East segment	St.9+000 – St.16+772, Total 7.8km, Bridge No.1 – No.3 (L= 460m)
Main office	Pigkawayan (St.16+700)

Source: JICA Study Team

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 9 is a 17-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 9

The road classification for subproject 9 – Manuangan-Parang 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**.

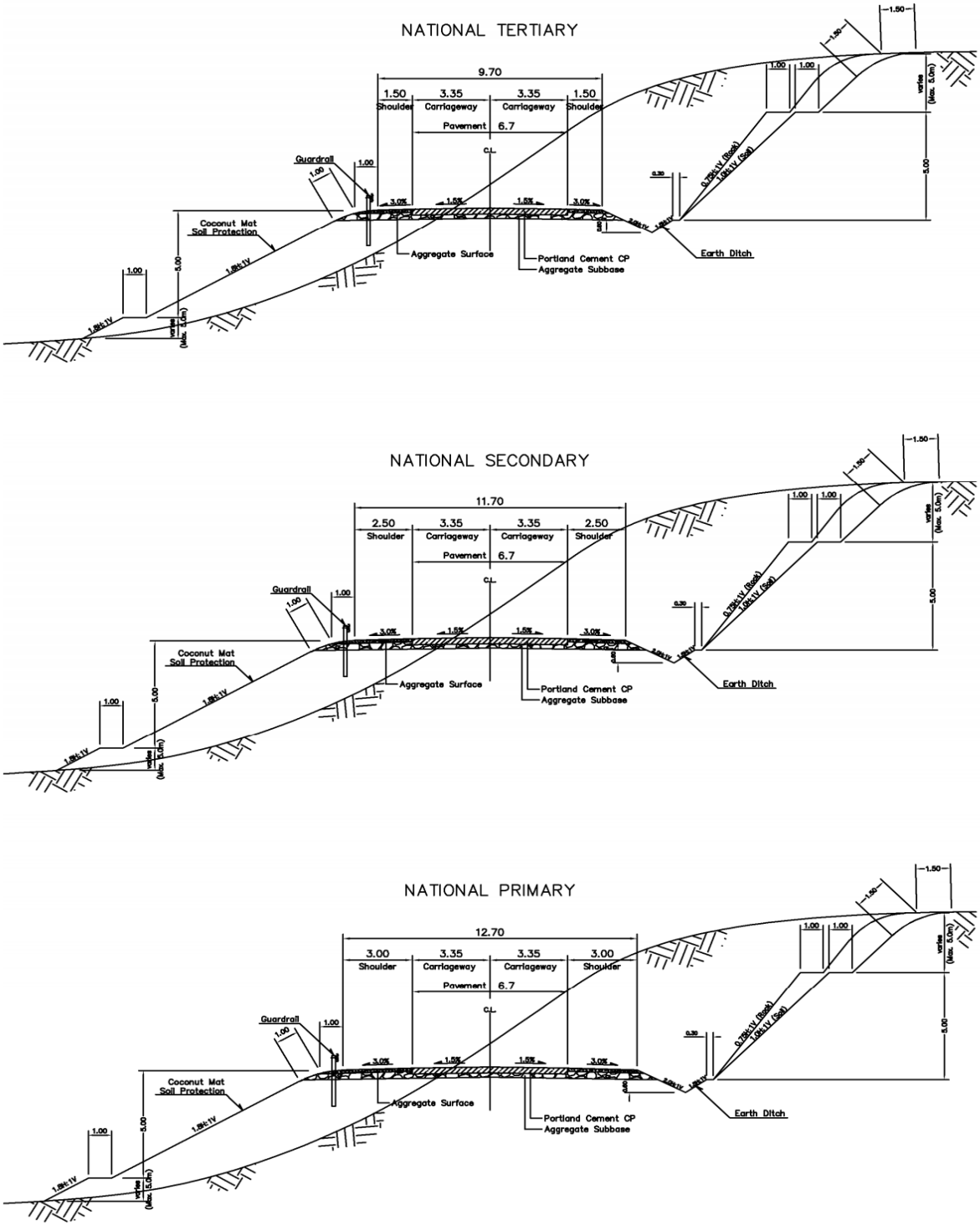
Table 6. Summary of Geometric Design Standards for Subprojects

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

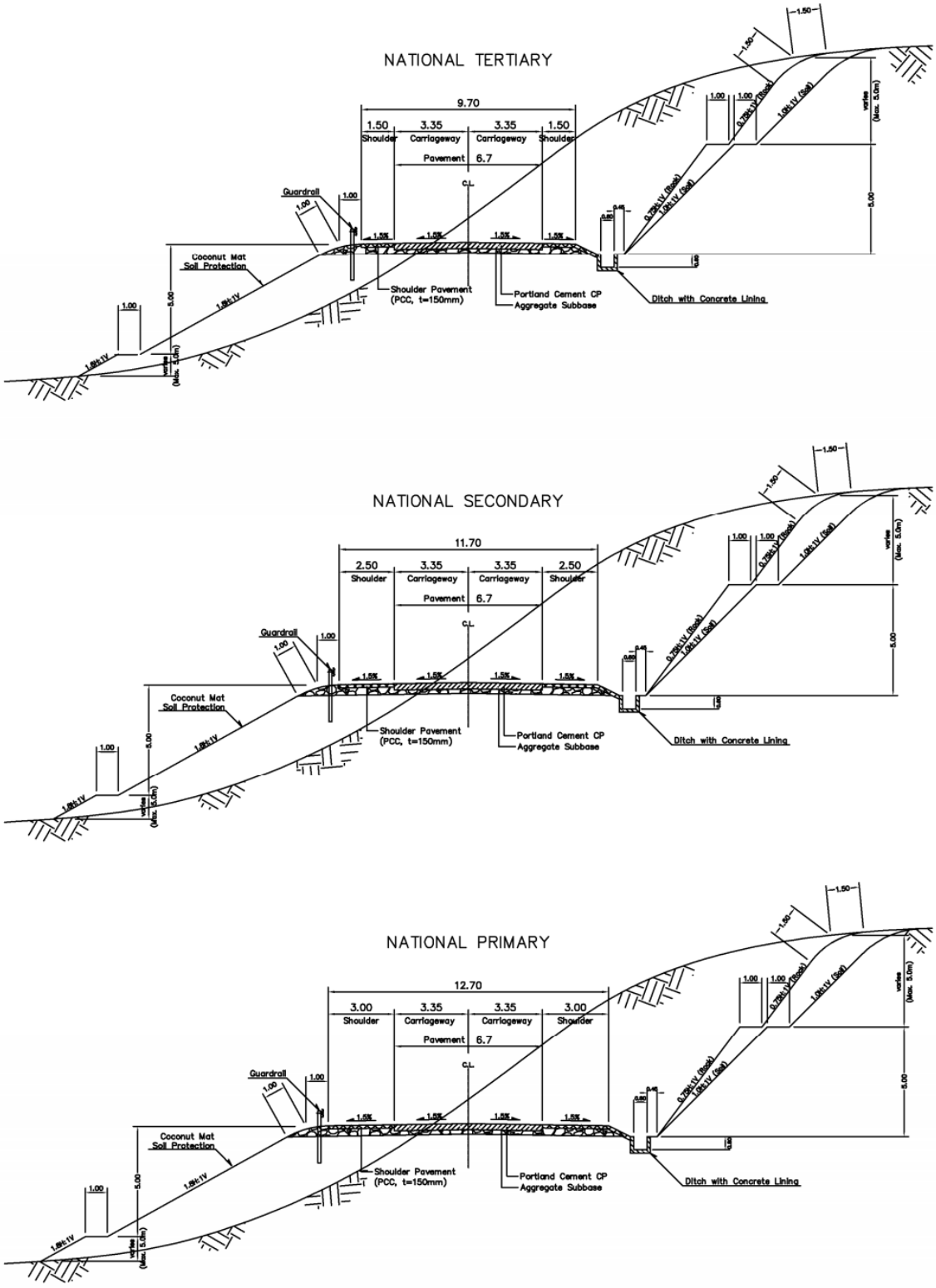
1.4.2.2 Typical Cross Sections

Typical cross sections by class of road are shown in **Figure 6 and Figure 7.**



Source: JICA Study Team

Figure 6. Typical Cross Sections for Subproject Roads (Vertical Grade Less Than 4%)



Source: JICA Study Team

Figure 7. 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

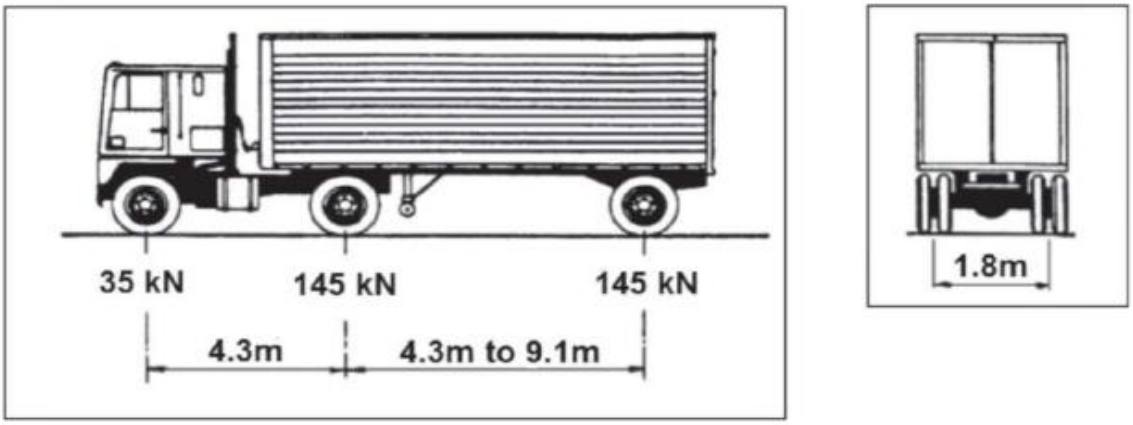
Design live loads of the bridges shall consist of:

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 8.**

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 8. 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.**

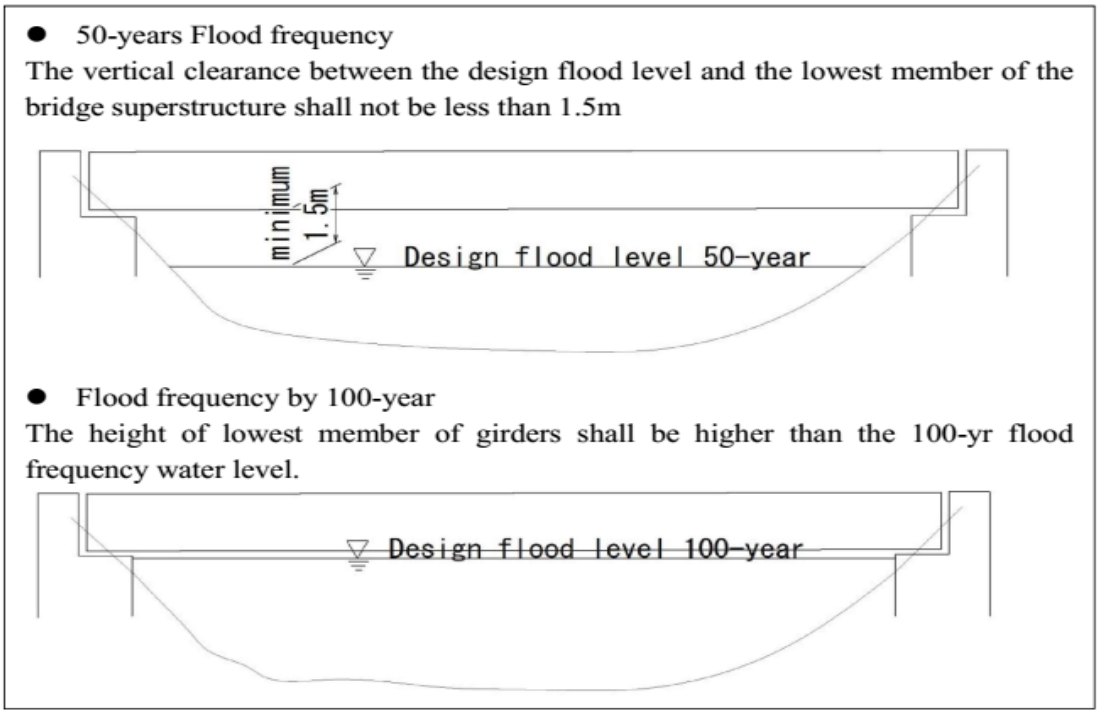
- 50 years flood frequency shall be applied for the estimation of flood level (DFL)
- 100 years flood shall be used for check vertical clearance of the bridge superstructure

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 9.**



Source: JICA Study Team
Figure 9. Vertical Clearance of Bridge Superstructure

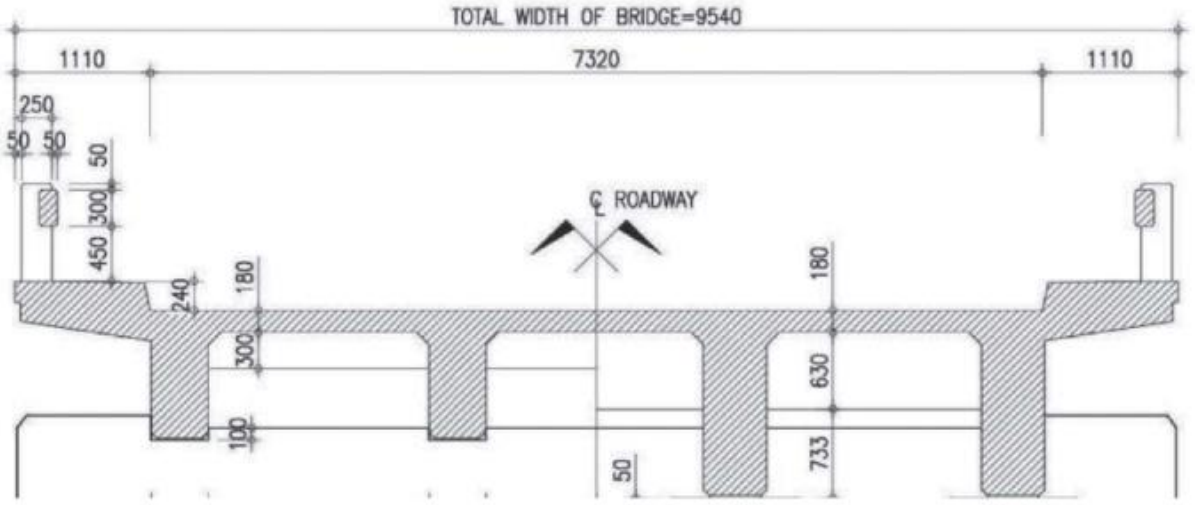
Discharge of river will be estimated in accordance with DPWH DGCS Volume 3 and 4. The Criteria for hydrological analysis are described in separate report of JICA Study Team.

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 10.**



Source: JICA Study Team

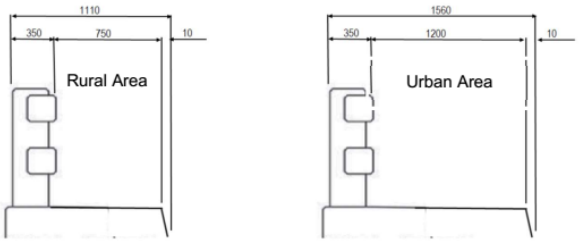
Figure 10. Typical Cross Section of Bridge

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 11**.



Source: JICA Study Team

Figure 11. Width of Sidewalk

1.4.3.6 Substructure Arrangements

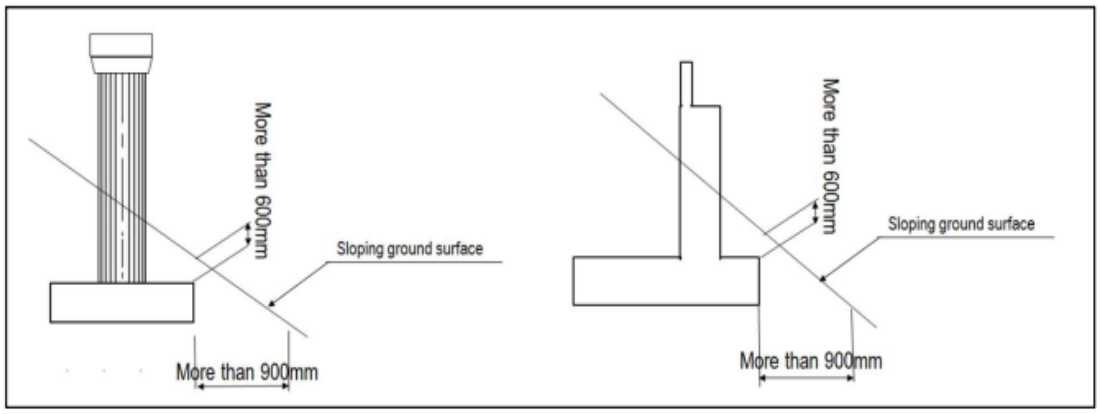
1) Seat Length

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 12.**
- Maximum height of abutment is 15.0m.



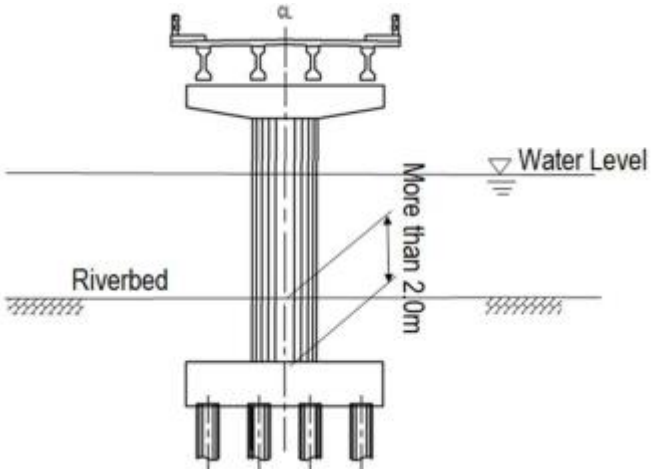
Source: JICA Study Team
Figure 12. Footing Position on Slope

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 13**.

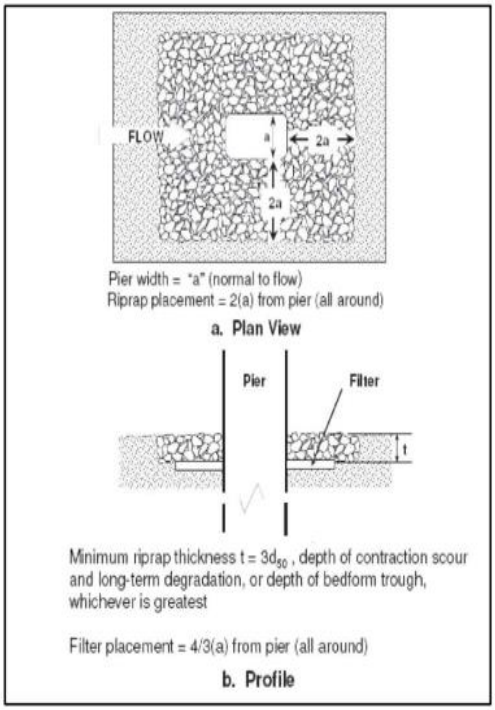


Source: JICA Study Team
Figure 13. Depth of Pier Footing in Water Way

1.4.3.7 River Protection

1) Pier Foundation

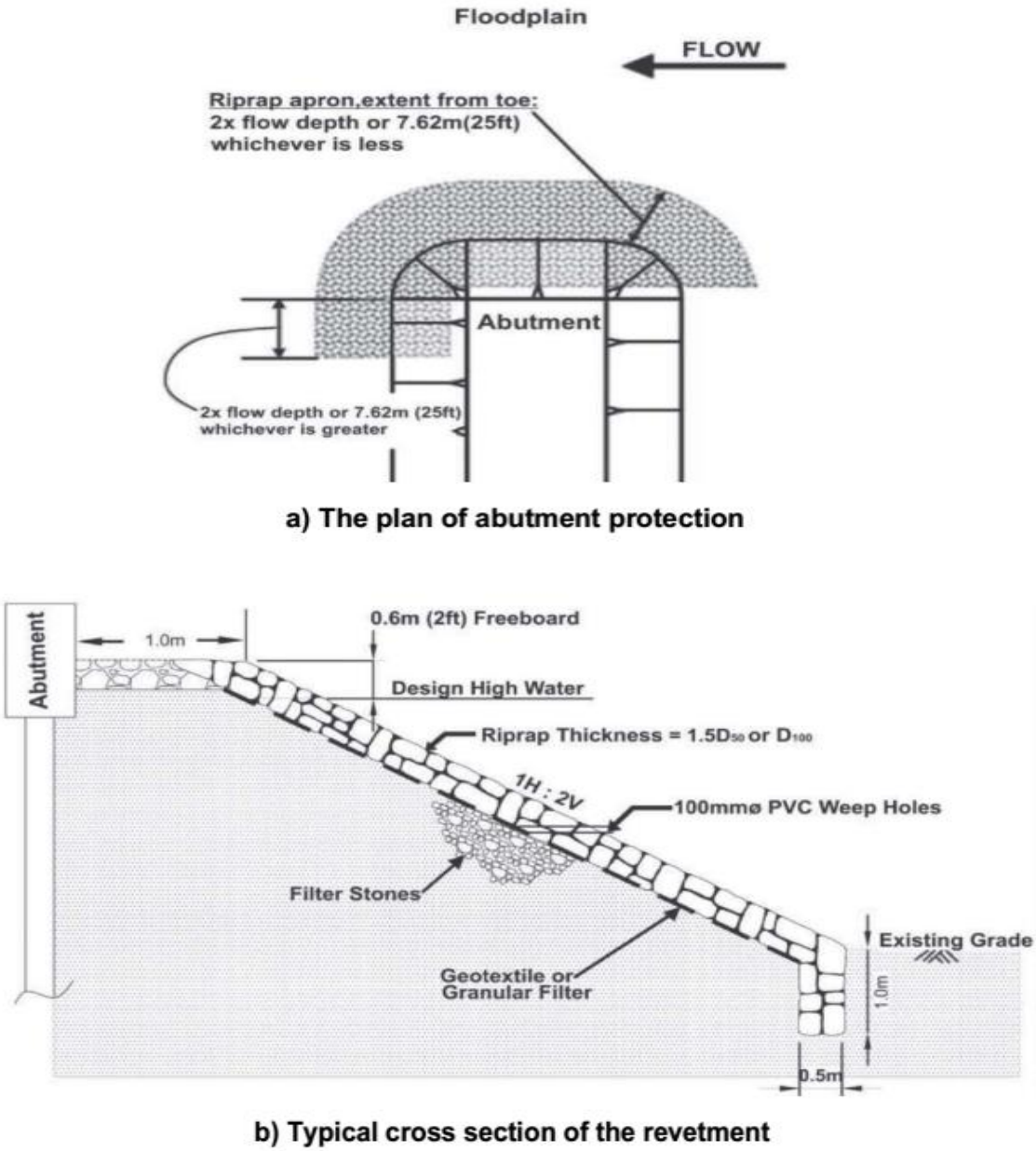
The pier footing shall be protected against a scouring of river bed by loose bolder apron, gabions, precast concrete blocks and grout-filled or sand/cement-filled bags. The example of the riverbed protection measure at the pier is shown in **Figure 14**.



Source: JICA Study Team
Figure 14. 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 15**.



Source: JICA Study Team
Figure 15. Example of Protection for Abutment

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.

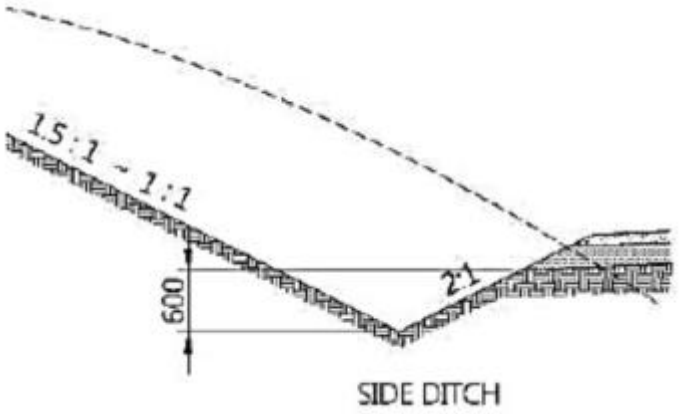
- Chapter 5 Highway Drainage DGCS Volume 4 Highway Design 2015, BoD, DPWH
- Guidelines for drainage work; Japan Road Association

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 16.**



Source: JICA Study Team
Figure 16. 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

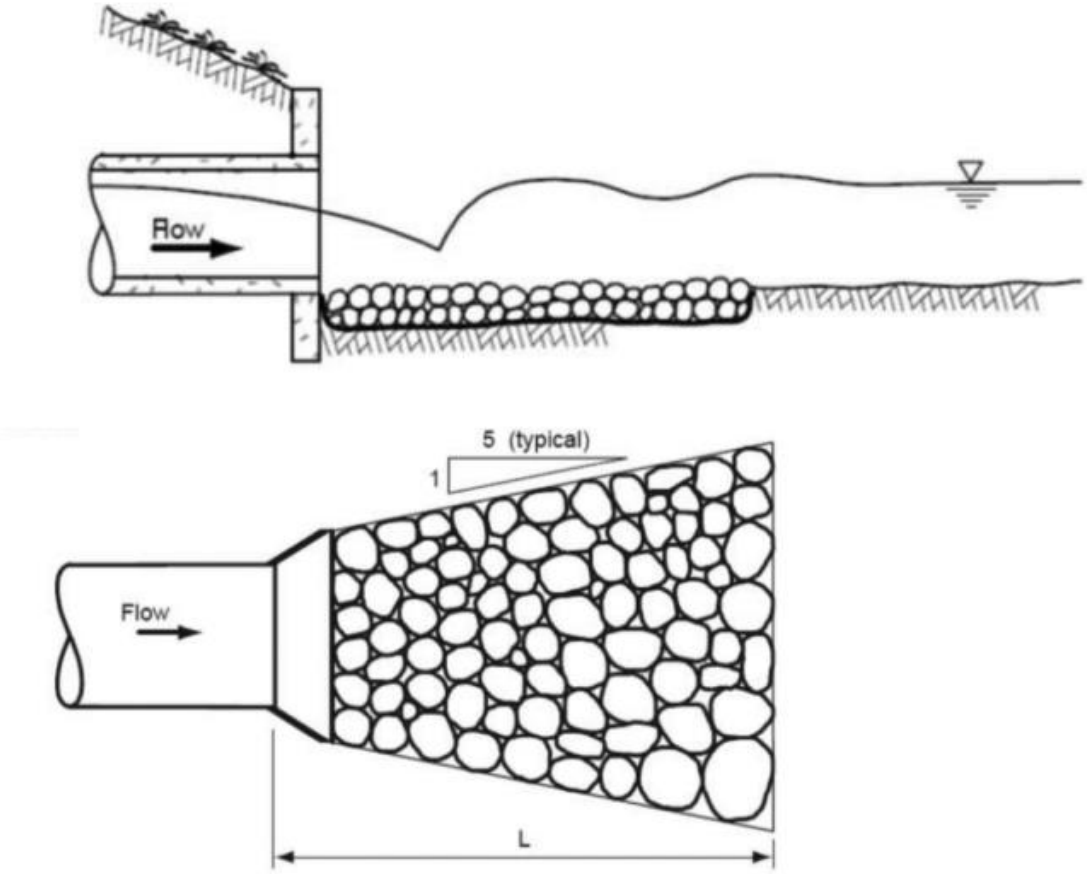
1) Discharge (Hydrologic Analysis)
2) Hydraulic and Structural Design of Culvert

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 17**.



Source: JICA Study Team

Figure 17. 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 project is 16.8 km and 3 bridges with total length of 460m.

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 1,937 for skilled and 4,264 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 1,535.60.** 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.9	16.772	3	460	1	1,419.0	116.6	1,535.6	57.50	1.05	91.56

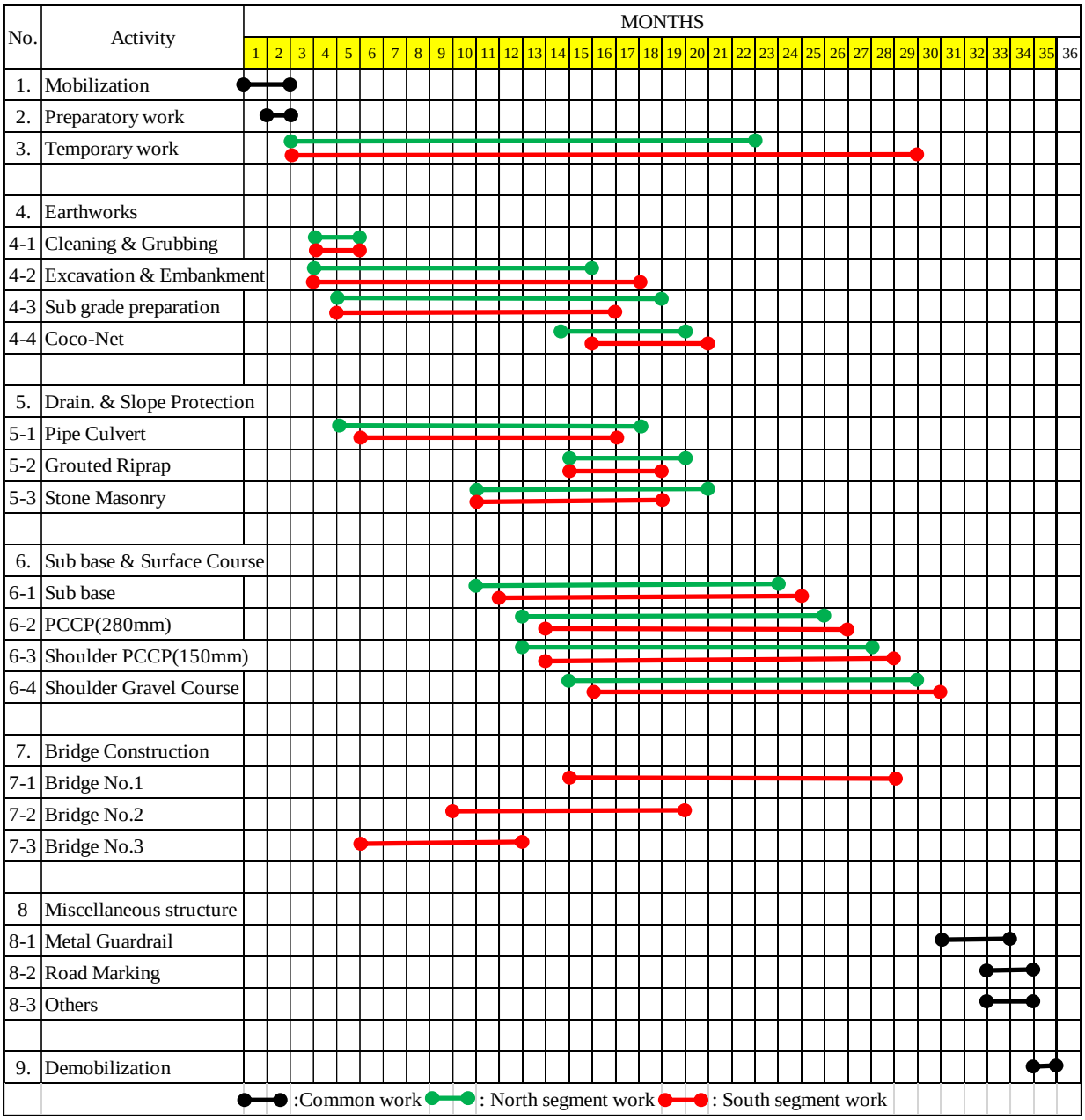
Table 16. Detailed Estimated Project Cost

Item	Contents	Qty.	Cost (mill. php)	Cost per km (mill. Php)	Bridge/m (mill. Php)	Portion (%)
A	Facilities for engineer	1.0	21.956	1.35		1.4%
B	Other general requirement	1.0	49.889	3.06		3.2%
C	Earth work	1.0	271.013	16.61		17.6%
D	Subbase and base course	1.0	120.976	7.42		7.9%
E	Surface course	1.0	316.863	19.43		20.6%
F	Bridge structure (Total)	245m	481.013		1.05	31.3%
	F1	160m	270.151		1.00	17.6%
	F2	60m	161.336		1.08	10.5%
	F3	25m	49.525		1.24	3.2%
G	Drainage and slope protection	1.0	68.035	4.17		4.4%
H	Miscellaneous item	1.0	89.188	5.47		5.8%
I	Farm to Market road	11km	116.628			7.6%
	Grand Total		1,535.562	57.50		100.0%

1.10 Project Duration and Schedule

Estimated construction period is 35 months. **Table 17** shows the project duration and schedule.

Table 17. Project Duration and Schedule



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 Road and Bridges Project

The project falls under **item D.3.c (Roads, new construction, widening including RO-RO facilities)** with a total length of 14 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 were held on February and March 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 Kilala, Dulay West, Papandayan Caniogan, Guimba, Pantao, Rorogagus East, Bogang and Banga in Marawi, Barangays Palao, Matampay, Bacong and Daanaingud in Marantao, Barangays Rantian, Paling and Bobo in Piagapo, Barangays Mipaga, Bubong, Pagalamatan, Lumbaca Toros, Bagoaingud, Alinun, Linao and Lombayanague in Saguiaran 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 **Item Major Roads and Bridges D.3.c (Roads, new construction, widening including RO-RO facilities)** with a total length of 65.7 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 28** 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 Area	Agricultural Area	Total
Parang, Maguindanao	Gadungan	0	8,365	8,365
	Orandang	2,522	56,319	58,841
	Cabuan	774	37,229	38,003
	Sub-total	**3,296**	**101,913**	**105,209**
Sultan Kudarat, Maguindanao	Olas	659	143,955	144,614
	Nekitan	0	39,433	39,433
	Matengen	0	123,595	123,595
	Sub-total	**659**	**306,983**	**307,642**
Pigcawayan, North Cotabato	North Manuangan	0	55,352	55,352
	New Culasi	0	36,140	36,140
	Sub-total	**0**	**91,492**	**91,492**
	TOTAL	**3,955.00**	**500,388.00**	**504,343.00**

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.

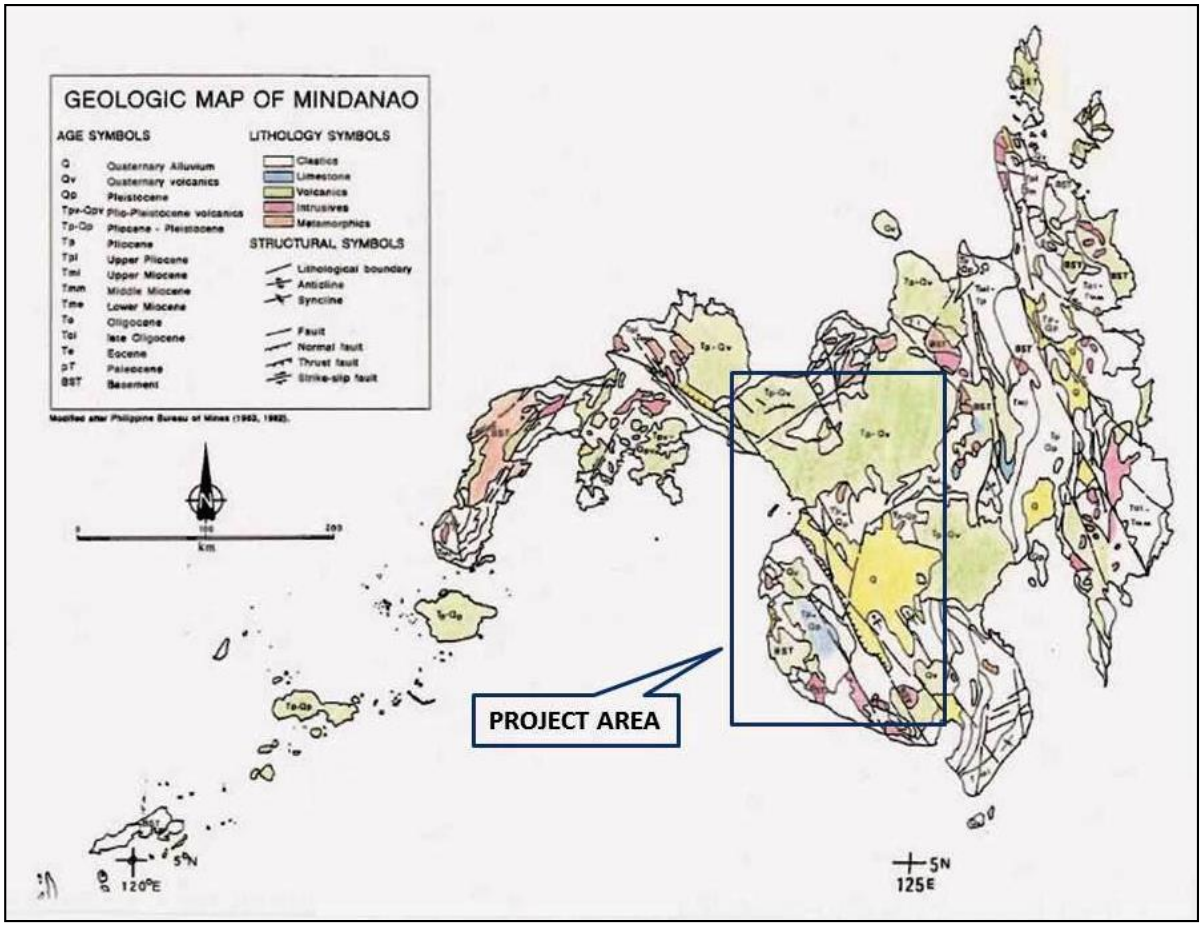
3.1.2.1 Regional Setting

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 18**.



Source: MGB, as cited in Corpuz, 1992

Figure 18. General Geology of Mindanao

3.1.2.1.2 Tectonics

Mindanao Island is a composite of at least two terrains; 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 terrains were separated by an ocean that disappeared continuously by subduction of its two edges beneath western and eastern Mindanao. The suturing of the two terrains 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 19**. 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).

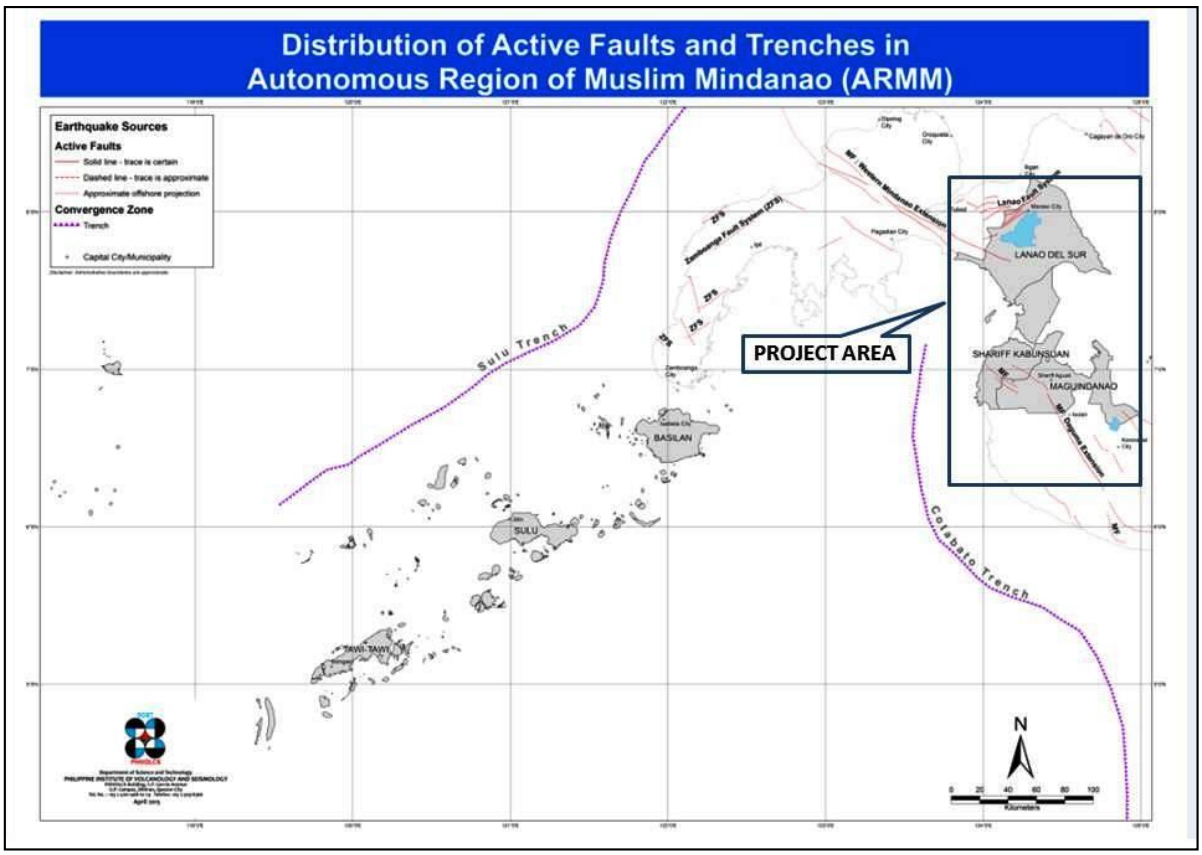
c) Philippine Fault Zone

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.



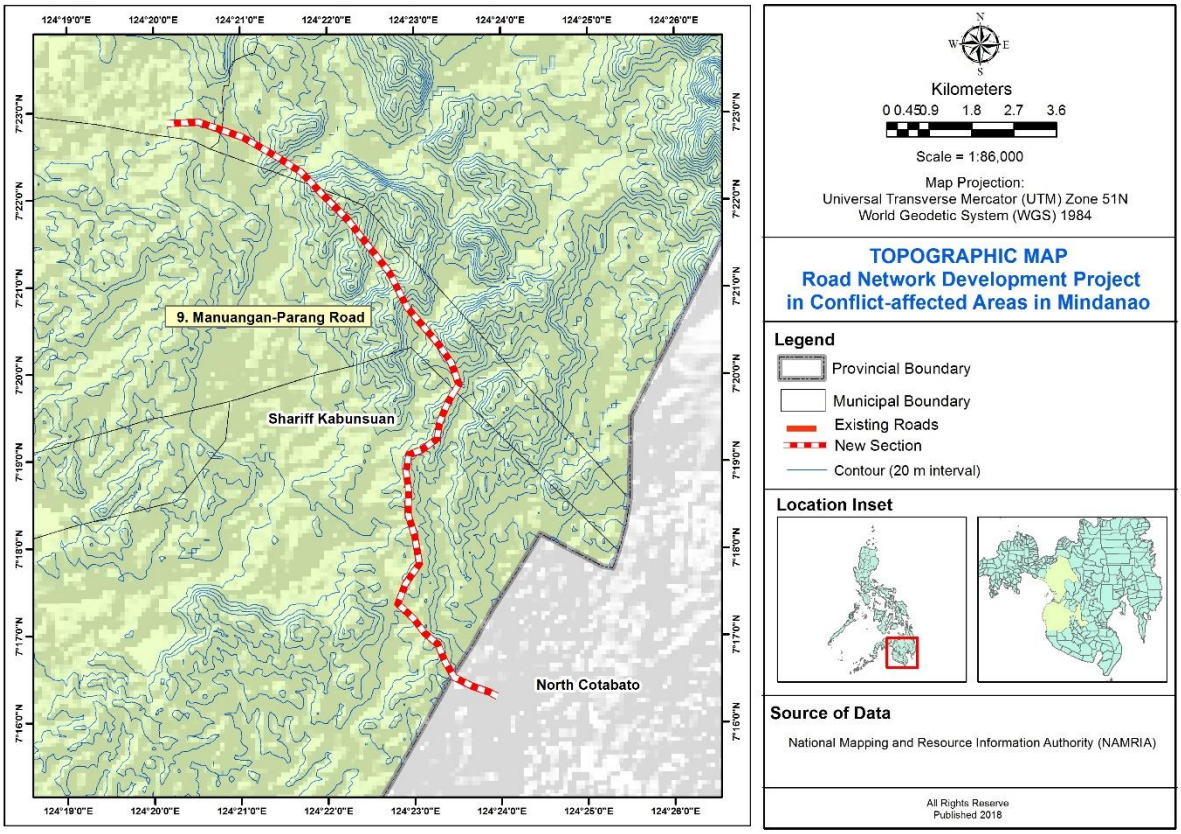
Source: PHIVOLCS

Figure 19. 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 20** shows the topographic map of the area.



Source: NAMRIA
Figure 20. 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.

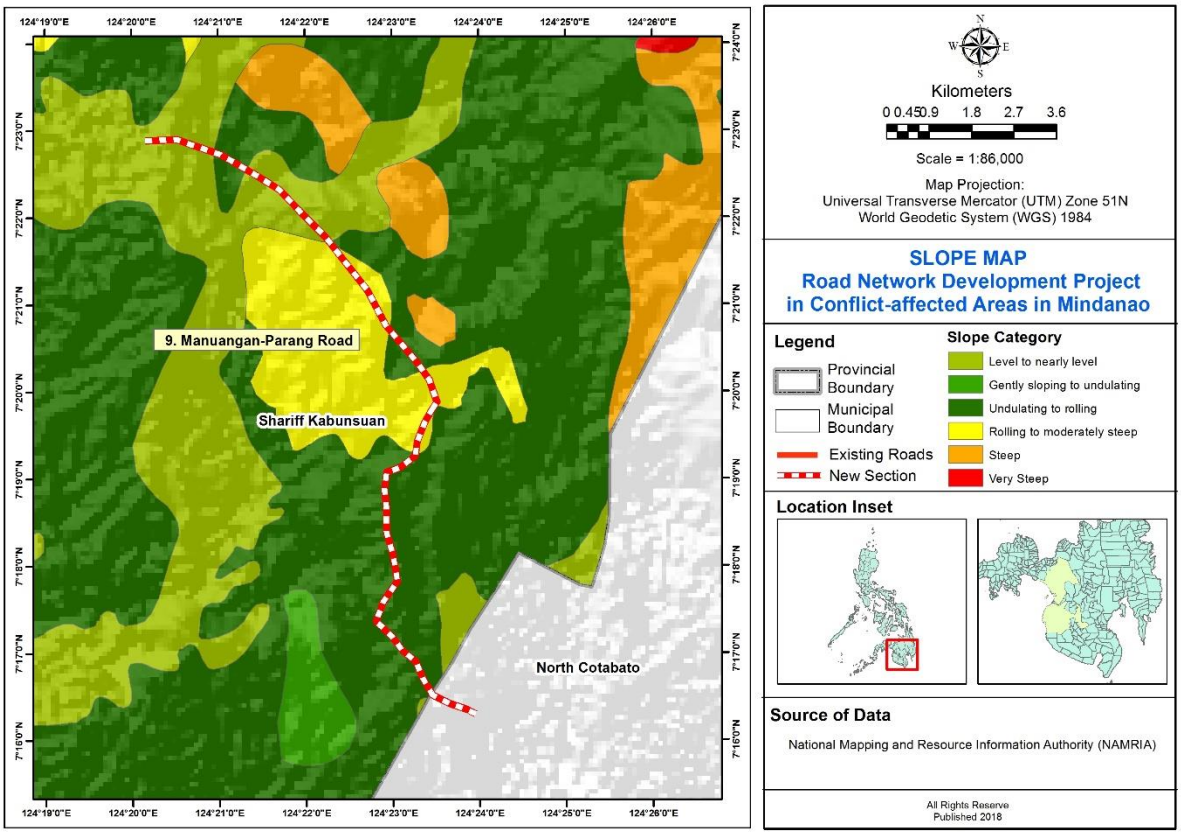
The undulating to rolling area is underlain by volcanic and/or sedimentary rock formation that gave rise to undulating to rolling ground. The ground slope ranges from 8 to 18 degree. The groundwater table is expected to be fairly deep. Most areas are covered with assorted secondary growth trees, coconuts, 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 21** shows the slope map of the project site.

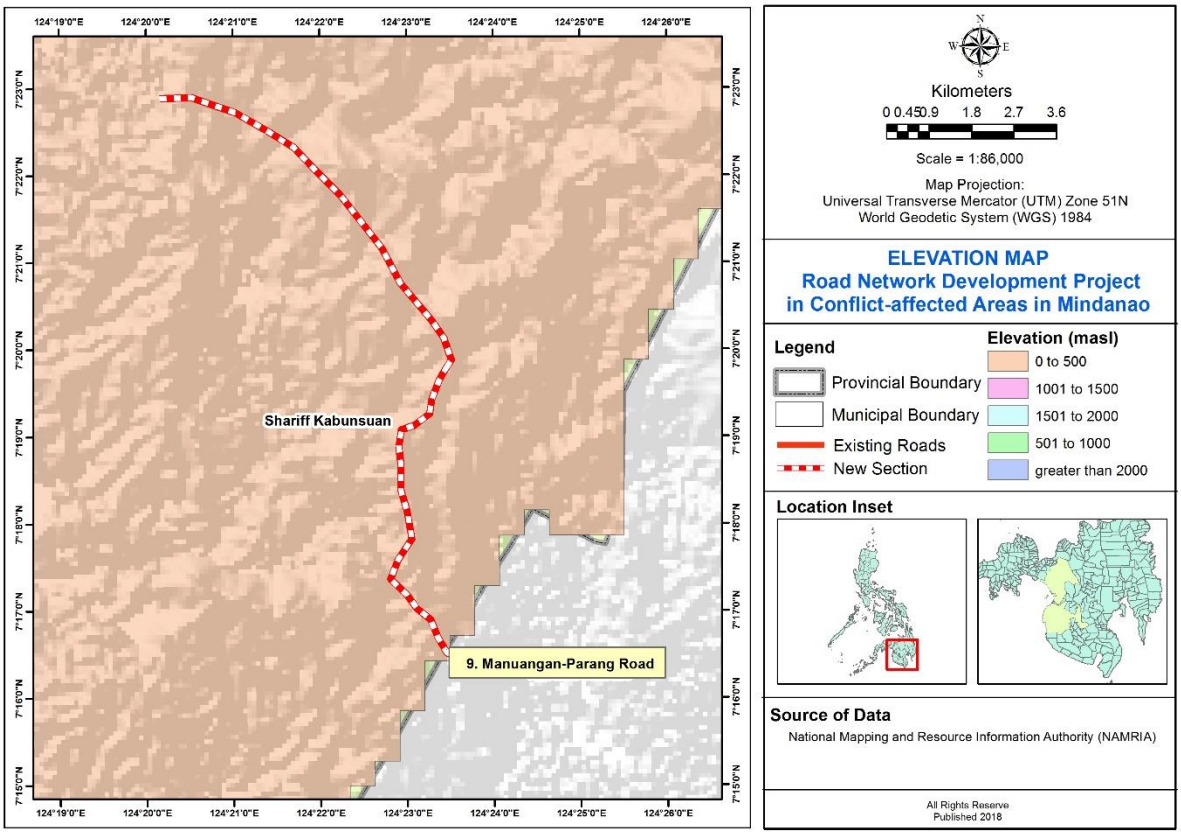
Table 24. Slope Classification of the Project Area

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 21. Slope Map of the Project Area

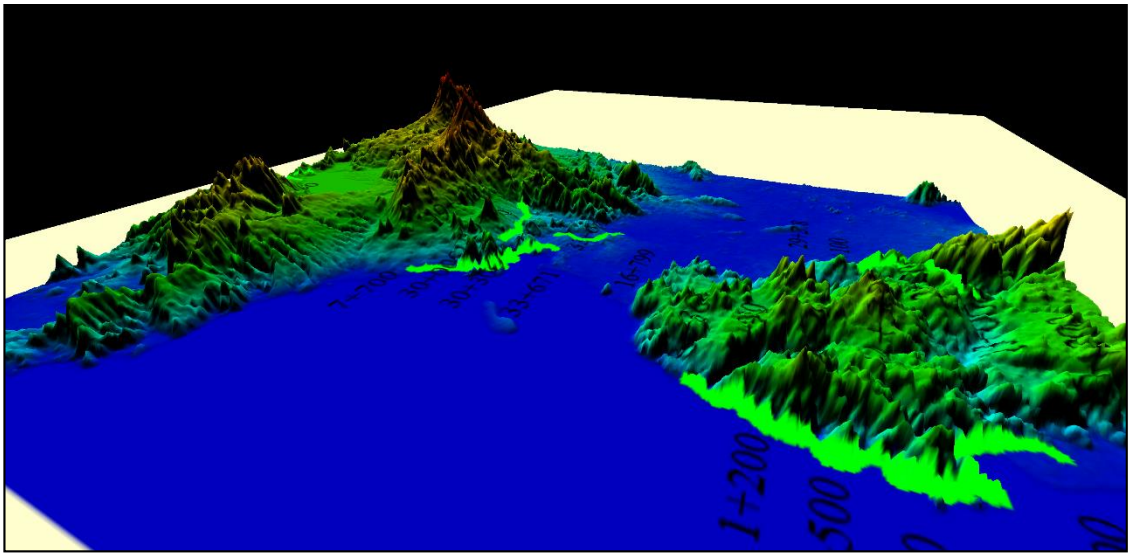
Generally, the elevation within the project area varies from 0 to 500 meter above sea level (masl) and from 501 to 1000 masl. The lower elevation is concentrated mainly at SP 9 – Manuangan-Parang Road. **Figure 22** shows the elevation map of the project site.



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

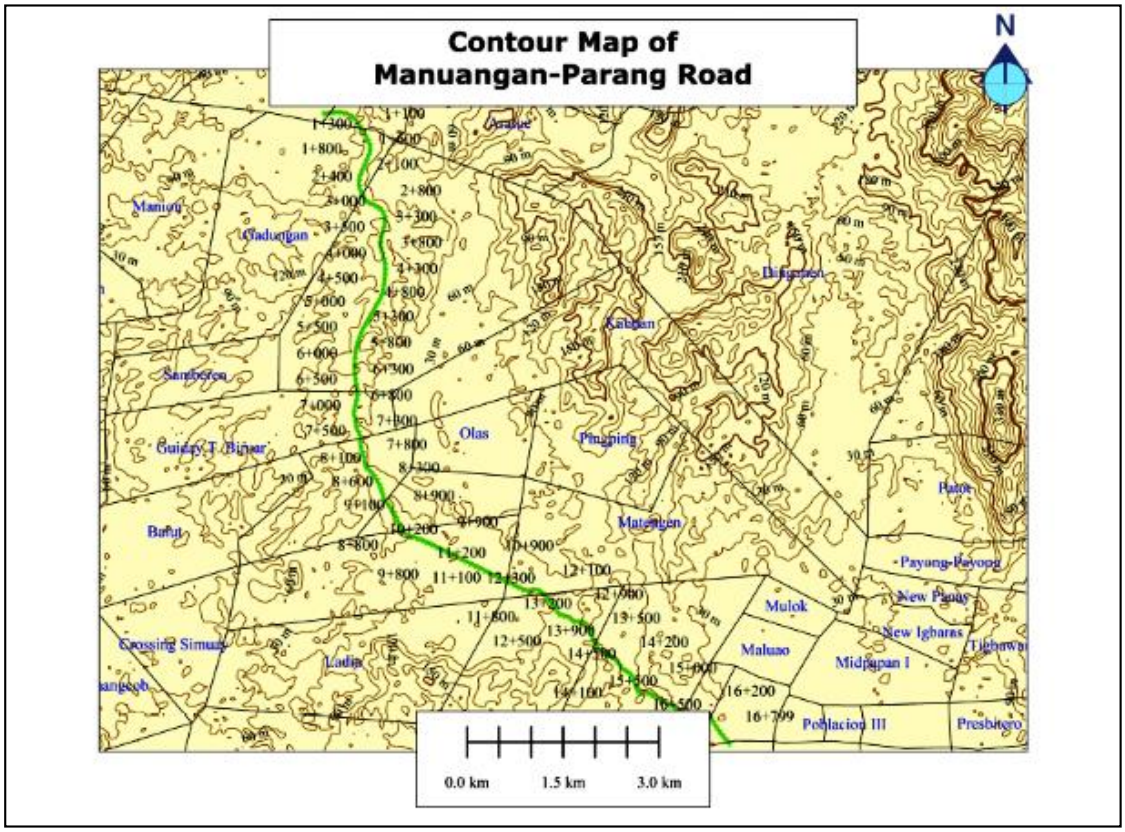
3.1.2.2.2 Geomorphology

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 23** shows the type of rock transected by the proposed roads.

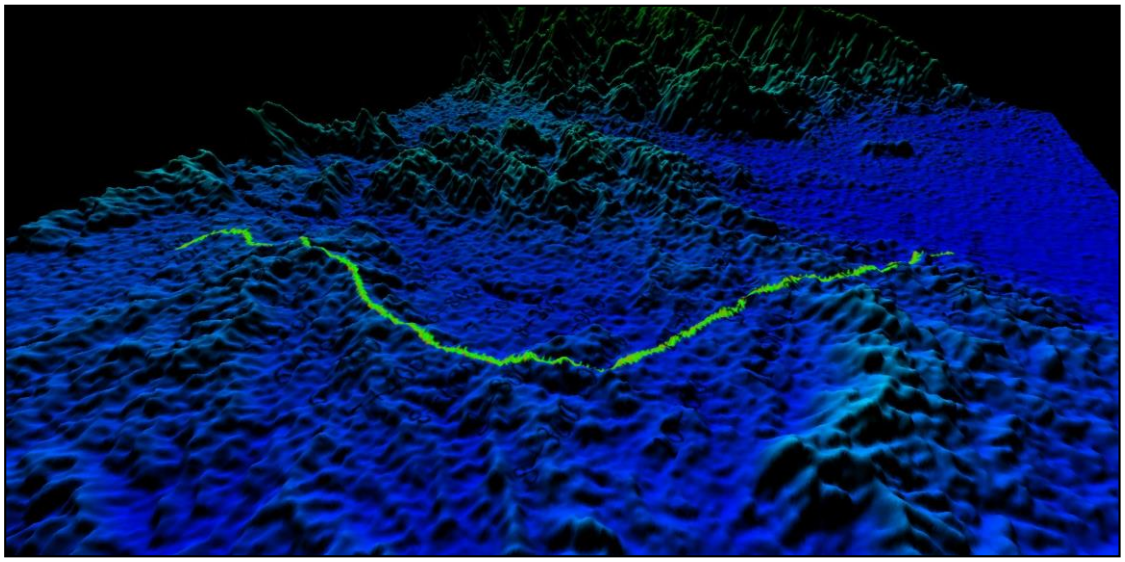


Base Map Source: JICA Study Team
Figure 23. 3D View of Type of Rock (pyroclastics/volcaniclastics/submarine rocks) Transected by the Proposed Roads.

The contour maps and 3D maps of the Project are shown in **Figure 24** and **Figure 25**. The proposed Manuangan-Parang Road transects the volcanic rocks in the area. The general topography is a combination of undulating and steep to very steep terrain with elevation ranging from 200 to 250 meters above sea level (masl).



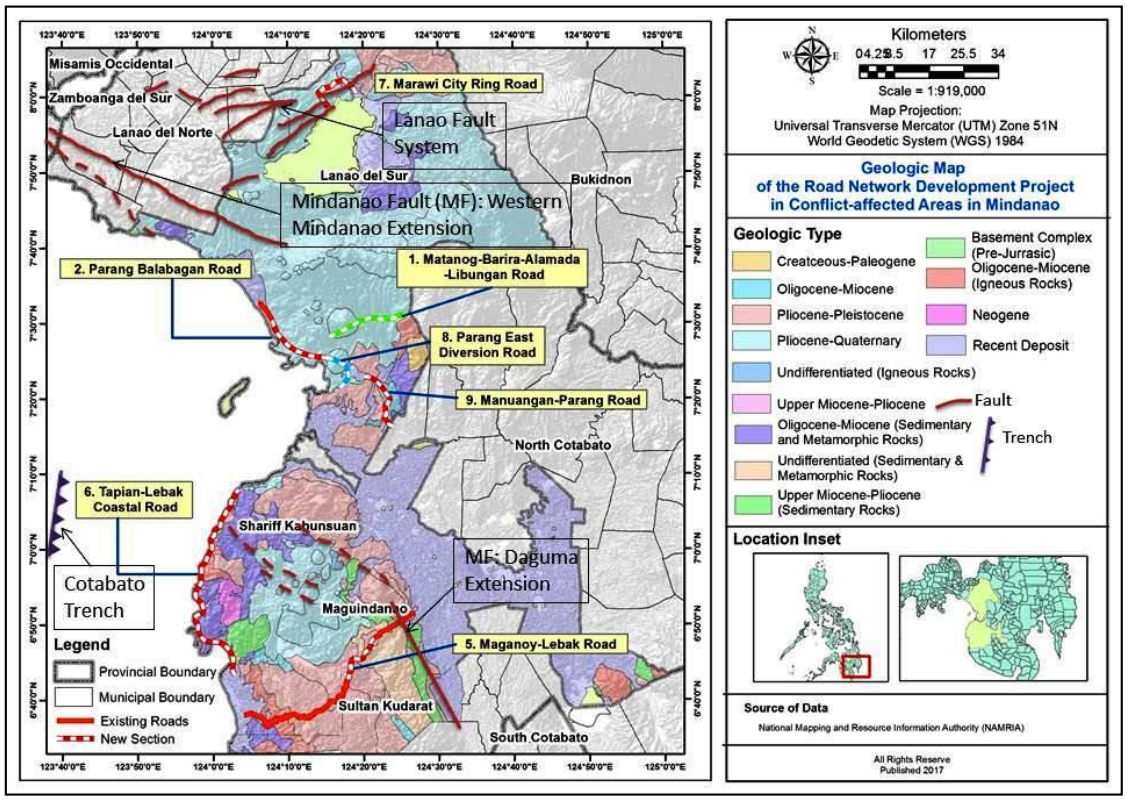
Base Map Source: JICA Study Team
Figure 24. Contour Map of SP No. 9 Manuangan-Parang Road



Base Map Source: JICA Study Team
Figure 25. 3D View of SP No.9 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 26** presents the geologic map of the project area.



Source: JICA Study Team
Figure 26. 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.

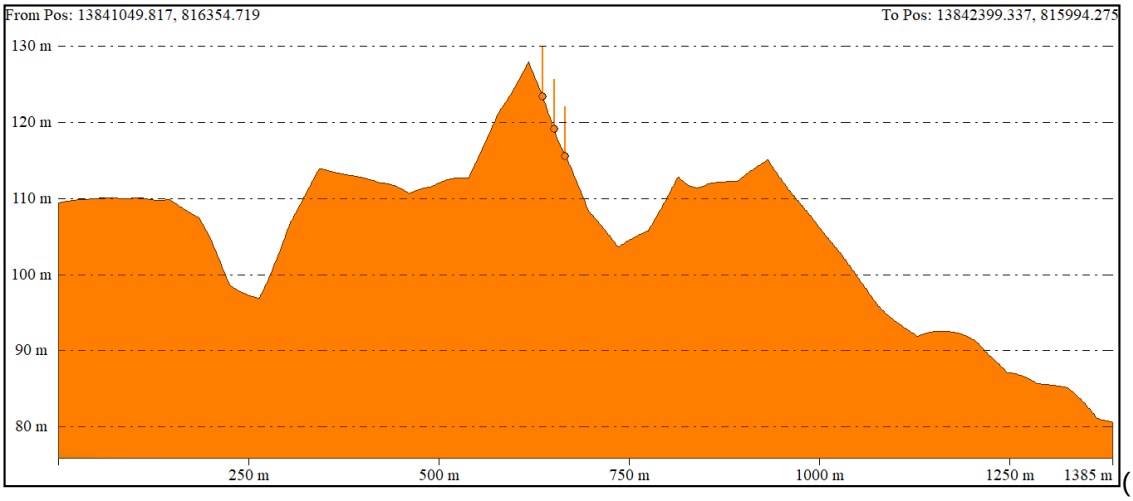
Thick, extensive, transgressive mixed shelf marine deposits, largely wackes, shales and reef limestone are also present. These are underlain by conglomerate and associated with coal measures in places. Sometimes the rock unit is associated with basic to intermediate flows and pyroclastics. They are largely arkosic and quartzitic clastics, generally well-indurated, ffolded 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 27 shows the proposed road section is underlain by reworked calcium carbonate rocks or reworked tuffaceous sediments. Slope stability problem may be encountered due to the high-gradient of the slope.



Source: Google Earth Elevation Profile)

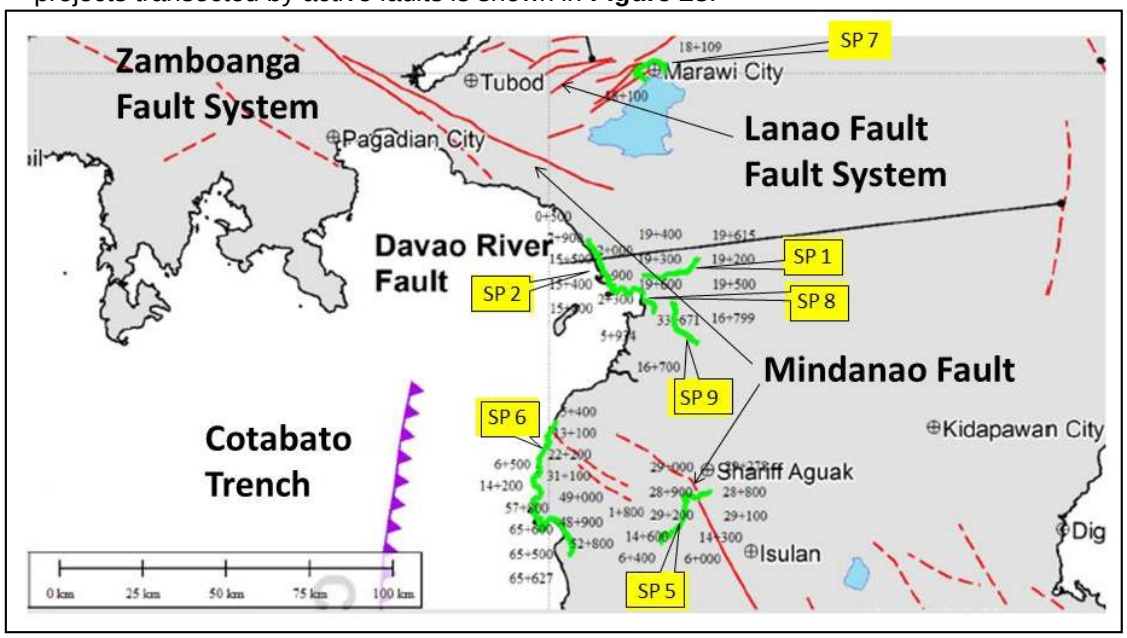
Figure 27. Sta 3+200 -Representative Geologic Profiles along SP No. 9 Manuangan-Parang Road

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 28**.



Source: PHIVOLCS

Figure 28. 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.

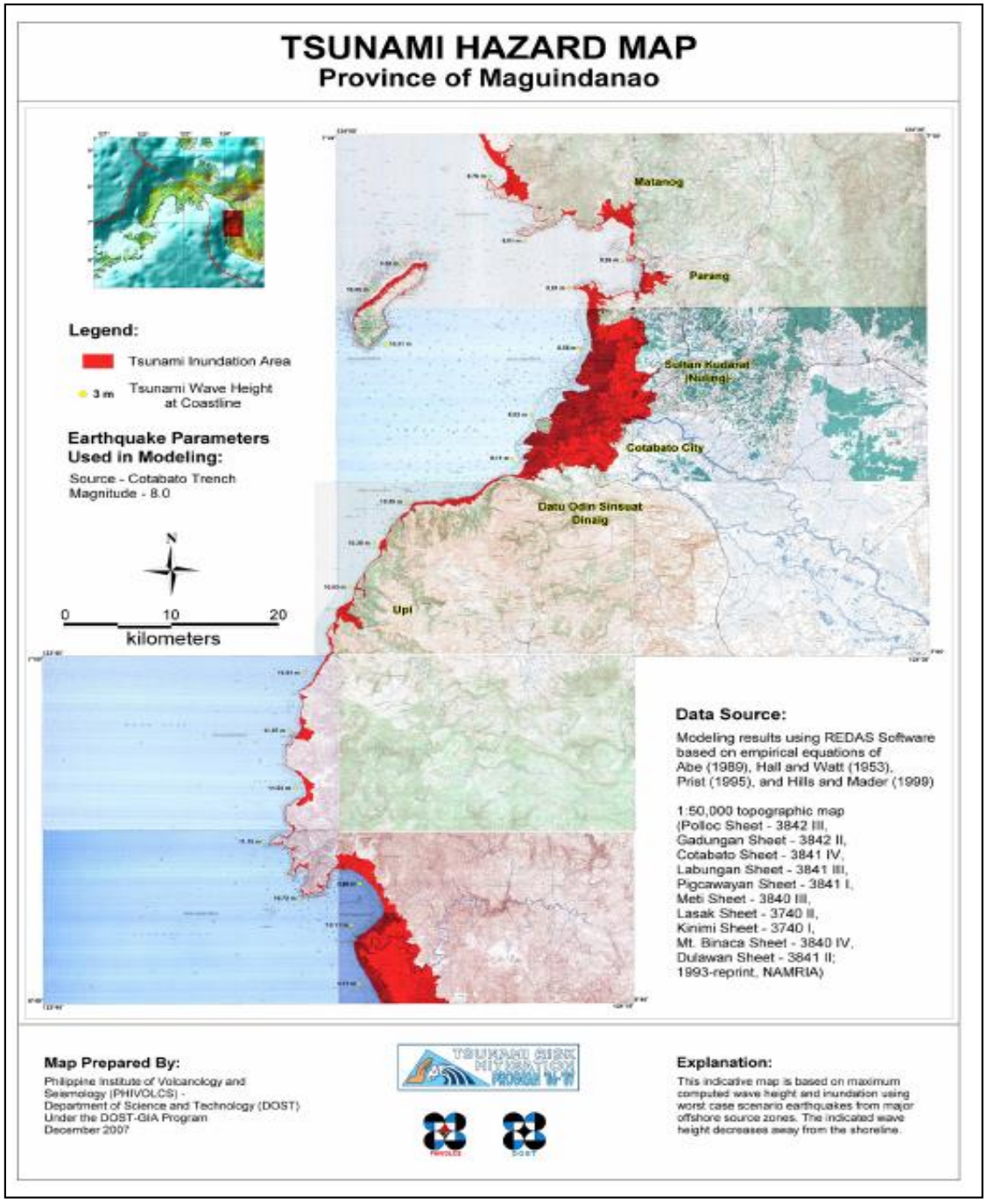
The proximity of active faults to the proposed road alignments indicates that moderately strong to strong ground shaking could be felt in the project area.

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).

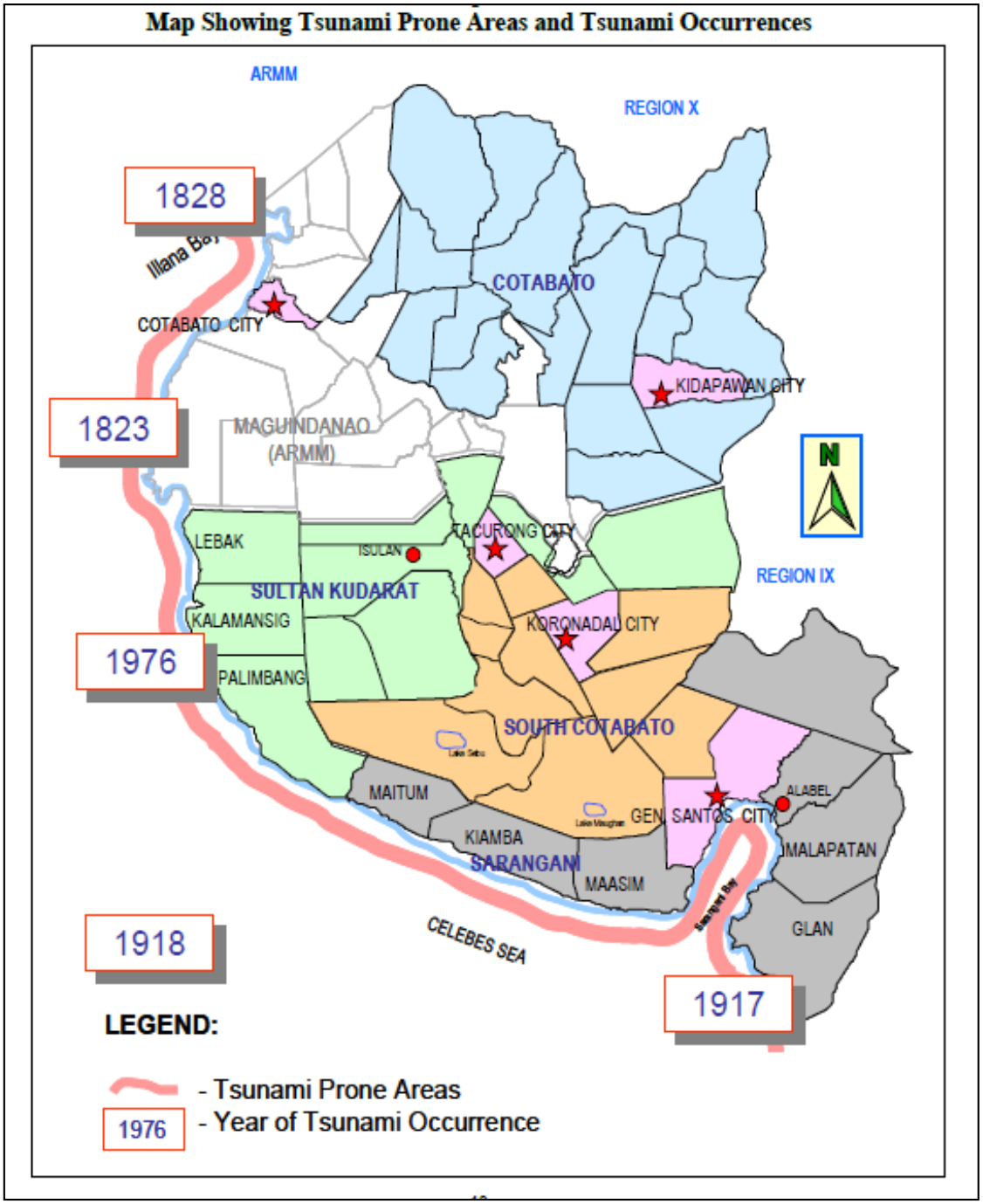
PHIVOLCS has prepared tsunami hazard map for Maguindanao as shown in **Figure 29** using a magnitude 8.0 tsunamigenic earthquake generated by the Cotabato Trench, as parameters. Based on the map, SP-9 is not prone to tsunami since the area is far from the coastal line.



Source: PHIVOLCS

Figure 29. Tsunami Hazard Map of Maguindanao

The historical tsunami occurrences within the region is shown in **Figure 30**.



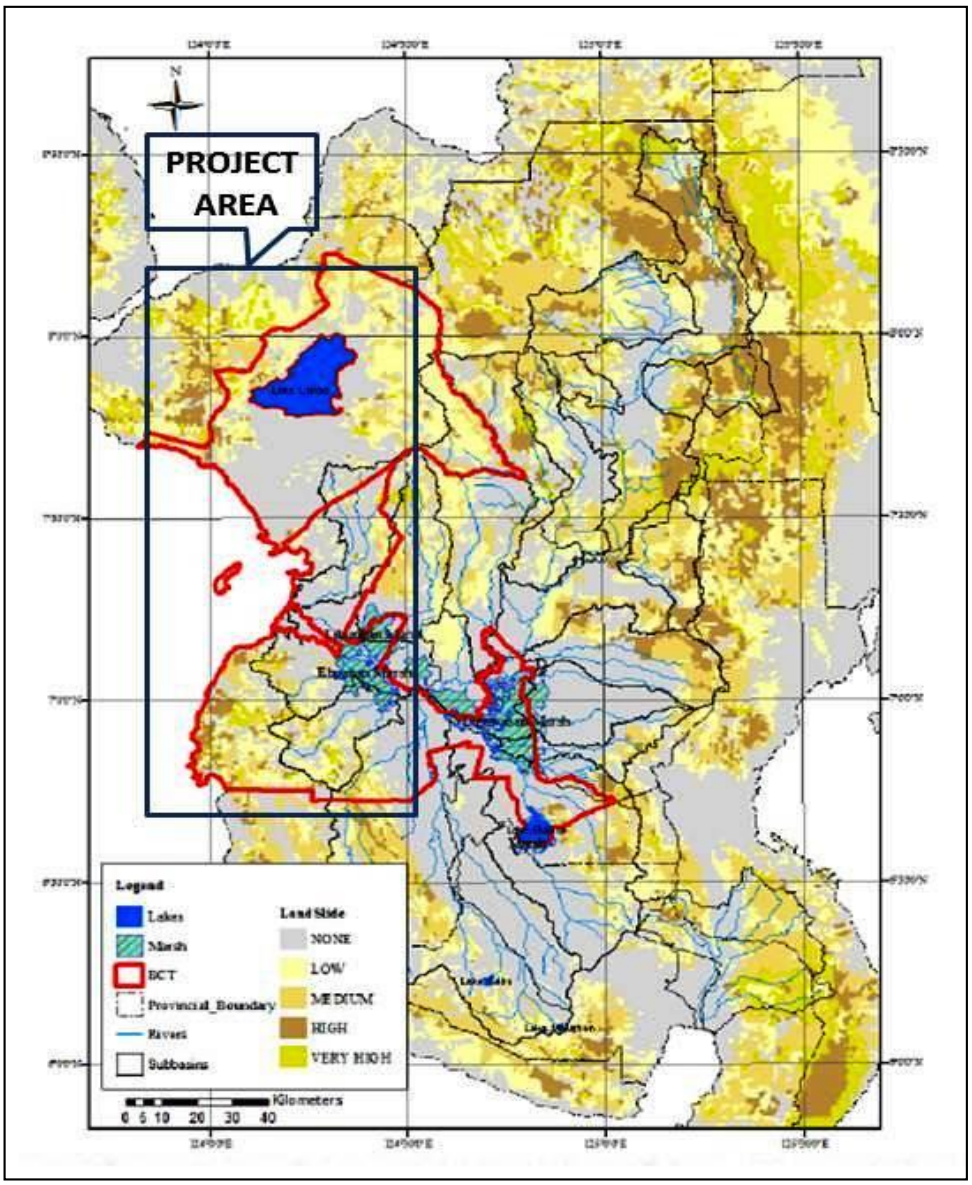
Source: Region XII DRM

Figure 30. 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 31** by the PHIVOLCS regional map of earthquake-triggered landslide, the mountainous areas in the region could experience low to moderate susceptibility to this hazard.

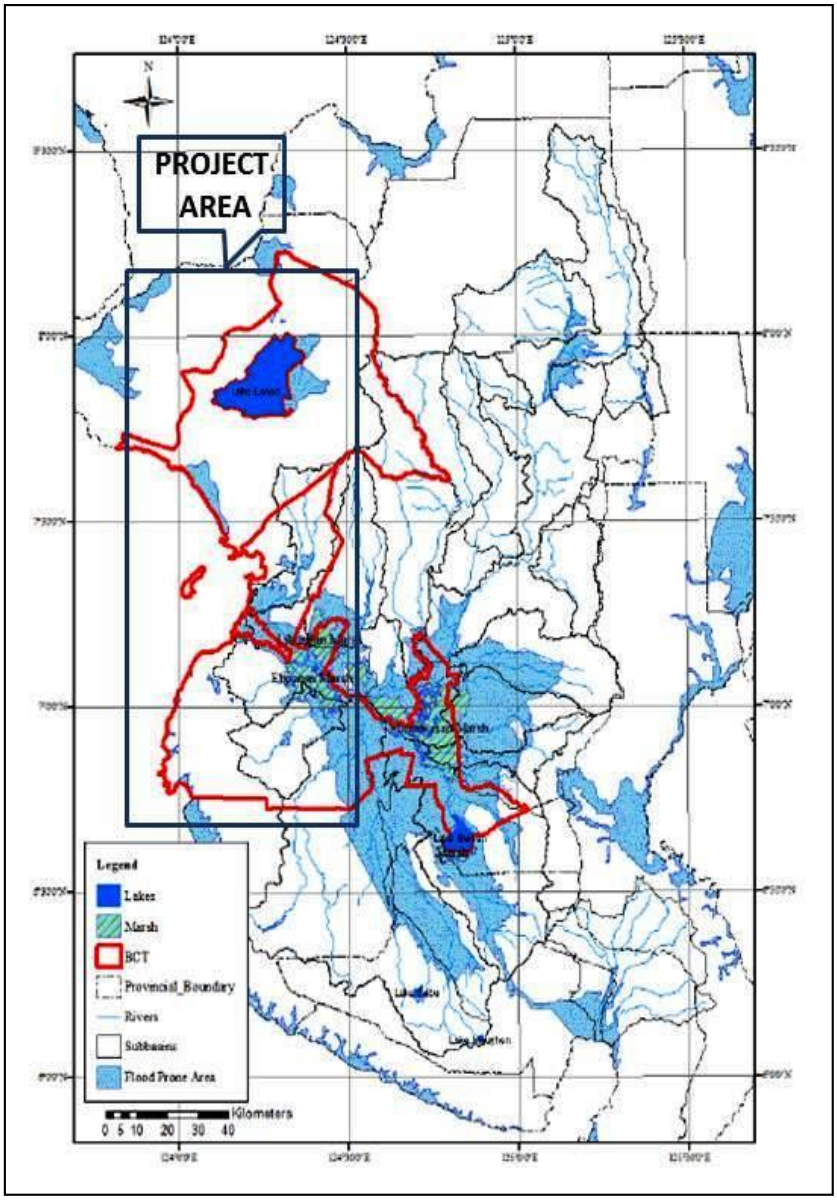


Source: PHIVOLCS
Figure 31. Earthquake-triggered Landslide Map

3.1.2.4.5 Flooding

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

Figure 32 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 32. Flood-prone Areas in Bangsamoro Region

Flood susceptibility in the Manuangan-Parang 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 Manuangan-Parang Road is underlain by volcanic and/or sedimentary rocks which are not considered susceptible to liquefaction.

3.1.2.4..7 Volcanic Hazard

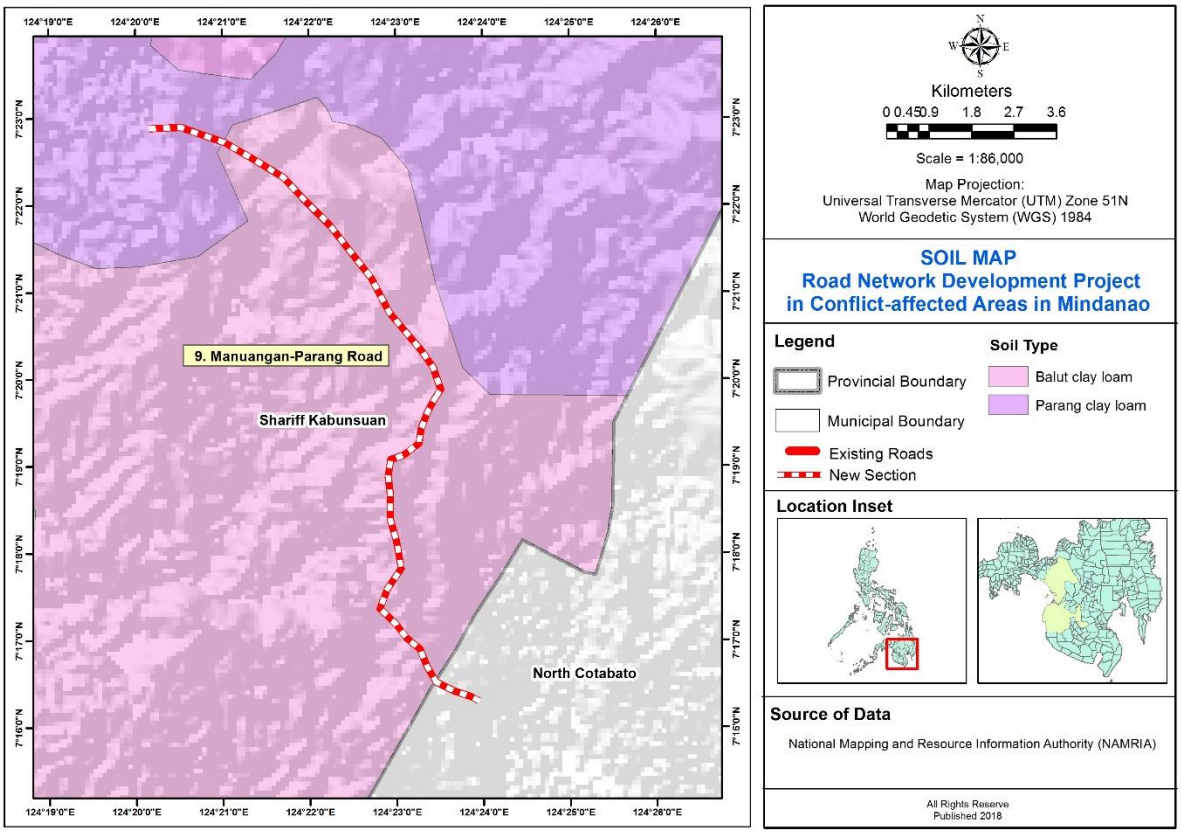
Five volcanoes within or proximate to the Project Area have been considered by PHIVOLCS as active. These are Mt. Makaturing in Lanao del Sur, Mt. Matutum in Cotabato, Mt. Musuan in Bukidnon, Mt. Parker in South Cotabato/General Santos/North Cotabato/Sarangani Provinces, and Mt. Ragang in Lanao del Sur 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 clay loam to Parang clay loam. **Figure 33** shows the soil map of the study area.



Source: NAMRIA (JICA Study Team)

Figure 33. Soil Map of the Project Area

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 Sultan Kudarat, Parang and Pigcawayan. **Figure 34** 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 35** presents the photos showing the vegetation in the area.

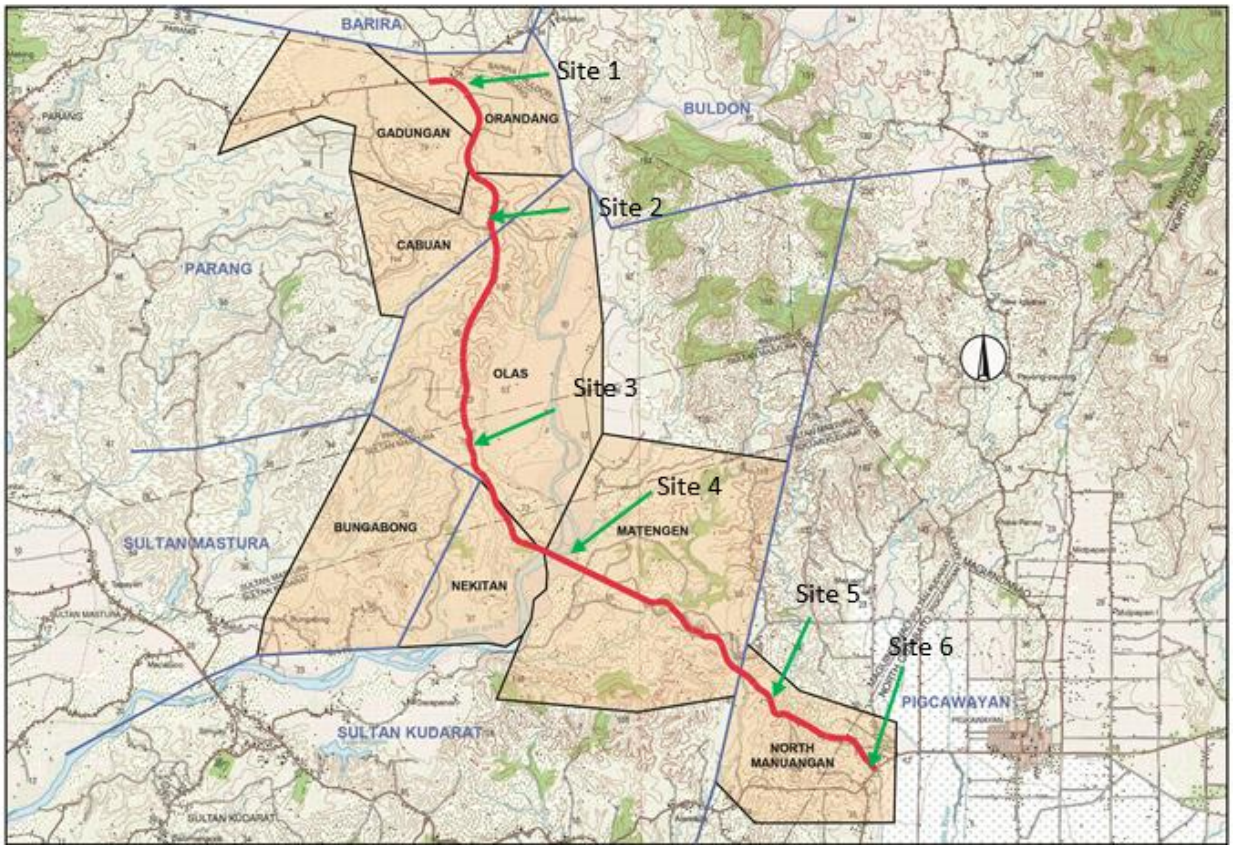


Figure 34. Location of Sampling Sites within the Proposed Road Alignment

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

Municipality	Barangay	Geographic coordinates	
		Northing	Easting
Parang	Orandang	7°22'51.18"	124°20'10.69"
	Cabuan	7°21'25.12"	124°20'31.58"
Sultan Kudarat	Olas	7°19'17.56"	124°20'20.26"
	Matengan	7°18'17.88"	124°21'22.92"
Pigkawayan	South Manuangan	7°17'3.69"	124°23'5.76"
	North Manuangan	7°16'28.29"	124°24'2.34"

Brgy. Orandang, Parang

Brgy. Cabuan, Parang

Brgy. Olas, Sultan Kudarat

Brgy. Nekitan, Sultan Kudarat

Figure 35. 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 alignment, 6 sampling plots with a dimension of 20 m by 20 m were established for the identification of tree species at the canopy layer with diameter at breast height (dbh) of 10 cm and above. The dbh and height of each tree were measured 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 intermediate canopy. All pole size trees with dbh ranging from 5cm to 9.5 cm were recorded and measured. At the ground canopy, a 1m x 1m sub-plot is also measured for the identification of species representatives immediate the ground layer.

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

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

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

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 assessed area is a prime agricultural area planted with coconut, corn and aggregates of other perennial crops including banana and fruit bearing trees. Other than agricultural crops, vegetation cover within the proposed alignment also comprised of naturally growing and planted tree species. There are 64 plant species identified in the sampled areas within the alignment belonging to 27 families dominanted by Fabaceae. The 33 species were recorded from the 6 sample plots and sub-plots, and the remaining 31 species are observed outside the plots following the alignment. Species dominating the canopy layer is the Niog or *Cocus nucifera* while Kakauate or *Gliricidia sepium* dominates the understory layer. On the other hand, Hagonoy or *Chromolaena odorata* is the most common in the ground layer. The computed biodiversity index of the study area reveals a low diversity composition. With regards to the conservation status of the listed species reveals that only the Narra or *Pterocarpus indicus* is the only critically endangered in the IUCN category.

With regards to fauna composition of the study area, most of the species observed are common and distributed in a wide range of habitats, including agricultural areas, settlements, grassland and open areas. Diversity composition is found to be nominal which is possibly influenced by the current vegetational cover. Likewise, no endangered species observed nor reported within the study area. Endemism of the recorded species showed that only 3 of the faunal species are endemic to the country.

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. Based on the table below, out of the 64-species identified from the project area, one (1) is critically endangered (CR), and three (3) are vulnerable (VU). **Figure 36** shows some species found in Plot numbers 1 & 2. **Table 27** provides the list of species and its corresponding status.

Table 27. List of Species and its corresponding Conservation Status

SPECIES			CONSERVATION STATUS
COMMON NAME	SCIENTIFIC NAME	FAMILY	
Narra	*Pterocarpus indicus* Willd.	FABACEAE	CR
Amugis	*Koordersiodendron pinnatum* (Blanco) Merr.	ANACARDIACEAE	VU
Puso-puso	*Neolitsea vidalii* Merr.	LAURACEAE	VU
Dalinsi	*Terminalia pellucida*	COMBRETACEAE	VU

A. Amugis (*Koordersiodendron pinnatum)* (Located adjacent plot no. 2)

B. American Kapok (*Ceiba pentandra*) (Located in Plot no. 1)

Figure 36. Family percentage in terms of species count

i. Floristic composition

A total of 64 species belongs to 59 genera and 27 families were identified from the proposed Manuangan-Parang Road within and outside the sampling plots, following the alignment. Fabaceae is found to be the dominant family in the project site in terms of species count by having both 8 (12.50%) species, seconded by Moraceae with 7 (10.938%) species, respectively as shown in **Figure 37**. While thirteen (13) families were represented by only 1 (1.563%) species and genera.as presented at **Table 28**.

Table 28. Families with Highest Number of Genera and Species Along the Proposed Area

FAMILY	NUMBER OF SPECIES	NUMBER OF GENERA	PERCENTAGE (SPECIES)	PERCENTAGE (GENERA)
FABACEAE	8	8	12.500%	12.500%
MORACEAE	7	2	10.938%	3.125%
POACEAE	6	6	9.375%	9.375%
MALVACEAE	5	5	7.813%	7.813%
EUPHORBIACEAE MELIACEAE	4	4	6.250%	6.250%

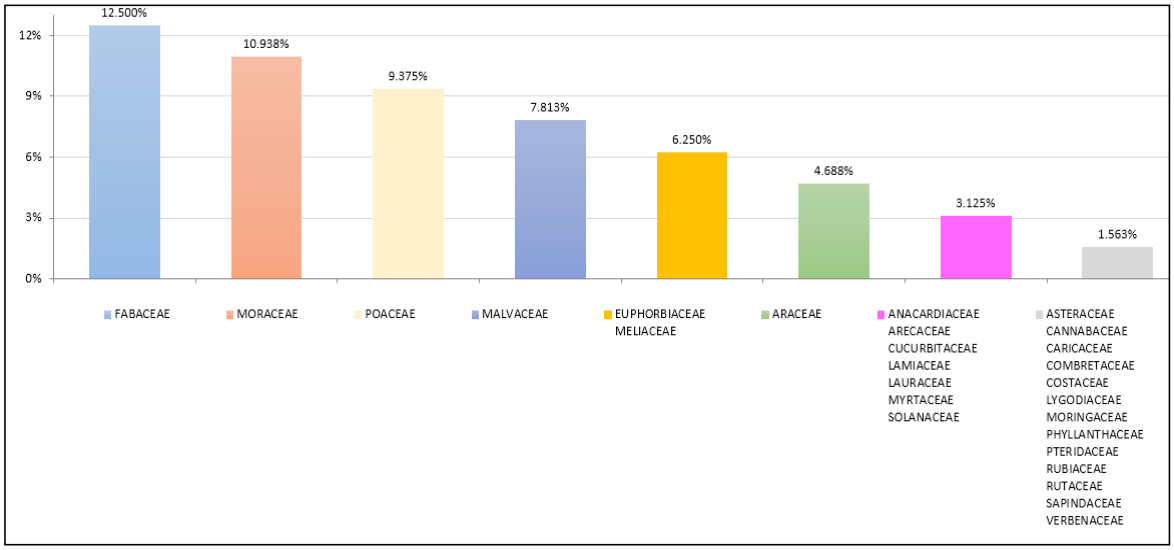


Figure 37. Family percentage in terms of species count

From the 64 plants species identified, 33 species were recorded from the 18 sample (20m x 20m, 5m x5m and 1m x 1m) plots and sub-plots. While 31 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 (56%); seconded by herb (14%), followed by grasses and shrubs (8%); palms (3%); and the remaining are ferns (2%) as shown in **Figure 38**. On the other hand, more than half (86%) of the listed species are naturally growing and the remaining (14%) species are planted on the site (Refer to Annex 13.6.1).

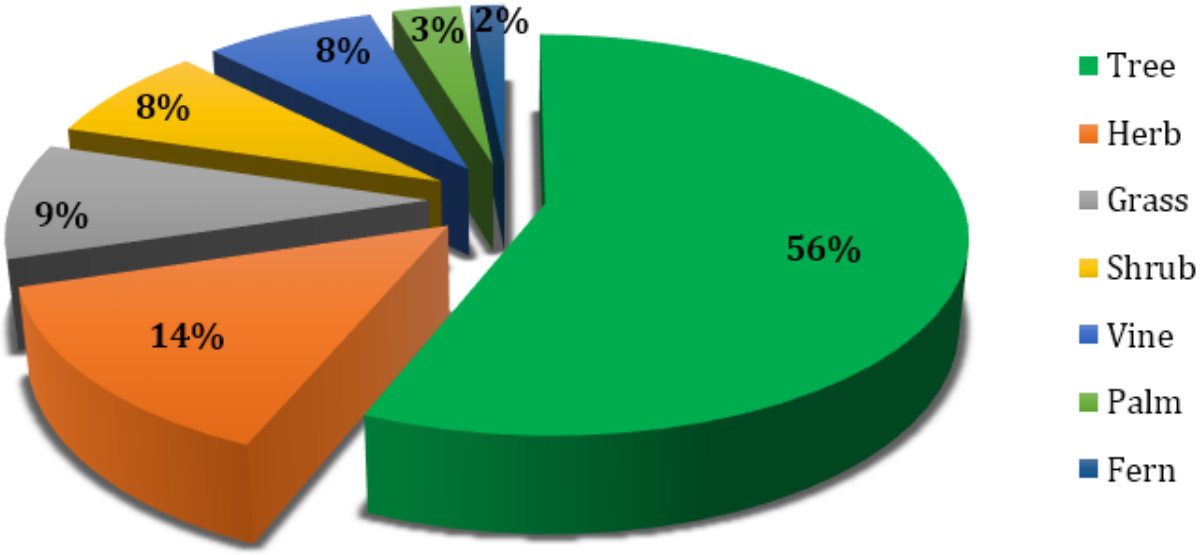


Figure 38. Distribution of plant species by their habits

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, Niog or *Cocos nucifera* has the highest relative density (Rρ) 31.429% but includes in the lowest relative frequency value of (Rf) 7.143%. It is followed by Gmelina or *Gmelina arborea* with Rρ 14.286% and has the highest Rf 14.286%, relatively. While four (4) species were represented by less than 5% density and contributed about 4 (11%) of the total 36 recorded individual trees under 11 identified species.

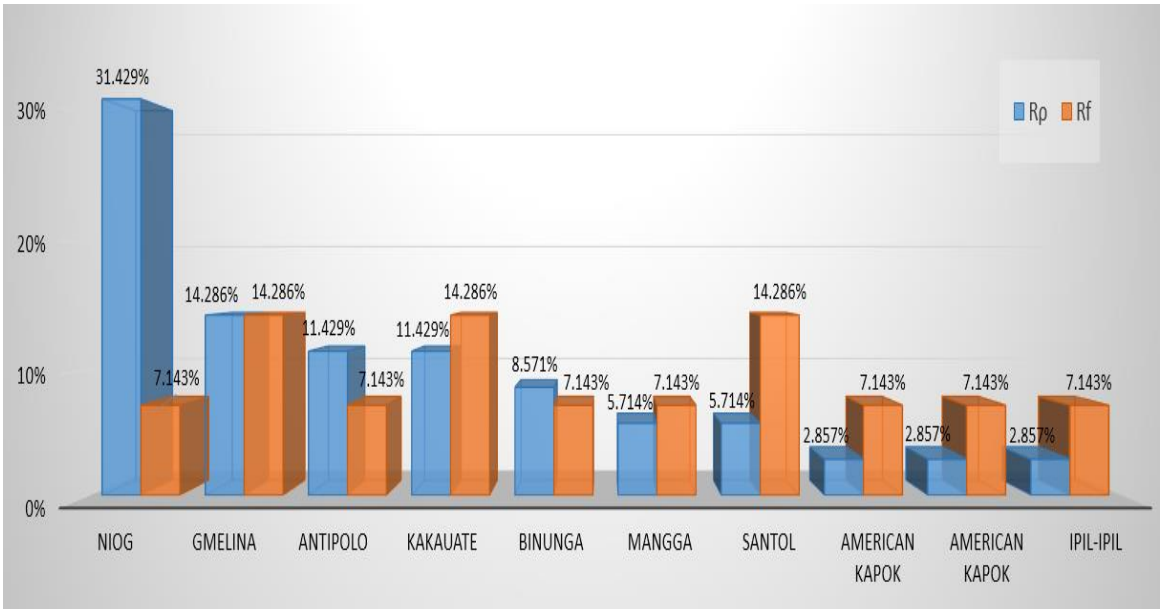


Figure 39. Species in the Canopy Layer with their Corresponding Density and Frequency

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**, plot 5 has the highest value of 1.705 which indicates relatively diverse community. While 3 out of the 6 sample plots have relatively low to low diversity having H' value less than 1.7. Additionally, plot 6 has zero (0) computed value of Shannon H' and J which indicates the plots have only 1 species.

In terms of the Simpson's D index, 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 11) being the highest diversity as shown in **Figure 41**. Based on the figure, it supports the the analysis in Shannon H' stating the sample plot 5, located at Brgy. South Manuangan, Pigkawayan, has the highest value of 5.143 and relatively diverse. While Plot 6, at Brgy. North Manuangan has the lowest value of D equals to 1 which indicates that there are only 1 species present in the plot.

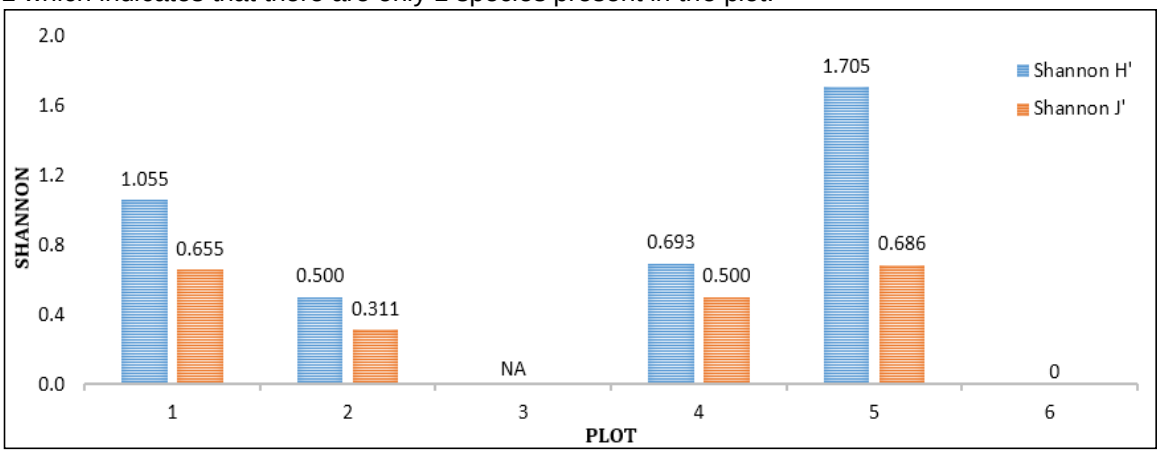


Figure 40. Shannon H' and J Diversity Index in the 6 Sample Plots in the Canopy Layer

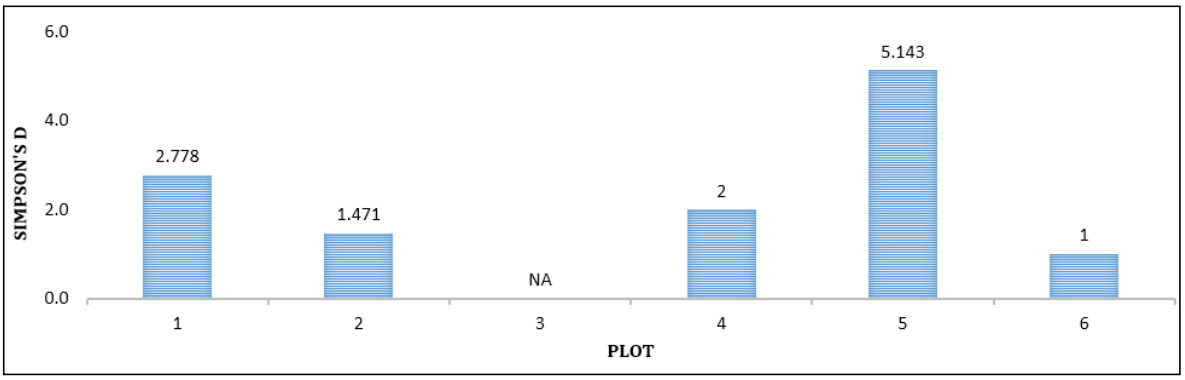


Figure 41. Simpson's D in the 6 Sample Plots in the Canopy Layer

iii. Understory layer

a) Density and Frequency

As shown in **Figure 42** and details in Annex 13.6.1, Kakauate or *Gliricidia sepium* has highest in both Rp and Rf with 43.750% and 33.333%, respectively. It is followed by Anabiong or *Trema orientalis* having Rp 12.500% and Rf 8.333%. While the rest of the species have less than 10% for both density and frequency and contributed about 7 (44%) of the total 16 recorded individual species in understory layer.

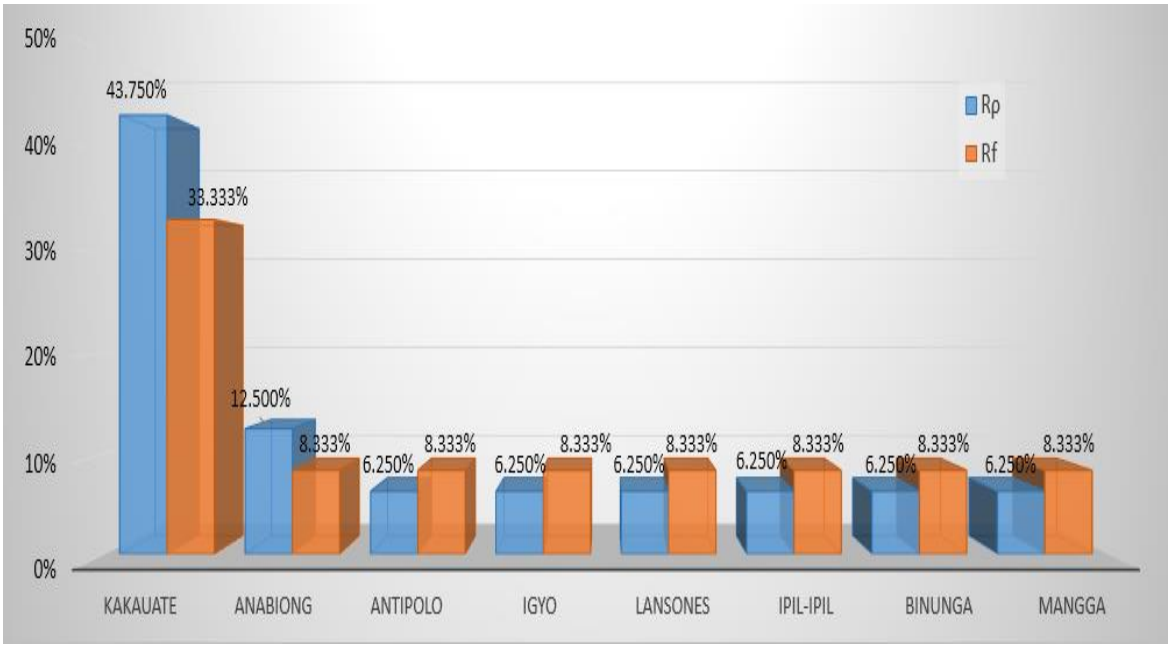


Figure 42. Species in the Understory Layer with their Corresponding Density and Frequency

b) *Biodiversity Index*

As shown in **Figure 43**, from the 6 sample plots, two (2) plots have NA (not applicable) which means there are no recorded understory species; three (3) plots are identified to have relatively low diversity with H' less than 1.7; and plot 4 has the lowest value of H' less than 1 which indicates low diversity.

For Shannon J, plot 1 and 2 have J' equals to 1 which indicates species are evenly abundant in the plot. In terms of Simpson's D in the understory layer, it supports the analysis in Shannon H' stating that 3 plots: Plot 1 located at Brgy. Orandang, Parang; Plot 2 at Brgy. Cabuan, Parang; and Plot 5 in Brgy. South Manuangan, have relatively diversity with D' equals to 3. While Plot 4, located at Brgy. Matengan, Sultan Kudarat, has the lowest value as shown in **Figure 44**.

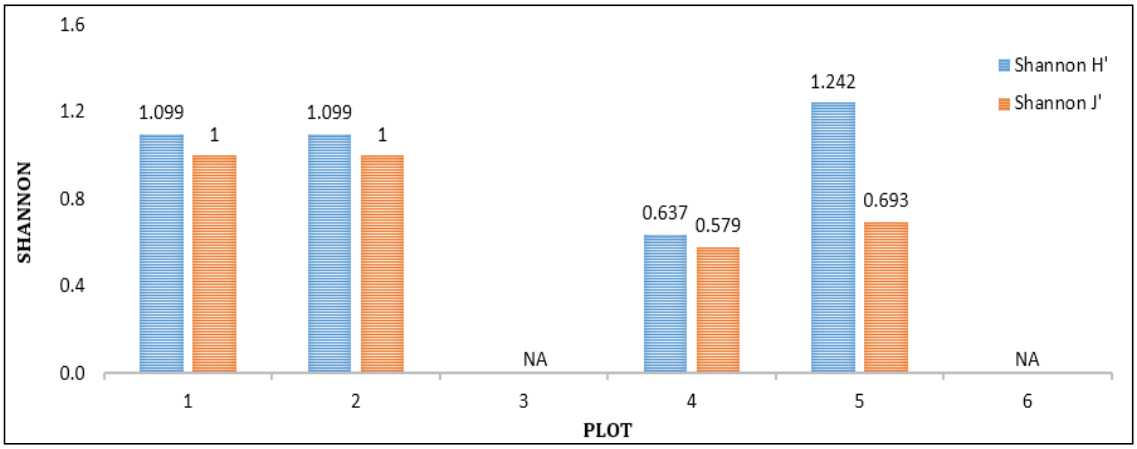


Figure 43. Shannon H' and J' Diversity index in the 6 Sample Plots in the Understory Layer

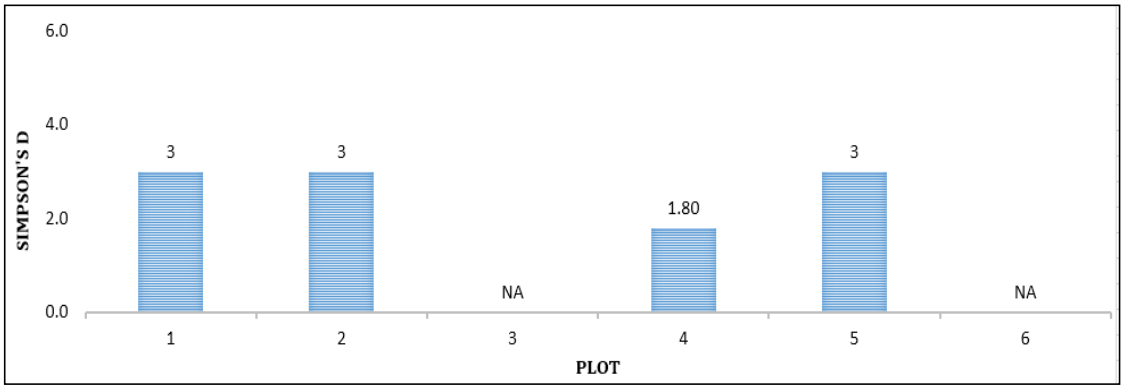


Figure 44. Simpson's D in the 6 Sample Plots in the Understory Layer

iv. Ground layer

a) Density and Frequency

As shown in **Figure 45**, Hagonoy or *Chromolaena odorata* has highest Rp 24.7067% and Rf of 14.815%. It is followed by silver fern or *Pityrogramma calomelanos* with Rp 15.294% and Rf with 3.704%. While seven (7) species were represented by less than 5% density and frequency, and contributed about 7 (8%) of the total 85 recorded individual species as shown in Annex 13.6.1.

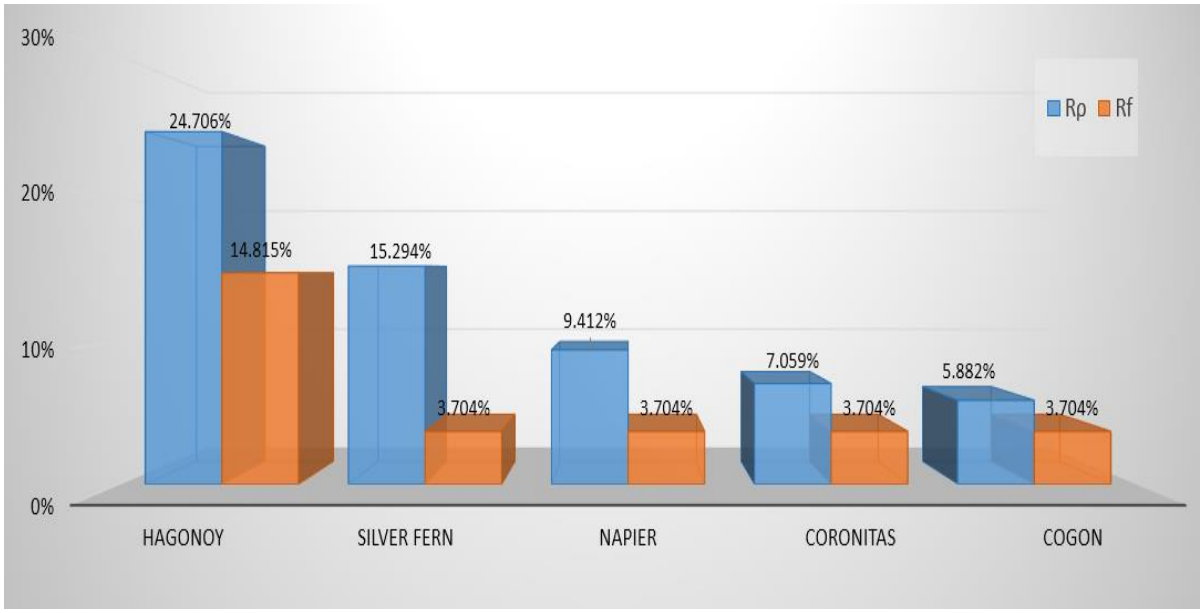


Figure 45. Species in the Ground Layer with Highest Corresponding Density and Frequency

b) *Biodiversity Index*

As shown in **Figure 46**, Plots 5 have the highest Shannon H' value with 1.790, which indicates a diverse community. While the rest of the plots are identified as relatively low to low diversity with H' less than 1.7. With regards to Simpson's D, it supports the Shannon H' computation that Plots 5, at Brgy. South Manuangan, Pigkawayan, has the highest value among the 6 plots.

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, Figure 50 and Figure 51.**

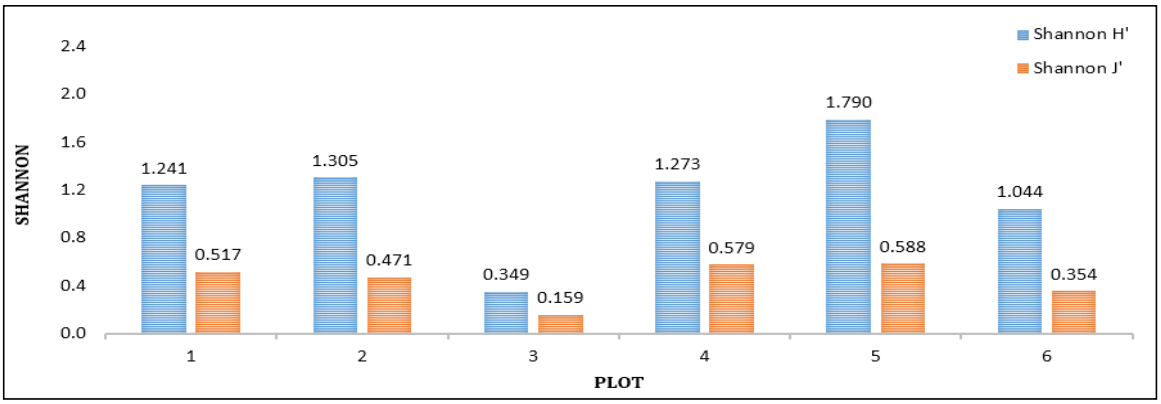


Figure 46. Shannon H' and J' Diversity Index in the 6 Sample Plots in the Ground Layer

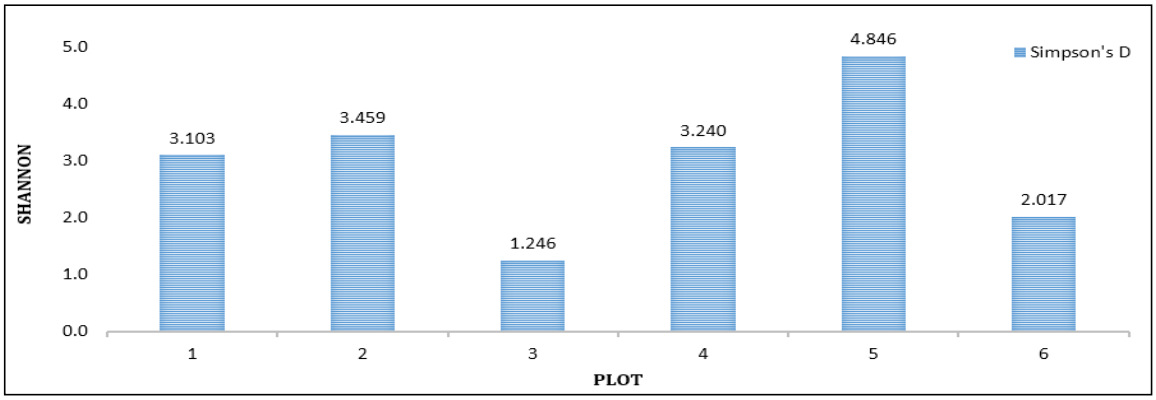


Figure 47. Simpson's D in the 5 Sample Plots in the Ground Layer

Figure 48. Photo of sample plot no. 2 in Brgy. Cabuan, Parang

Figure 49. Photo of sample plots no. 3 in Napier plantation in Brgy. Olas, Sultan Kudarat

Figure 50. Photo of sample plot no. 4 in Brgy. Matengen, Sultan Kudarat

Figure 51. Photo of sample plot no. 5 in Brgy. South Manuangan, Pigcawayan

2) Terrestrial Fauna

Survey on terrestrial fauna was undertaken in 6 sampling sites together with flora within the proposed road alignment. The sampling are situated in 6 barangays in the municipalities of Parang, Sultan Kudarat and Pigcawayan. Said barangays are Orandang and Cabuan in the municipality of Parang, barangay Olas and Matengan in Sultan Kudarat and barangay South and North Manuangan in Pigkawayan.

Observation sites are mostly situated within and along the road alignment which land cover are aggregates of agricultural areas, grassland and along settlement sites. Elevations of selected observation sites are in between 10 to 80 meters above sea level.

i. Fauna composition and richness

a) Avifauna

The overall result of fauna survey in the proposed project site exhibited a total of 25 species of Aves belonging to 20 families with a total abundance of 99. The dominant family is the Columbidae represented by 4 species of Doves followed by Estrildidae and Lanidae comprised of 2 species in each family, respectively.

With regard to species abundance, the Barn Swallow (*Hirundo rustica*) and Yellow Vented Bulbul (*Pynonotus goiavier*) are the most abundant species having a total of 18 and 12, respectively as shown in **Table 29**. These species have belonged to families Hirundinidae and Pycnonotidae.

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 29. Species distribution and abundance

Avi-fauna Species			Conservation Status (IUCN)	Species abundance/sampled site						Total Abundance
Family Name	Scientific Name	Species Name		1	2	3	4	5	6	
Sturnidae	*Aplonis payanensis*	Asian Glossy Starlings	Least Concern	3					4	7
Hirundinidae	*Hirundo rustica*	Barn Swallow	Least Concern				18			18
Oriolidae	*Oriolus chinensis*	Black Naped- Oriole	Least Concern			1	1			2
Meropidae	*Merops viridis*	Blue throated Bee-eater	Least Concern		2					2
Accipitridae	*Haliastur inbus*	Brahminy Kite	Least Concern		1					1
Laniidae	*Lanius cristatus*	Brown Shrike	Least Concern				1			1
Ardeidae	*Bubulcus ibis*	Cattle Egret	Least Concern				5			5
Estrildidae	*Lonchura malacca*	Chestnut Munia	Least Concern		2					2
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	Least Concern	3						3
Cuculidae	*Centripus sinensis*	Greater Coucal	Least Concern				1			1
Estrildidae	*Lonchura oryzivora*	Java Sparrow	Vulnerable		5					5
Laniidae	*Lanius schach*	Long Tailed-Shrike	Least Concern			1				1
Nectariniidae	*Nectarinia jugularis*	Olived-Backed Sunbird	Least Concern	1	2				5	8
Muscicapidae	*Saxicola caprata*	Pied Bush Chat	Least Concern		1					1
Rhipiduridae	*Rhipidura javanica*	Pied Fantail	Least Concern					1		1
Dicaeidae	*Dicaeum pygmaeum*	Pygmy Flower Pecker	Least Concern		5		3			8
Columbidae	*Streptopella tranquebarica*	Red Turtle-Dove	Least Concern	1					1	2
Columbidae	*Macrophygia phasianella*	Reddish Cucko-Dove	Not Evaluated		1					1
Corvidae	*Corvus enca*	Slender Billed Crow	Least Concern	2				1		3

Turnicidae	*Turnix sylvatica*	Small Bottonquail	Least Concern		1					1
Columbidae	*Spilopelia chinensis*	Spotted Dove	Least Concern				2			2
Alcedinidae	*Halchyon chloris*	White Collared King Fisher	Not Evaluated				1			1
Motacillidae	*Artamus leucocrynchus*	White-Breasted Wood- Shallow	Least Concern		2					2
Pycnonotidae	*Pycnonotus goiavier*	Yellow Vented Bulbul	Least Concern		4		6	2		12
Columbidae	*Geopelia striata*	Zebra Dove	Least Concern	3			6			9
			Total	**13**	**26**	**2**	**44**	**4**	**10**	**99**

Sampling site with the highest **diversity** is site no. 2 and 4 comprised of 11 and 10 species, respectively. While, site nos. 3, 5 and 6 are the least diverse which only comprised of 2, 3 and 3 species, respectively. Sampling site with the highest species **abundance** is the site no. 4, conversely, site no. 3 has the lowest abundance with only 2 population as shown in **Table 29**. The general observation relative to avifaunal composition of the area showed that most of the recorded species are found to be common and thrives in a wide range of habitats. Species habitats include lowland areas, agricultural areas, shrublands, grasslands and even settlement sites.

b) Herpeto-fauna species

Other fauna species found within the assessed area also includes, 3 species of reptiles and 1 mammal as shown in Annex 13.6.1.
These species are the Fruit bat (Cynopteros sp.), Mindanao Flying lizard (Draco mindanensis), Skink (Eutropis multifasciata) and the Tokay/Gecko (Gecko gecko).

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
- Hunting/poaching
- Proximity of the study area to settlements
- Loss of habitat due to conversion of forest lands to other land uses

c) Endemism and conservation status

In terms of avifauna endemicity, 2 species are found to be endemic in the country, and the rest are native/non-endemic species. Among the endemic species is the Pygmy Flower Pecker *(Dicaeum pygmaeum)* and Small Buttonquail *(Turnix sylvaticus)*.

On the hand, 1 species of herpeto-fauna are endemic in the country- Mindanao Flying Dragon (*Draco mindanensis*). **Table 29** present the summary of wildlife 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 and 4 species 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
Near Threatened	-	-	-	-	0
Vulnerable	1	-	1	-	2
Least Concern	22	1	-	-	23
Not evaluated	2	-	2	-	4
TOTAL	**25**	**1**	**3**	**0**	**29**

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 6 observation sites shown in **Table 31** has a computed biodiversity index of 1.401 with species evenness value of .911. Interpretation of these values using the Fernando's Biodiversity Scale (1998) showed that the area has **very low biodiversity** with **very high species evenness**.

Computed diversity richness of the 6 observation sites reveals that most of the sites have low to very low level of diversity richness with a very high species evenness. Site no. 2 have the highest computed diversity of 2.213. While site no 3 registered the lowest computed biodiversity index of .693.

On the other hand, computed species evenness showed that site no. 1 has the highest computed evenness value of .948, while, the site no. 4 has the lowest evenness value of .792, respectively.

Table 31.Computed Biodiversity Index of Sampled Sites

Sampling site no.	Shannon-Wiener Biodiversity index (H')	Pielou's Index (J') species Evenness	Fernando's Biodiversity Scale (1998)
1	1.698	.948	Very low diversity with very high species evenness
2	2.213	.923	Low diversity with very high species evenness
3	.693	1.0	Very low diversity with very high species evenness
4	1.824	.792	Very low diversity with very high species evenness
5	1.040	.946	Very low diversity with very high species evenness
6	.943	.859	Very low diversity with very high species evenness
Average	**1.401**	**0.911**	**Very Low diversity with very high species evenness**

e) Species Relative Frequency

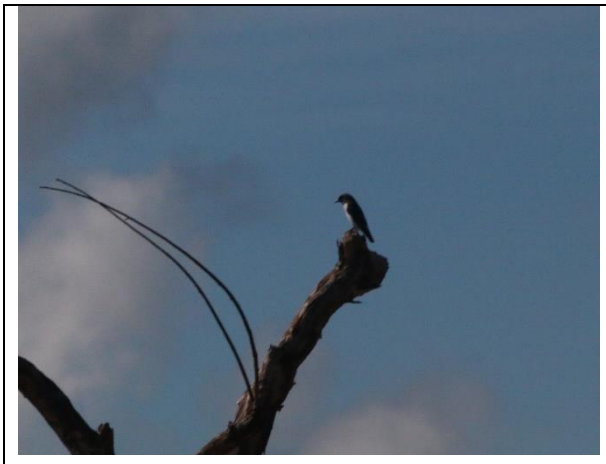
Of the 6 observation sites, there are 25 species of avifauna were recorded with a total abundance of 99. The computed relative frequency of recorded species showed that the Olive-Backed Sun Bird (*Nectarinia jugularis)* and the Yellow Vented Bulbul (*Pycnonotus goiavier)* has the highest relative frequency of 8.571, seconded by 6 other species with the same relative frequencies of 5.714. This species includes the Asian Glossy Starlings (*Aplonis payanensis),* Black Naped- Oriole (*Oriolus chinensis),* Pygmy Flower Pecker (*Dicaeum pygmaeum),* Red Turtle-Dove (*Streptopella tranquebarica),* Slender Billed Crow (*Corvus enca),* and Zebra Dove (*Geopelia striata).* The rest exhibits the least computed relative frequencies with the same value of 2.857, respectively as shown in **Table 32**. **Table 33** shows some fauna photos taken during the survey.

Table 32. Species Relative Frequency

Family	Scientific Name	Common Name	Relative Frequency (%)
Sturnidae	*Aplonis payanensis*	Asian Glossy Starlings	5.714
Hirundinidae	*Hirundo rustica*	Barn Swallow	2.857
Oriolidae	*Oriolus chinensis*	Black Naped- Oriole	5.714
Meropidae	*Merops viridis*	Blue throated Bee-eater	2.857
Accipitridae	*Haliastur inbus*	Brahminy Kite	2.857
Laniidae	*Lanius cristatus*	Brown Shrike	2.857
Ardeidae	*Bubulcus ibis*	Cattle Egret	2.857
Estrildidae	*Lonchura malacca*	Chestnut Munia	2.857
Passeridae	*Passer montanus*	Eurasian Tree Sparrow	2.857
Cuculidae	*Centripus sinensis*	Greater Coucal	2.857
Estrildidae	*Lonchura oryzivora*	Java Sparrow	2.857
Laniidae	*Lanius schach*	Long Tailed-Shrike	2.857
Nectariniidae	*Nectarinia jugularis*	Olived-Backed Sunbird	8.571
Muscicapidae	*Saxicola caprata*	Pied Bush Chat	2.857
Rhipiduridae	*Rhipidura javanica*	Pied Fantail	2.857
Dicaeidae	*Dicaeum pygmaeum*	Pygmy Flower Pecker	5.714
Columbidae	*Streptopella tranquebarica*	Red Turtle-Dove	5.714
Columbidae	*Macrophygia phasianella*	Reddish Cucko-Dove	2.857
Corvidae	*Corvus enca*	Slender Billed Crow	5.714
Turnicidae	*Turnix sylvatica*	Small Bottonquail	2.857
Columbidae	*Spilopelia chinensis*	Spotted Dove	2.857
Alcedinidae	*Halchyon chloris*	White Collared King Fisher	2.857
Motacillidae	*Artamus leucocrynchus*	White-Breasted Wood- Shallow	2.857
Pycnonotidae	*Pycnonotus goiavier*	Yellow Vented Bulbul	8.571
Columbidae	*Geopelia striata*	Zebra Dove	5.714
		Total	**100.00**

Table 33. Some Faunal Species Photo Documented During the Survey

Photo	*Common Name/ Scientific name*	**Conservation Status (IUCN)**	**Location/ Geographic Coordinates**
	*Black Naped Oriole* *(Oriolus chinensis)*	*Least Concern*	Site 3 Brgy. Olas Sultan Kudarat (7°19'17.56" Northing 124°20'20.26" Easting)
	*Olived-Backed Sunbird* (*Nectarinia jugalaris)*	*Least Concern*	Site 2 Brgy. Cabuan Parang (7°21'25.12" Northing 124°20'31.58" Easting)
	*Java Sparrow* (*Lonchura oryzivora)*	*Vulnerable*	Site 2 Brgy. Cabuan Parang (7°21'25.12" Northing 124°20'31.58" Easting)

	*White Breasted Wood Swallow* (*Artamus leucocrynchus)*	*Least Concern*	Site 2 Brgy. Cabuan Parang (7°21'25.12" Northing 124°20'31.58" Easting)
	Pygmy Flower Pecker (*Dicaeum pygmaeum)*	Least Concern	Site 4 Brgy. Matengan Sultan Kudarat (7°18'17.88" Northing 124°21'22.92" Easting)
	*Yellow Vented Bulbul* (*Pycnonotus goiavier)*	*Least Concern*	Site 5 Brgy. South Manuangan Pigcawayan (7°17'3.69" Northing 124°23'5.76" Easting)

	*Zebra Dove* (*Geopelia striata)*	*Least Concern*	Site 1 Brgy. Orandang Parang (7°22'51.18" Northing 124°20'10.69" Easting)
	*Mindanao Flying Dragon* (*Draco mindanensis)*	*Vulnerable*	Site 1 Brgy. Orandang Parang (7°22'51.18" Northing 124°20'10.69" Easting)
	*Asian Glossy Starlings* (*Aplonis payanensis)*	*Least Concern*	Site 1 Brgy. Orandang Parang (7°22'51.18" Northing 124°20'10.69" Easting)
	*Brown Shrike* (*Lanius cristatus)*	*Least Concern*	Site 4 Brgy. Matengan Sultan Kudarat (7°18'17.88" Northing 124°21'22.92" Easting)

3.1.4.5 Environmental, economic significance and threats

3.1.4.5.1 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 family with the highest vegetational cover is the Fabaceae, also known as legumes, helps increase soil nitrogen and provide rich sources of vegetable protein for humans, livestock, and wild animals. There are many species in the area having a high economic importance, one of them is Narra which is widely known to have high economic value aesthetically and commercially. There are also major and/or important agricultural crops that are found in the area such as coconut and rambutan.

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 like cogon have also a positive impact on soil erosion. 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.

3.1.4.5.2 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. The existence of varieties of faunal species are 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, a decrease of the 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 tributaries of Simuay River and **(Figure 52).** 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 53)**.

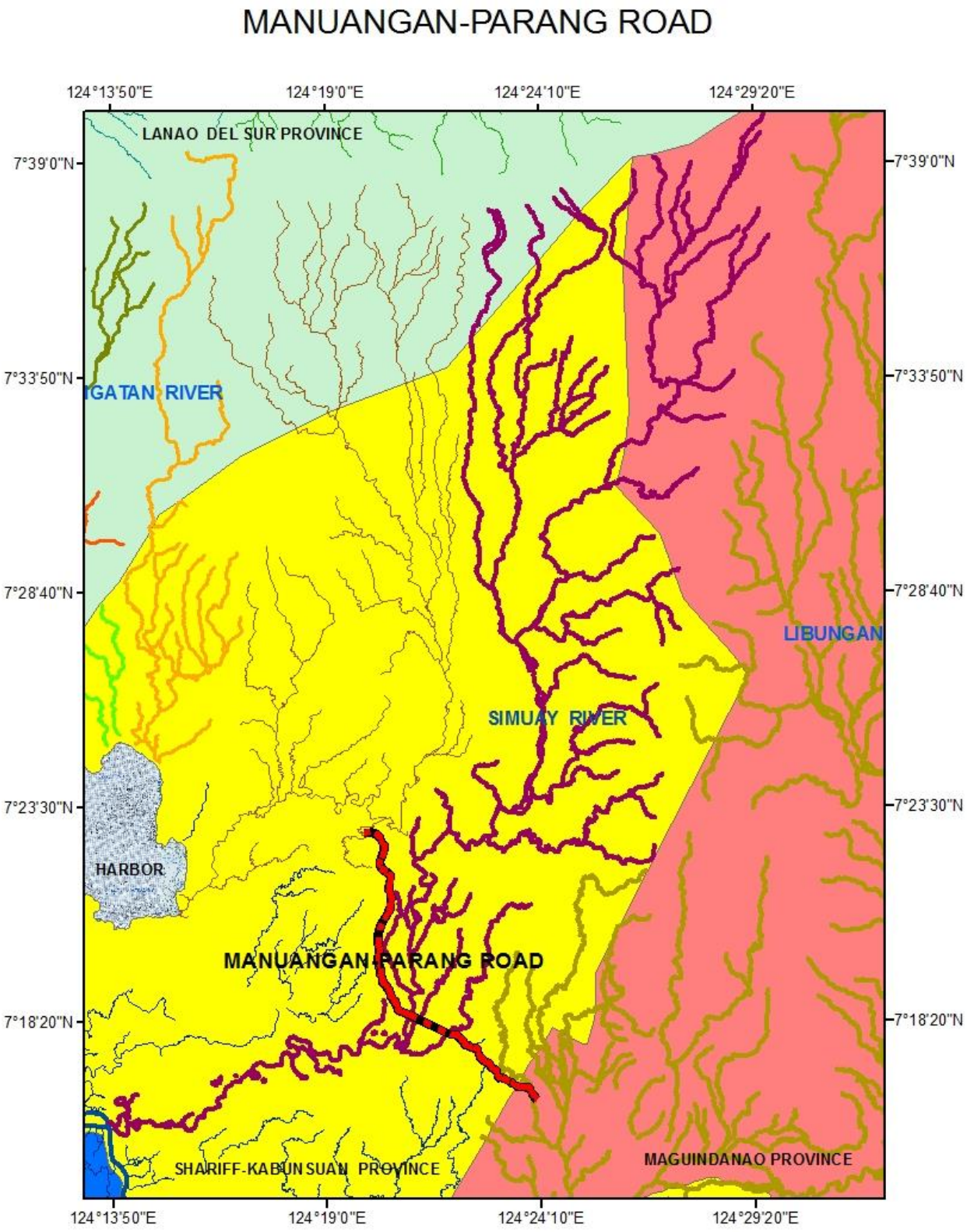


Figure 52. Rivers affecting Manuangan-Parang Road

Source: Google Earth

Figure 53. Location of Groundwater Wells or Springs affected by Manuangan-Parang Road

3.2.2 Water Quality

Grab sampling was used for surface water quality measurement. Samples were collected on November 15, 2017 on a sunny to cloudy 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 Brgy. Matengen and Brgy. Nikitan, Maguindanao. **Figure 54** presents the sampling map of Sub-Project No. 9.

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	Matengen Creek, Brgy. Matengen	7°17'28.8" N 124° 20'46.9" E	Sunny	November 15, 2017, 1144H
S2	Simuay River	7°17'39.0" N 124° 19' 52.0" E	Cloudy	November 15, 2017, 1245H

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.**

Figure 54. Sampling Map of Water Quality Stations Collected at Sub-Project No. 9

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 Discuussions

Table 36 shows the results of physical and chemical analyses for surface water collected in Brgy. Matengen and Nikitan. 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	8.1	6.5 – 9.0
Temperature, °C	28.6	30.4	25-31
Turbidity, NTU	6.4	17	---
BOD, mg/L	3	2	7
TSS, mg/L	25	62	80
DO, mg/L	7	8	5.0 mg/L minimum

Hereto attached as Annex 13.6.2 are the results of Water Quality Stations. **Figure 55** and **Figure 56** show the sampling pictures taken at SP No. 9.

Figure 55. Water Sampling at Matengen Creek, Brgy. Matengen

Figure 56. Water Sampling at Nikitan confluence and Simuay River

3.3 Baseline in Air

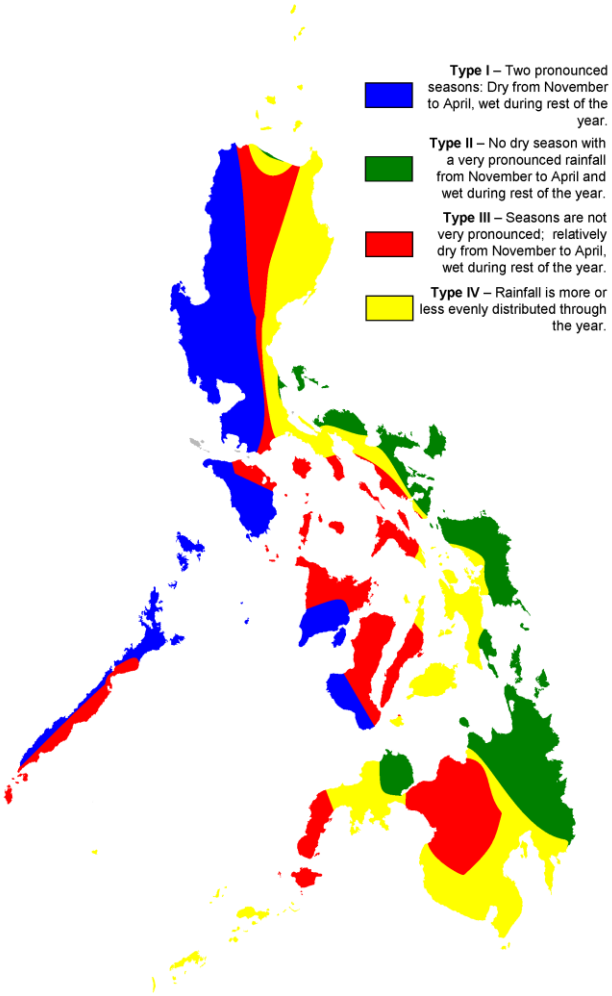
3.3.1 Meteorology

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 57** from which seasons are not very pronounced, relatively dry from November to April and wet during the rest of the year.



Source: PAGASA

Figure 57. 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 58**.

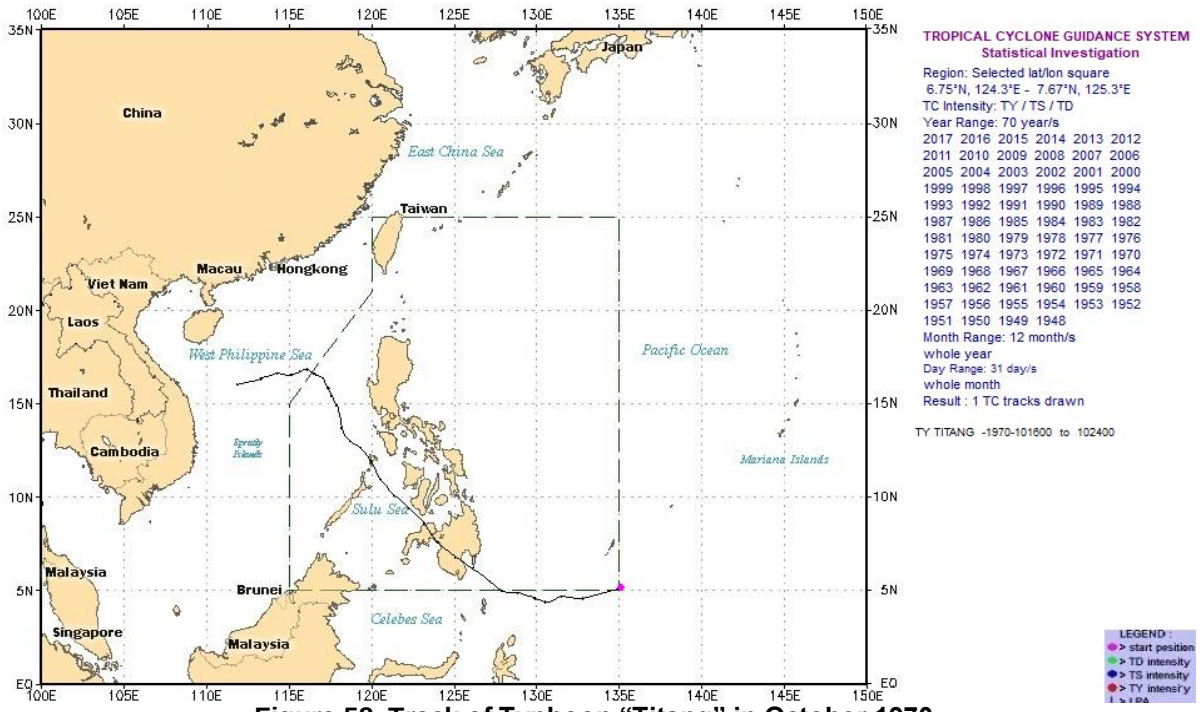
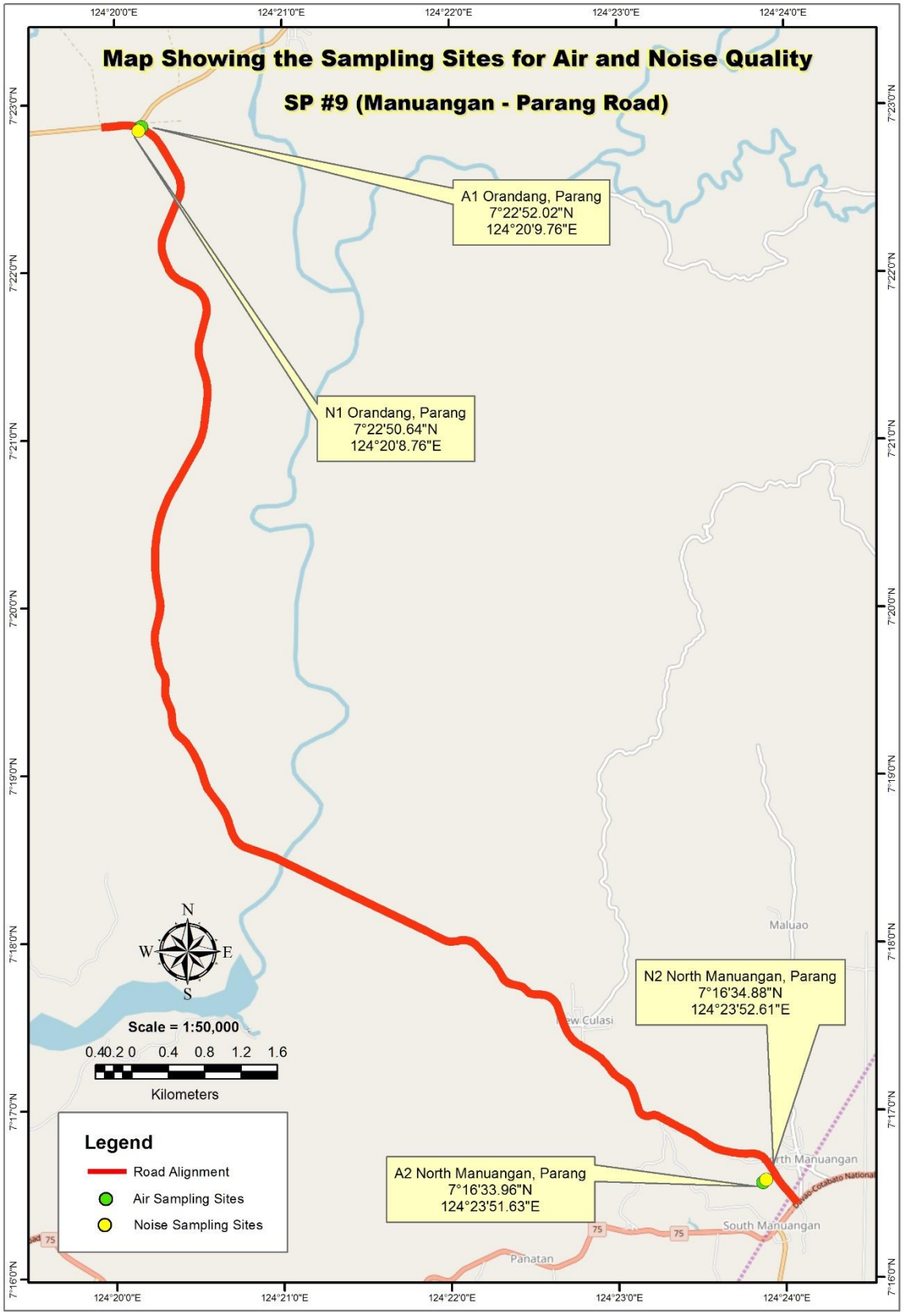


Figure 58. Track of Typhoon "Titang" in October 1970

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 59** 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 59. Sampling location at SP 9 Manuangan-Parang 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	Brgy. Orandang, Parang, Maguindanao	7°22'52.02"N 124°20'9.76"E	December 10-11, 2017, 1540H
A2	Brgy. North Manuangan, Pigcawayan, Cotabato	7°16'33.96"N 124°23'51.63"E	December 16-17, 2017, 1300H

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 9. **Table 40** and **Table 41** present the meteorological data observed during sampling.
.
Figure 60 and Figure 61 present the photos during the actual air sampling at two sites.

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

Station No.	Location	Date and Time Sampling	TSP (µg/Ncm)	PM_{10} (µg/Ncm)	NO2 (µg/Ncm)	SO2 (µg/Ncm)
A1	Brgy. Orandang, Parang, Maguindanao	December 10-11, 2017 1540H – 1540H	30.9	5.9	3.0	1.4
A2	Brgy. North Manuangan, Pigcawayan, Cotabato	December 16-17, 2017 1300H – 1300H	36.7	2.1	5.7	1.6
***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^{o}C, 760mm Hg; *RA 8749 (Philippine Clean Air Act of 1999)

Figure 60. Air Sampling at Brgy. Orandang, Parang, Maguindanao

Figure 61. Air Sampling Near Brgy. Manuangan, Pigcawayan, Cotabato

Table 40. Meteorological Data at Brgy. Orandang, Parang, Maguindanao

Brgy. Orandang, Parang, Maguindanao

Division of 24-Hour Sampling	Prevailing Wind	Temperature (deg. C)	Barometric Pressure (mmHg)	Remarks
December 10-11, 2017 1540H	NW-SE	33.5	749.3	Sunny, Cloudy
1740H	W-E	28.1	750.8	Fair
1940H	Calm	26.6	751.1	Rains Lightly
2140H	Calm	26.9	751.2	Fair
2340H	Calm	26.5	751.0	Rains Lightly
0140H	Calm	25.5	750.0	Rains Lightly
0340H	Calm	25.1	751.2	Fair
0540H	SE-NW	25.4	750.8	Sunny
0740H	SE-NW	27.7	751.3	Sunny
0940H	SW-NE	27.5	751.0	Sunny
1140H	SW-NE	31.8	749.8	Sunny
1340H	NW-SE	30.7	748.7	Cloudy

Table 41. Meteorological Data at Brgy. Manuangan, Pigcawayan, Cotabato

Brgy. North Manuangan, Pigcawayan, Cotabato

Division of 24-Hour Sampling	Prevailing Wind	Temperature (deg. C)	Barometric Pressure (mmHg)	Remarks
December 16-17, 2017 1300H	SW-NE	33.4	753.9	Sunny
1500H	NE-SW	32.5	753.4	Sunny
1700H	Calm	28.4	753.5	Cloudy
1900H	NW-SE	26.1	754.7	Fair
2100H	Calm	27.6	755.1	Fair
2300H	Calm	27.3	755.3	Fair
0100H	Calm	26.6	754.5	Fair
0300H	SW-NE	26.4	754.1	Fair
0500H	SW-NE	26.7	754.8	Fair
0700H	SW-NE	28.6	755.6	Sunny
0900H	SW-NE	32.7	755.8	Sunny
1100H	SW-NE	31.1	754.7	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. Samping map was presented in **Figure 59**.

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	Brgy. Orandang, Parang, Maguindanao	7°22'53.21"N 124°20'11.17"E	December 10-11, 2017, 1540H
N2	Brgy. North Manuangan, Pigcawayan, Cotabato	7°16'34.88"N 124°23'52.61"E	December 16-17, 2017, 1300H

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, sounds from insects such as crickets etc. and passing of vehicles 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 Brgy. Orandang, Parang, Maguindanao

December 10-11, 2017 Sampling time	Average dB (A)	DENR Standard Maximum Allowable Noise Level, Class A, dB (A)***	Remarks	Noise Sources
1540H	50.7	55	Within	Residential area, birds
1740H	50.4	55	Within	Residential area, birds, passing vehicle
1940H	52.5	50	Exceeded	Residential area, dogs, passing vehicle, insects
2140H	49.5	50	Within	insects
2340H	49.9	45	Exceeded	insects
0140H	47.5	45	Exceeded	insects
0340H	49.5	45	Exceeded	Insects, roosters
0540H	50.9	50	Exceeded	Insects, roosters
0740H	51.8	50	Exceeded	Residential area, insects, roosters
0940H	47.1	55	Within	Insects, birds, dogs
1140H	49.1	55	Within	Residential area, birds, dogs, passing vehicle
1340H	51.5	55	Within	Residential area, birds, dogs, passing vehicle

***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 at Brgy. Manuangan, Pigcawayan, Cotabato

December 16-17, 2017 Sampling time	Average dB (A)	DENR Standard Maximum Allowable Noise Level, Class A, dB (A)***	Remarks	Noise Sources
1300H	48.3	55	Within	Residential area, birds
1500H	50.7	55	Within	Residential area, dogs
1700H	62.9	55	Exceeded	Sound system, dogs, passing vehicle
1900H	56.2	50	Exceeded	Sound system, insects, passing vehicle
2100H	48.3	50	Within	Insects, dogs
2300H	47.2	45	Exceeded	Insects
0100H	48.3	45	Exceeded	Insects
0300H	49.3	45	Exceeded	Insects
0500H	53.3	50	Exceeded	Insects, roosters
0700H	52.2	50	Exceeded	Residential area, birds, passing vehicle, roosters
0900H	53.0	55	Within	Residential area, birds, passing vehicle
1100H	45.6	55	Within	Birds, dogs

***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 62 and Figure 63 show the photos of noise sampling conducted at SP 9.

Figure 62. Noise Sampling at Brgy. Orandang, Parang, Maguindanao

Figure 63. Noise Sampling at Brgy. Manuangan, Pigcawayan, Cotabato

3.5 Social Condition (The People)

3.5.1 Demographic Data

3.5.1.1 Population and Growth Rate

The Manuangan-Parang Road-SP 9 is located in three (3) Municipalities of Maguindanao and in one (1) Municipality of North Cotabato covering a total of 10 barangays. In terms of population of barangays in SP 9, the largest population is 2,465 in Matengen of Sultan Kudarat municipality, while the smallest population is 700 in Nekitan of the same municipality. Populations of the barangays covered is shown in **Table 45**.

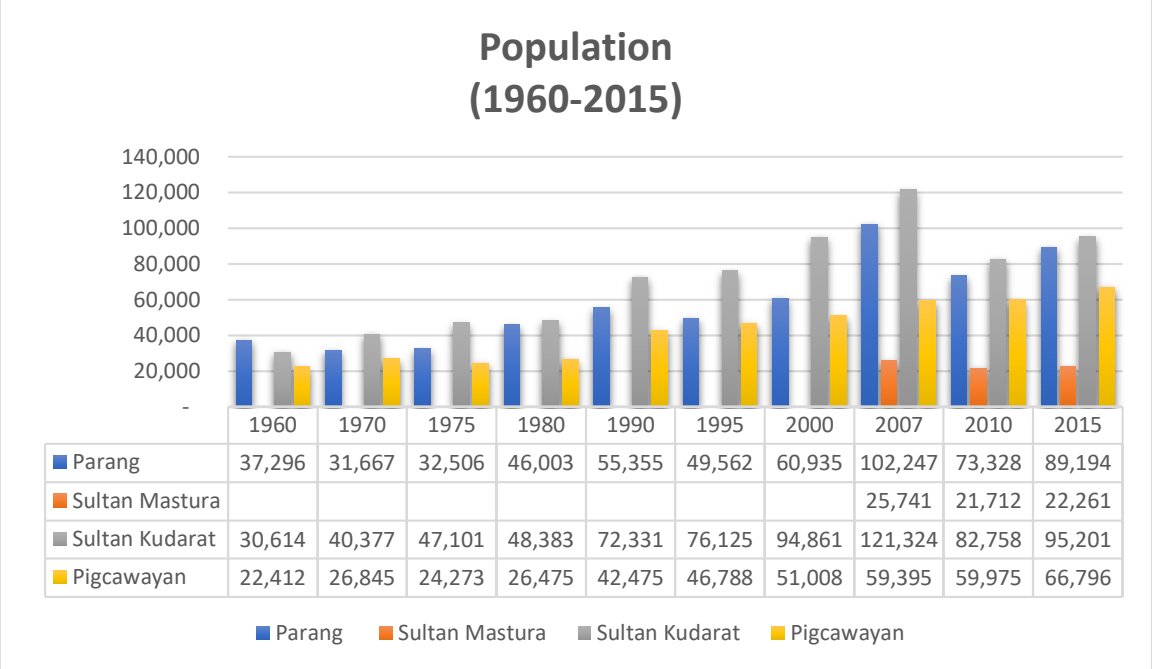
Table 45: Population per Barangay Covered by the Project (2015)

Province	Municipality	Barangay	Population
Maguindanao	Parang	Gadungan	1,547
		Orandang	1,330
		Cabuan	1,278
	Sultan Mastura	Bungabong	1,167
	Sultan Kudarat	Olas	943
		Nekitan	700
		Matengen	2,465
North Cotabato	Pigkawayan,NC	New Culasi	886
		North Manuangan	2,462
		South Manuangan	2,297
		Total	15,075

Source: Philippine Statistics Authority (2015)

Historically, there are significant changes in terms of population growth in the project area. Parang has an increase and decrease of population between 1960 to 2015 with the highest population of 102,247 recorded in 2007. Sultan Mastura doesn't have existing records of population in PSA from 1960-2000 since its corporate existence as municipality started only in 2003. As of 2015, the municipality has a total population of 22,261. Sultan Kudarat on the other hand has a consistent increase in population from 1960 to 2007 and decline of about 32 % or decrease of 38,566 populaces. As of 2015, Sultan Kudarat has a total population of 95, 201.

Pigcawayan in North Cotabato has a consistent growth of population from 1960-2015 except in 1975 with a decrease in population of about 10% or 2,572 compared to the previous Census Year. **Figure 64** shows the population affected by SP 9.



	1960	1970	1975	1980	1990	1995	2000	2007	2010	2015
Parang	37,296	31,667	32,506	46,003	55,355	49,562	60,935	102,247	73,328	89,194
Sultan Mastura								25,741	21,712	22,261
Sultan Kudarat	30,614	40,377	47,101	48,383	72,331	76,125	94,861	121,324	82,758	95,201
Pigcawayan	22,412	26,845	24,273	26,475	42,475	46,788	51,008	59,395	59,975	66,796

Figure 64: Population per Census Year in the Municipalities Affected by SP 9

With regard to population growth, the four municipalities have various trends. For the more recent years between 2010 and 2015, the annual average growth rate of Parang, Sultan Kuradat and Pigkawayan range from 2 to 4 percent. Sultan Mastra has the highest growth rate at 3.16 percent between 2000 and 2010, but the lowest growth rate at 0.5 percent between 2010 and 2015 as presented in the Table below.

Table 46: Population Growth in Parang, Maguindanao (2000-2015)

Province	Municipality	Annual Average Growth Rate (in percent)		
		2000-2010	2010-2015	2000-2015
Maguindanao	Parang	1.87	4.00	2.57
	Sultan Mastura	3.16	0.50	2.26
	Sultan Kudarat	-1.36	2.84	0.02
North Cotabato	Pigkawayan	1.63	2.18	1.81
	Average	0.66	2.84	1.38

Source: Philippine Statistics Authority, 2015

3.5.1.2 Population Density

Based on 2015 Census of Population and Housing by the Philippine Statistics Authority, the four municipalities have a total population of 273,452, and an average population density of 127 persons/km2. Their population density is higher than the average of Maguindanao province (118 persons/km2) but lower than Sultan Kudarat province (151 persons/km2). The population density of Pigkawayan is much higher than the other three municipalities. Table below shows the population density per municipality in the project area.

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

Province	Municipality	Population	Land area (km2)	Population density (persons/km^2)
Maguindanao	Parang	89,194	850.78	105
	Sultan Mastura	22,261	242.07	92
	Sultan Kudarat	95,201	712.91	134
North Cotabato	Pigkawayan	66,796	340.11	196
	Total	273,452	2,145.87	127

Source: Philippine Statistics Authority, 2015

3.5.1.3 Household and Household Size

In terms of household number, Parang has a total households of 15,307, Sultan Mastura has 3,864, Sultan Kudarat has 15,652 and Pigkawayan has a household number of 15,826. These households are headed mostly by male. Sultan Kudarat on the other hand has the highest household size with average of 6.1 person per household while Pigkawayan has the least with 4.2 as shown in **Table 48**.

Table 48: Household and Household Size in the Municipalities Affected by SP 9

Province	Municipality	Household Number			Household Size
		Male Headed Households	Female Headed Households	Total	
Maguindanao	Parang	14,028	1,279	15,307	5.8
	Sultan Mastura	3,531	333	3,864	5.8
	Sultan Kudarat	14,067	1,585	15,652	6.1
North Cotabato	Pigkawayan	13,488	2,338	15,826	4.2

Source: Philippine Statistics Authority, 2015

3.5.1.4 Religious Affiliation

Majority of the population in Maguindanao belong to Islam comprising about 83% of the total population in Maguindanao with only 8% of Roman Catholic, 3% National Council of Churches in the Philippines, and 1% Tribal Religions (PSA 2015). The remaining percent belongs to different religious sectors such as Aglipay, Buddhist, Baptist, among others.
North Cotabato in terms of religious affiliations, Roman Catholic is the most dominant comprising about 47% of the total population. Likewise, Islam are about 29%, 8% are Evangelicals, and remaining populations belongs to other sectors (PSA 2015).

3.5.1.5 Ethnicity

In terms of ethnicity, the project area is dominated with Iranun, Maguindanaon, Cebuano and Maranao. There are also indigenous people such as Manobo and Tiduray however comprises only small portion of the project area and outside an Ancestral Domain Claim/Title.

The Manobo tribe usually build their villages near small bodies of water or forest clearings, although they also opt for hillsides, valleys, and rivers. Cultivating rice and corns is a part of the Manobo way of living, some shifted to the cultivation of coconut for copra export.

Tiduray on the other hand are scattered in different provinces in Mindanao. Their primary source of livelihood is farming and fishing. Majority of the farmers still practice slash-and-burn methods of farming. Thus, most of the farmers get marginal production which is very insufficient to serve the needs of their families.

3.5.2 Access to Basic Services

3.5.2.1 Education

In terms of access to educational services in the four municipalities affected by SP 9, availability of school facilities is present in all municipalities from Pre-schools to Colleges. Based on the data of the Philippine Statistics Authority (2015), the highest grade completed of most of the population in the affected municipalities are elementary 1st to 4th grade while post baccalaureate has the least number. Special education is also available except for Sultan Kudarat. Table below presents the grade level completed with corresponding numbers of population.
.

Table 49: Highest Grade/Year Completed in the Municipality Affected by SP 9

Highest Grade/Year Completed	Parang	Sultan Mastura	Sultan Kudarat	Pigkawayan
No Grade Completed	5,383	1,846	7,913	3,203
Pre-School	2,211	669	2,814	1,782
Special Education	12	4	-	5
Elementary	30,406	10,860	39,839	22,077
1st - 4th Grade	17,548	5,952	22,375	11,485
5th - 6th Grade	8,129	1,980	10,761	4,585
Graduate	4,729	2,928	6,703	6,007
High School	24,094	4,515	20,541	22,142
Undergraduate	11,747	2,487	12,315	9,552
Graduate	12,347	2,028	8,226	12,590
Post-Secondary	585	134	351	1,236
Undergraduate	52	4	21	119
Graduate	533	130	330	1,117
College Undergraduate	8,334	1,141	5,363	4,417
Academic Degree Holder	4,490	483	1,705	4,235
Post Baccalaureate	18	3	29	69
Not Stated	3,468	3	4,129	-
Total	79,001	19,658	82,684	59,166

Source: Philippine Statistics Authority, 2015

In terms of literacy, age group from 10-14 and 15-19 has the highest population recorded in all municipalities affected. Based on the data from PSA (2015), it consistently shows that young age group have higher literacy and decreases as age group gets older except there are increased in number from the age group 65 years old and over. Highest literacy in the data of PSA (2015) is in the municipality of Sultan Kudarat with 69,494 population.

Table 50: Literacy by Age Group

Age Group	Parang	Sultan Mastura	Sultan Kudarat	Pigkawayan
10 – 14	11,480	2,949	12,386	7,016
15 – 19	12,290	2,681	11,290	6,621
20 – 24	7,871	2,071	8,273	5,961
25 – 29	6,786	1,763	7,327	5,702
30 – 34	5,813	1,558	6,221	4,706
35 – 39	5,986	1,331	5,767	4,325
40 – 44	5,150	1,168	4,801	3,729
45 – 49	4,148	934	4,021	3,349

50 – 54	2,826	688	3,507	2,806
55 – 59	2,001	468	2,488	2,319
60 – 64	1,343	309	1,353	1,695
65 years old and over	1,822	576	2,060	3,019
Total	**67,516**	**16,496**	**69,494**	**51,248**

Source: Philippine Statistics Authority, 2015

3.5.2.2 Health Service

Public and private health services are also available in all municipalities affected. Based on the DILG-ARMM LGU Profile (2015), Parang has a total 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.

In Sultan Kudarat there is (1) government hospital in the town, the Cotabato Sanitarium, but it caters only to specific health needs. There are about 26 Barangay Health Centers and 10 health personnel, composed of 1 medical doctor, 1 dental doctor, 6 midwives, 1 nurse and 1 sanitary inspector, serving the 39 barangays of the municipality. The health personnel are being augmented by 8 health workers and 39 trained hilots.

There are health facilities in Sultan Mastura and Pigkawayan such as barangay heath centers, birthing facilities, and Rural Health Office from the LGU however, no record of the total accounts of health facilities are available.

3.5.2.3 Water and Power Supply

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 Pigkawayan, there is a private entity that provides water supply but not most of the households are connected.

The municipality's power source comes from Magelco. Magelco has a capacity of 10-MVA, 69/13.2KV substation and provides electrification services in Parang, Sultan Kudarat and Sultan Mastura while COTELCO in Pigcawayan North Cotabato. Majority of the households in the project area are connected to these power providers. For the years starting 2010 up to 2014, MAGELCO has implemented load curtailment in its franchise area due to generation deficiency in Mindanao GRID.

3.5.2.4 Communication Networks

Communication Networks available in the project area includes Globe, PLDT, Smart and Sun Cellular. However, some areas in Cabuan, Parang, Matengen, Sultan Kudarat and New Culasi have weak signal connection because of inavailability of cell sites.

3.5.2.5 Transportation and Road Networks

The municipalities are accessible to people coming in from its connected municipalities and provinces through public road transport include vans, trisikads, town ace and single motors. Accessibility in some portion of the affected areas such as New Culasi, Pigcawayan, Nekitan and Matengen in Sultan Kudarat, and Cabuan in Parang are difficult because of the rough road networks. High powered vehicles or habal-habal are used for transportation.

3.5.2.6 Poverty Incidence

The poverty incidence for Maguindanao is 54.6 percent in 2006. It has come down to 52.2 percent in 2009, has increased to 63.7 percent in 2012, and has declined again to 57.2 percent in 2015. It has always been higher than the poverty incidence for ARMM and for any other regions of Mindanao. More than half of the population of Maguindanao province has been in poverty throughout the period. On the other hand, the poverty incidence for North Cotabato has been much lower than Maguindanao. It is 31.4 percent in 2006, 30.6 percent in 2009, has increased to 52.4 percent in 2012, and declined to 41.4 percent in 2015. The poverty incidence of North Cotabato after 2012 has been higher than the average of SOCCSKSARGEN.

For the poverty incidence at the municipality level, the data are derived from the National Color-Coded Agricultural Guide Map of the Department of Agriculture, which contains a municipal poverty database created in 2010. The poverty incidence for the four municipalities ranges from 41.90 percent for Pigkawayan to 74.00 percent for Parang.

3.5.2.7 Gender and Children Rights

There is a proposed gender and development code for the whole province of Maguindanao subject for approval to the provincial board. According to the provincial government, the code will provide equal protection to women in Maguindanao's Moro, Christian, and highland indigenous communities. The code also seeks to protect women in the province, regardless of religion and tribal identities, from exploitation, human trafficking, pornography, political and religious persecution. Women's group are organized in each barangays of all municipalities and participated municipal and provincial wide activities/programs for women's development.

The Province of North Cotabato is the first province in the country to craft the Gender and Development (GAD) Code under Provincial Ordinance No. 202 Series of 2000. Activities usually undertaken for the National Women's Month in the Provincial Capitol include the series of training for Gender and Development (GAD) and other relevant sessions like the Kalalakihang Tumutugon sa Responsibilidad at Obligasyon Para sa mga Anak (KATROPA)) and Getting To Know You and Me (GAYM), free legal assistance, medical checkup (PAPSMEAR) and gift giving to female inmates at the North Cotabato District Jail (NCDJ) and school visitations and other activities.

Also, North Cotabato got the Seal of Child-Friendly Local Governance for 2015 with a 100% rating made it with another province and two cities from SOCCSKSARGEN in successfully passing the child friendly local governance audit in 2015.

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.

For North Cotabato province, income and expenditure estimates are 149,739 pesos and 126,934 pesos respectively. These estimates for North Cotabato are higher than those of Maguindanao, but lower than the average of the SOCCSKSARGEN region.

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 31,361 for the four municipalities.

Table 51: Employment/Workers in the Municipalities Affected by SP 9

Major Occupation Group	Parang	Sultan Mastura	Sultan Kudarat	Pigkawayan
Managers	2,108	372	1,528	1,606
Professionals	1,052	120	439	1,103
Technicians and Associate Professionals	575	85	341	528
Clerical Support Workers	728	95	579	480
Service and Sales Workers	5,381	477	4,196	3,918
Skilled Agricultural Forestry and Fishery Workers	9,228	3,763	9,832	8,538
Craft and Related Trades Workers	1,016	125	2,152	1,087
Plant and Machine Operators and Assemblers	3,218	750	4,087	2,022
Elementary Occupations	3,075	1,090	4,593	5,449
Armed Forces Occupations	212	13	47	406
Other Occupation Not Elsewhere Classified	-	-	-	-
Not Reported	2,927	25	3,261	8
Total	29,520	6,915	31,055	25,145

Source: Philippine Statistics Authority, 2015

3.5.2.10 LGU Income

Based on the Bureau of Local Government Finance, Department of Finance CY 2014 data, Parang has the highest IRA with Php 164,312,348.00 pesos which includes local sourced revenues came from Municipal Taxes, Fees and other Charges. Pigkawayan on the other hand has the lowest IRA recorded among the municipalities in the project area with 94,441,248 pesos as presented in the Table below.

Table 52: Income In the Project Area

Province	Municipality	Income
Maguindanao	Parang	164,731,866
	Sultan Mastura	55,209,978
	Sultan Kudarat	149,498,078
North Cotabato	Pigkawayan	116,357,364

Source: Bureau of Local Government Finance, Department of Finance CY 2014

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.

In Sultan Mastura, records shows that IRA dependency ranges from 98%-99% of thei total annual regular income except for 2010 where there is 0% IRA dependency in the municipality.

IRA dependency in Matanog from 2009 to 2012 is 0% to which they rely only to the support provided by the provincial government. In 2013 to 2016, Matanog was allotted IRA with

dependency percentage of 95% to 100% of the municipality's total annual regular income. Sultan Kudarat ranges from 94% to 97% IRA dependency and Pigkawayan ranges from 91% to 93% IRA dependency which is quite low that the other municipalities (Data source: Bureau of Local Government Finance, Department of Finance, 2017).

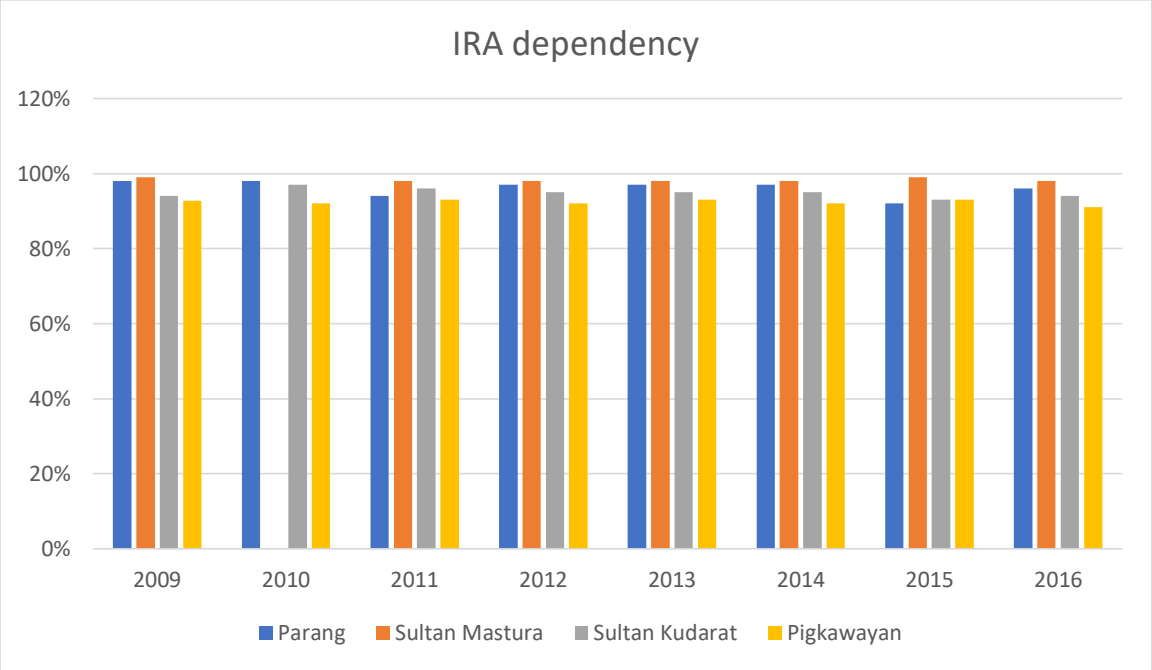


Figure 65: IRA Dependency in Municipalities Affected by SP 9

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 SP9:

Table 53. Affected structures in the area

Municipalities	Affected Barangays	No. of House	No. of Commercial Structures	Total
Parang	Orandang	4	0	4
	Cabuan	4	0	4
Sultan Kudarat	Olas	1	0	1
	Nekitan	0	0	0
	Matengen	2	0	2
Pigcawayan	North Manuangan	0	0	0
	New Culasi	0	0	0
Total		**11**	**0**	**11**

Source: RAP Survey Team

Table 54. Affected Area Cultivated with Crops

Municipalities	Barangays	Affected area of crops (sq.m.)		Total
		Corn	Palay	
Parang	Orandang	8,092	0	8,092
	Cabuan	0	24,524	24,524
Sultan Kudarat	Olas	0	14,990	14,990
	Nekitan	2,503	0	2,503
	Matengen	32,079	1,162	33,241
Pigcawayan	North Manuangan	0	0	0
	New Culasi	16,929	5,282	22,211
Total		**59,603**	**45,958**	**105,561**

Source: RAP Survey Team

Affected trees along the proposed alignment were inventoried; most of the tree species planted are fruit bearing and harvestable timber as shown in **Table 55.**

Table 55. Affected Trees

Municipality	Trees (Fruit Bearing *)	Trees (Timber/Non-fruit Bearing **)	Plant/CashTrees ***	Total
Parang	408	151	2	561
Sultan Kudarat	197	21	9	227
Pigcawayan	54	18	121	193
Total	**659**	**190**	**132**	**981**

Source: RAP Survey Team

Note:

* Fruit Bearing Trees: Mango, Coconut/ Buco, Jackfruit/ Langka, Santol, Kamatchile, Duhat, Tamarind/ Sampaloc, Aratiles/ Mansanitas, Guava/ Bayabas, Macopa, Kaimito, Avocado, Atis, Casoy/ Kasuy

** Timber, Non-friut Bearing Trees: Narra, Acacia, Talisay, Bangkal, Balite, Gmelina, Falcata, Mahogany

*** Plant, Cash Trees: Banana, Papaya, Atsuete, Cassava, Cacao

Table 56: Project Affected by SP 9

Loss Category	Unit	Quantity
Total Affected Households	HH	44
Total Project Affected Persons	PAPs	248
Loss of Land	m²	504,343
Affected Structures Residential	Unit	11
Affected Structure Religious	Unit	2
Affected Household by Loss of Structure	HH	11
Affected Cropland	m²	113,922
Affected Fruit Trees	Unit	659
Affected Timber/ Non-fruit Bearing Trees	Unit	190
Plant/ Cash Trees	Unit	12
Affected Utilities – Electrical Post	Unit	17

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 208 respondents were interviewed for this survey distributed in the 4 Municipalities with 10 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. The sample size was then allocated by barangay based on the size of the household population.

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 66.Perception interview within SP 9

3.5.3.1. Respondent's Profile and Household Information

Of the 208 respondents surveyed, around 131 or 62.98% are male while the remaining 77 or 37.02% are female (**Figure 67**). More females were interviewed, since during the conduct of the survey, most of the male household heads were at work.

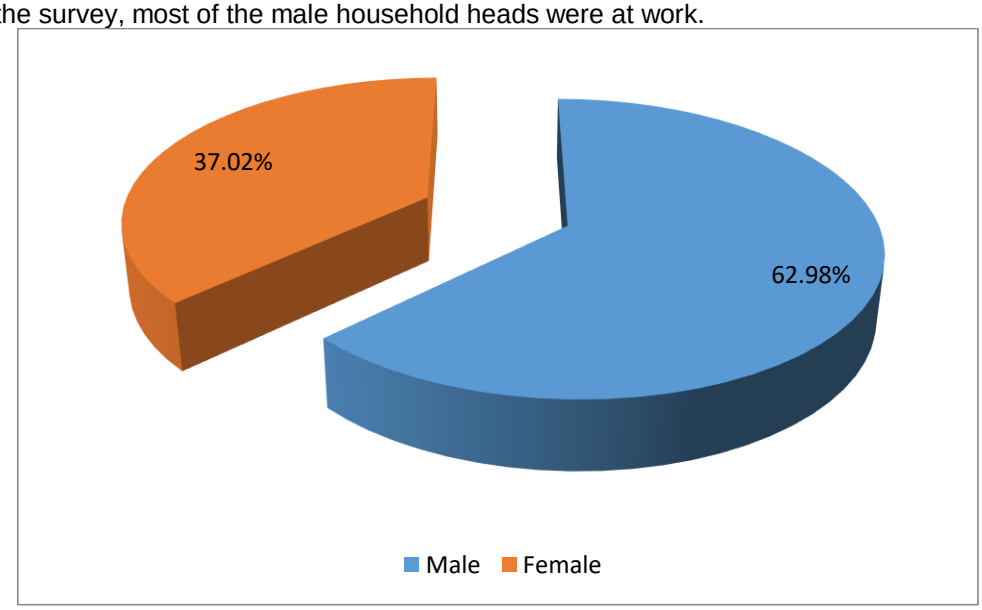


Figure 67: Gender of Respondents

In terms of age, those between 45 to 49 and 35 to 39 are the largest age group interviewed with both age groups representing 33.17% of the respondents. A summary of the age distribution of the respondents is shown in **Table 57**.

Table 57: Age Distribution of the Respondents

Age	Frequency	% Percentage
20-24	4	1.92%
25-29	13	6.25%
30-34	26	12.50%
35-39	33	15.87%

40-44`	22	10.58%
45-49	36	17.31%
50-54	31	14.90%
55-59	22	10.58%
60-64	13	6.25%
65 and above	8	3.85%

Figure 62 shows the civil status of the respondents. Majority 200 or 96.15% of the respondents are married with spouse present. Only 8 or 3.85% of the respondents are single.

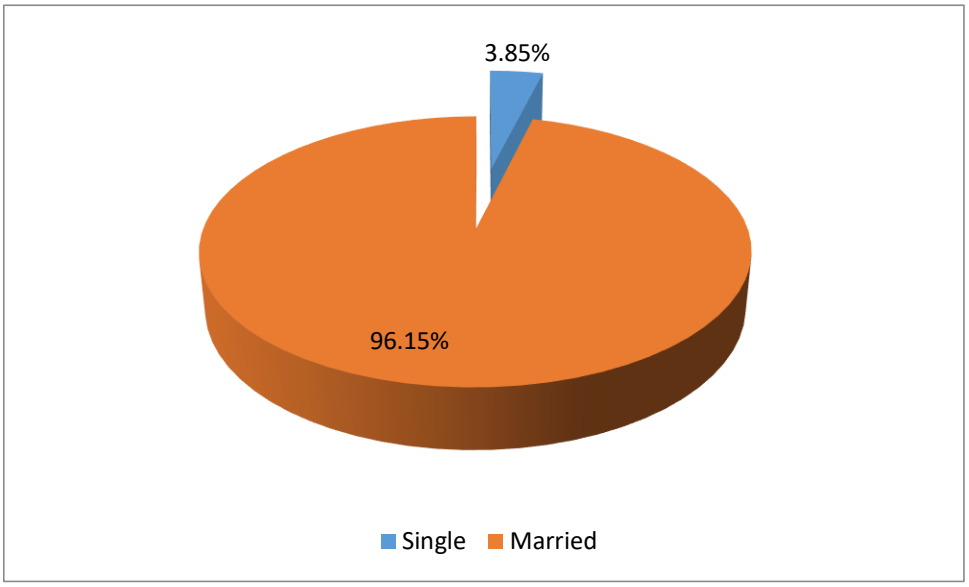


Figure 68: Civil Status of the Respondents

Figure 63 shows the highest educational attainment of the respondents. Around 51 or 24.52% of the respondents reported that they were finished up to high school level while 48 or 23.08% reported being able to reach elementary level only. Around 37 or 17.79% of the respondents reported being able to finish elementary level. Only around 9.13% of the respondents answered reaching college level and only around 2.40% reported finishing college. Around 13.94% of the respondents reported they have not received any formal education.

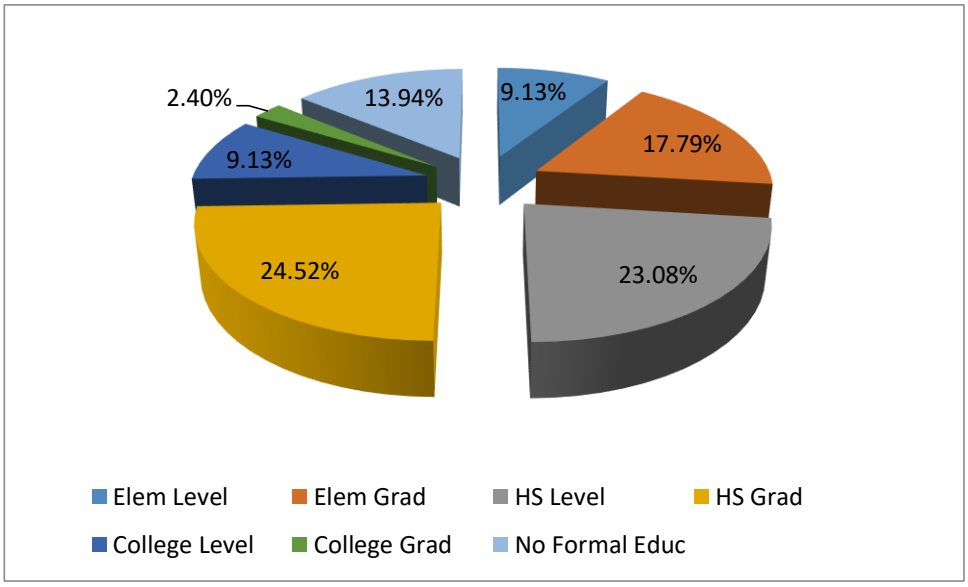


Figure 69: Educational Attainment of the Respondents

Table 58 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 58: 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 59 shows the number years that the respondents have lived in the barangay. The three highest frequency of stay in the barangay are 45 to 49, 30 to 35 to 39 and 50 to 54. The data notices that most of the respondents lived in the barangays or communities since their birth.

Table 59: 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	0	0.00%
21-24	4	1.92%
25-29	13	6.25%
30-34	26	12.50%
35-39	33	15.87%
40-44	22	10.58%
45-49	36	17.31%
50-54	31	14.90%
55-59	22	10.58%
60-64	13	6.25%
65 and above	8	3.85%

3.5.3.2 Income and Employment

Table 60 shows the employment profile of the households. Based on the occupation or source of income of the respondents, most of them depend on farming 65.38% and laborers 51.44% in the project area. Farming is the most strategic form of work due to the proximity of these people to the community. Around 15.87% are employed while 10.58% 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 60: Employment Profile

Household Employment	Frequency	% Percentage
Farming	136	65.38%
Employed	33	15.87%
Self-employed	5	2.40%
Business	15	7.21%
Fishing	0	0.00%
Laborers	107	51.44%
None	8	3.85%
Others	22	10.58%

The household income of the respondents reflects the status and capacity of providing the basic needs of the family. **Table 61** shows the household income reported by the respondents. As per interview, 68.75% have a total monthly income of 5,000-10,000 pesos, 15.87% earned 11,000 to 15,000 pesos, 9.62% have an income of 16,000 to 20,000 pesos, 3.85% for income earner of 21,000 to 25,000 pesos, and 1.94% earned 30,000 to 35,000.

Table 61: Household Income

Household Monthly Income	Frequency	% Percentage
5,000-10,000	89	3.85%
11,000-15,000	33	15.87%
16,000-20,000	81	38.94%
20,000-25,000	62	29.81%
26,000-30,000	20	9.62%
31,000-35,000	4	1.92%
36,000-40,000	0	0.00%
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 70 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 local water district and dug well.

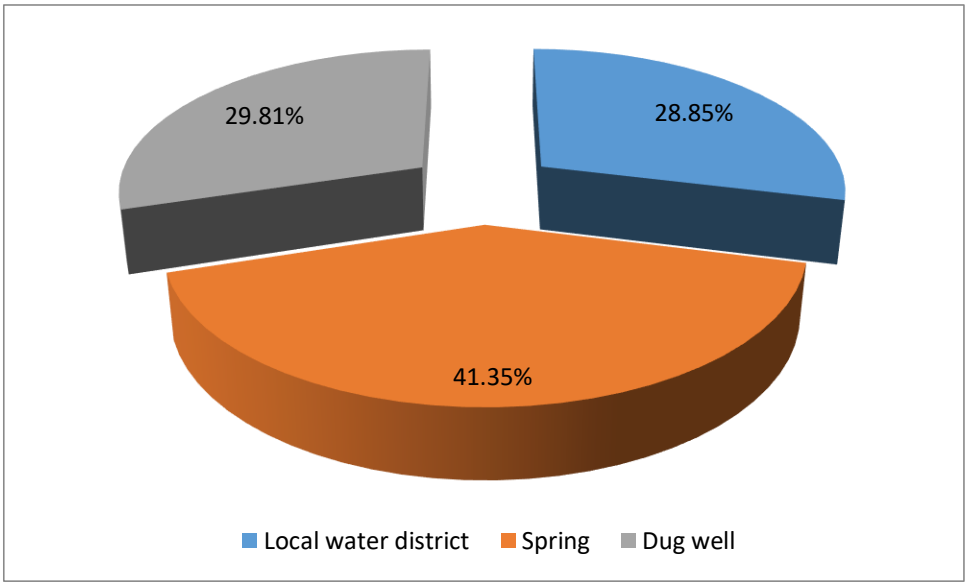


Figure 70: Source of Electricity

3.5.3.6 Access to Electricity

Majority of respondents source of electricity are from local electric supply (59.13%) as source of power in the area and 40.38% are from solar. This result indicates that the people in the area are capable of acquiring and paying for power connection.

3.5.3.7 House Types

Among the respondents, 68.27% of them have semi-concrete house structures, 16.35% are made of concrete materials and 15.38% of them made of light materials as shown in **Figure 71.**

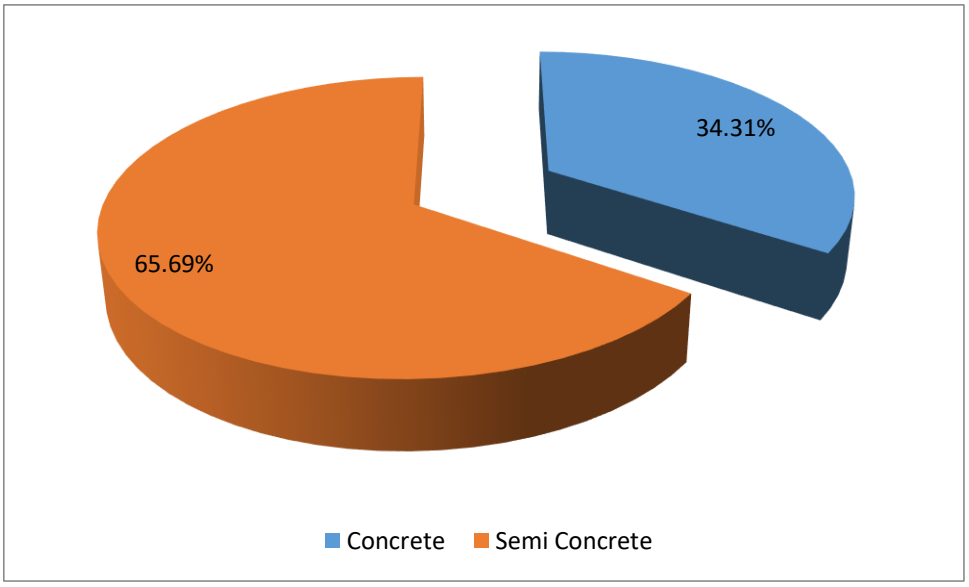


Figure 71: Type of House

3.5.3.8 Waste Management

The domestic waste disposal practiced by the respondents' shows in **Table 62.** They stated that they are burned their waste in their respective area. Also, they stated that they practiced open pit as a means of waste disposal and the Local Barangay collects their domestic solid waste.

Table 62: Waste Disposal

	Frequency	% Percentage
Collected	60	28.85%
Burned	103	49.52%
Open pit	42	20.19%
Others	3	1.44%

3.5.3.9 Type of Toilet System

In terms of type of toilet system, survey result shows in **Figure 72** that 201 or 96.63% of the respondents have their own private toilet system. Around 7 or 3.37% respondents mentioned that they shared by household.

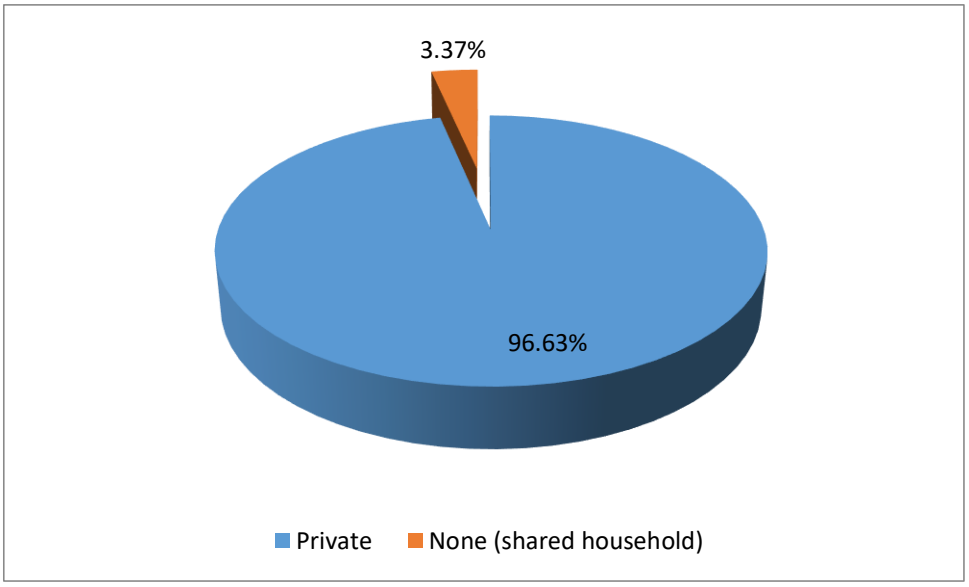


Figure 72: Type of Toilet System

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 73 shows that around 132 or 63.46% of the respondents mentioned that the project to have very beneficial while around 59 or 28.37% believe that the project would be extremely beneficial and 17 or 8.17% mentioned that the project have moderate beneficial in their communities.

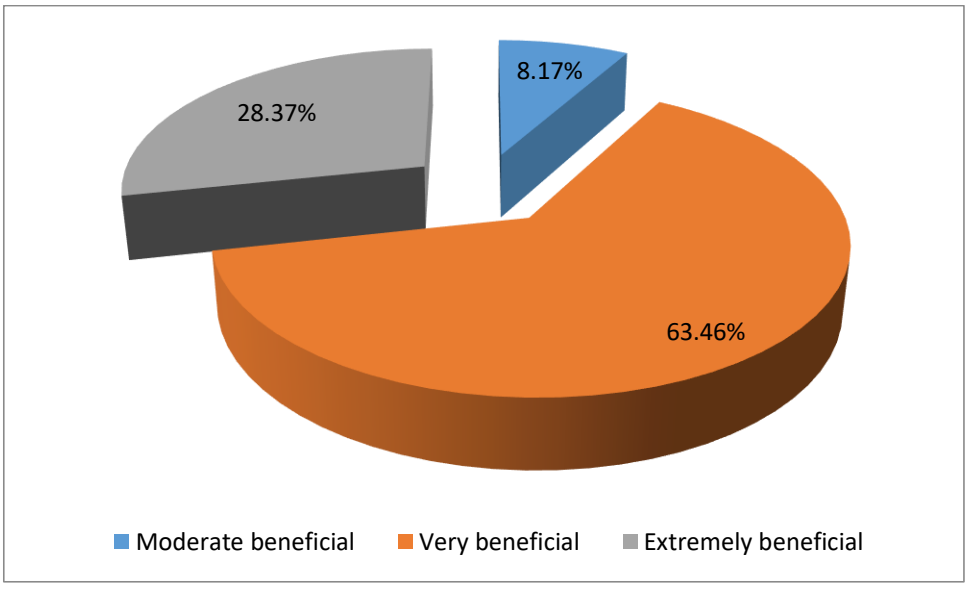


Figure 73: Perceived Beneficial Effects of the Project

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.

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

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.

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 barangay scoping meetings were held in four barangays within the direct affected community as shown in **Table 63**. These meetings discussed the project background and objectives, and the positive and negative impacts of the proposed SP 9 to the people, health, habitat, and among others. The major opinions of the participants are the process of land acquisitions and compensations as shown in **Table 64**. The queries and comments on the barangay scoping checklist was responded by the Study team. These were attended by 119 male and 33 female.

Table 63. **Contents Of Stakeholder Meeting on Scoping Stage Barangay Level**

Date (venues)	Objectives of the meeting	Major Agenda	Participants	No. of Participants
Jan. 11 and 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 – 15 Making – 22 Nituan – 14 Gumagadong Calawag – 16

Table 64. 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 9.

4.2 Summary of Baseline Survey and Forecast

Table 65. Summary of Baseline Survey and Forecast

ategory	No.	Impacted Item on JICA Guidelines (Philippines Item)	Rating		Rating After Bgy scoping		Summary Result		
			Pre/ During Construction		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, SO2NO2) at 2 stations are below the standard values.	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 75.
	2	Water pollution (water Quality)	B-	D	B-	D	Result of (pH, Temp, BOD, TSS, DO) are within the criteria 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 particularly during the night due to presence of insects like crickets that make noise during the dark.	During construction, noise measurement will exceed because of the construction equipment use and transportation vehicle coming in n out of the site	Impacts may be mitigated by avoidance and other measures such as no construction during the night and dawn, use of personal protective equipment for workers such as ear plug, muffler or sound proof barrier.
	6	Ground Subsidence	D	D	D	D			
	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 through 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 protected area is observed in the area.
Natural I Environment	10	Ecosystem (Terrestrial Flora and Fauna)	B-	C	B-	C	Floristic composition of the alignment relatively low comprised of 64 species dominated by trees. Recorded species are common and naturally growing in the area. Conservation status of recorded species showed that one (1) species is critically endangered and three (3) species are vulnerable in the category listing of the IUCN.	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	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

							Faunal composition of the alignment is nominal with only 29 species recorded dominated by avifauna. Most of the species are common and locally sited in different ecosystems including the agricultural areas, shrubland, grassland and settlements areas. These species also thrive even in highly disturb areas including cities. *Three* (3) species are endemic in the study area dominated by Aves. Two (2) species is vulnerable in the category of the IUCN.	species to migrate to other or nearby areas/habitat where disturbance is less.	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". 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	C	C	C	C	The river systems that affect the proposed road alignment are the tributaries of Simuay River.	Earthworks may cause turbidity of river water and as to the springs reported on the alignment will most likely affected	Impacts may be mitigated by sediment and silt traps .Appropriate assistance for other source of water
	12	Topography and Geology	B-	B-	B-	B-	The terrain is slightly undulating with difference in elevation reaching up to 75 masl.	• The proximity of active faults exposes the project to moderate to strong ground shaking. • Some sections may be prone to liquefaction due to presence of loose/unconsolidated sediments with shallow water table. • 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). • Appropriate geotechnical investigation to evaluate potential liquefiable soil layers. • 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 social assistance in accordance with Resettlement Action Plan (RAP) is prepared and minimize the adverse social impacts.
	14	The Poor (People)	B-/+	C	B+	C	Based on the profiles of the respondents during perception survey, 68.75 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 more than 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 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
	15	Indigenous and ethnic people (Indigenous People)	C	C	C	C	In terms of ethnicity, the project area is dominated with Iranun, Maguindanaon, Cebuano and Maranao. There are also indigenous people such as Manobo and Tiduray however comprises only small portion of the project area and outside an Ancestral Domain Claim/Title..	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 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

	16	Local Economy such as employment and livelihood (People)	B	D	B	D	Based on the occupation or source of income of the respondents, most of them depend on farming 65.38% and laborers 51.44% in the project area. Farming is the most strategic form of work due to the proximity of these people to the community. Around 15.87% are employed while 10.58% are engaged in others occupation.	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	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

							trucks in some areas that supplies water which 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	c/o RAP for the exact account of social infrastructure affected	c/o RAP for the exact account of social infrastructure affected
	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	These risks are avoided and minimized by installation of traffic signage such as sign board, reflector/lighting in the night, safety personnel and parking for construction machines
	30	Cross boundary impacts and climate change (Meteorolo	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	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 x 10^{-4} and 2.87 x 10^{-4} megaram per hectare,

		gy/climatology)						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	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.

Note) Rating:
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 66. Summary of Baseline and Forecasted Value (Air, Noise and Water)

No.	Item			Baseline Value (Standard Value)					Quantitative Forecast Analysis (Standard Value)				
1	Air Pollution	St.	Location	TSP	PM10	NO2	SO2		TSP	PM10	NO2	SO2	
		1	Brgy. Orandang, Parang, Maguindanao	30.9	5.9	3.0	1.4		-	6.0	3.1	1.4	
		2	Brgy. North Manuangan, Pigcawayan, Cotabato	36.7	2.1	5.7	1.6		-	2.1	5.8	1.6	
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	Matengen Creek	7.7	28.6	3	25	7	-	-	-	-	-
		2	Simuay River	8.1	30.4	2	62	8	-	-	-	-	-
5	Noise	St	Location	Morning (50)	Daytime (55)	Evening (50)	Night time (45)		Morning	Evening	Evening	Night Time	
		1	Brgy. Orandang, Parang, Maguindanao	**51**	50	**51**	**49**		**52**	52	**52**	**50**	
		2	Brgy. North Manuangan, Pigcawayan, Cotabato	**53**	52	**52**	**48**		**54**	53	**53**	**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 oC	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 67. 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	Not required	Contractor	DPWH

			▪ Used oil sent to TSD facility			
	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	Not required	Contractor	DPWH

			• Secure waterways in construction area			
	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 accordance with RAP	DPWH	LGU
	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 Indigenous 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	DPWH, LGU	LGU

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

Section 5

ENVIRONMENTAL/ ECOLOGICAL RISK ASSESSMENT

5.0 ENVIRONMENTAL RISK ASSESSMENT

Introduction

This chapter on Environmental Risk Assessment (ERA) supplements the Environmental Impact Statement (EIS) 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 74** 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.

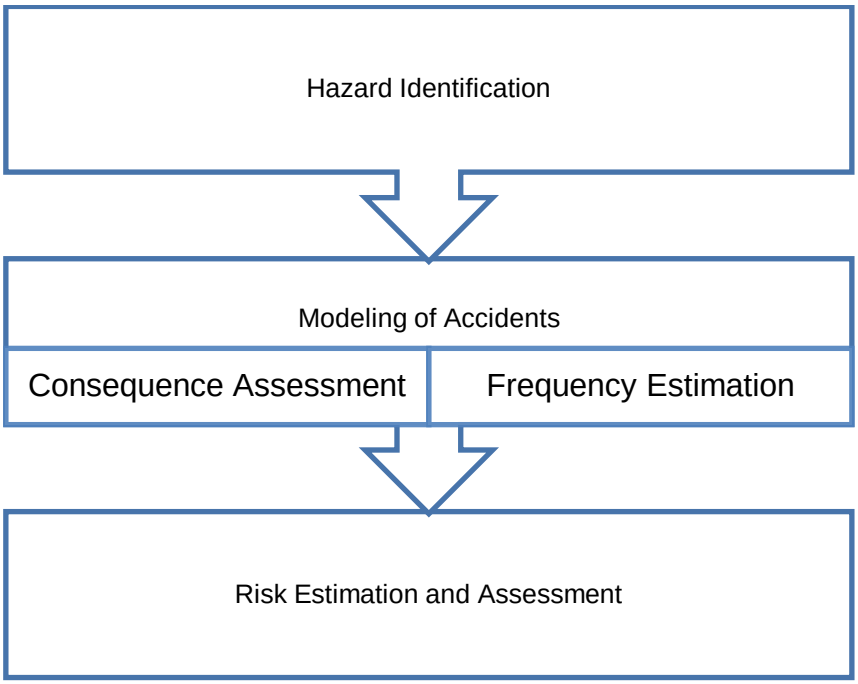


Figure 74. Overview of Quantitative Risk Assessment Procedure (IAEA, 1995)

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 68**.

Table 68. 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 3.84×10^{-4} and 5.52×10^{-4} megaram per hectare, and with estimated Carbon stored value of 8.54×10^{-4} and 1.23×10^{-3} 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 69 presents the Impact Management Plan and enhancement measures in each type of activity.

Table 69. 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	• Set-up temporary fence around the construction area • Conduct slope stability analysis and construct silt trap and spoils disposal area	Proponent/ Contractors	Included in the Construction cost	ECC

		Removal of vegetation and habitat disturbance Soil erosion Increase run off	• 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 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	• Preparation and implementation of traffic management scheme			
		Landslide: - The study area has low to moderate	• Assess the stability of slope during construction and long-term conditions;			

		susceptibility to landslide	• 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 equipment, vehicles and regular watering activities • Contamination of surface water with oil and grease	• 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 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	Proponent/ Contractors	Included in the operating cost	ECC
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 construction workers • Health Risk	• 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 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	Proponent	Included in the operating cost	ECC

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	Proponent/ Operator / Contractors	Included in the Operating cost	ECC

			• Safety Data Sheet will be in place • Climate Change Adaptation: - Reduction of greenhouse emissions from energy used in 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 18 stakeholders' meetings were held for SP 9. 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, Sultan Mastura, Sultan Kudarat, and Pigcawayan with the affected stakeholders, barangay and municipal officials, and concerned LGU offices such as Assessors, MPDC as shown in **Table 70**. These meetings were attended by a total of 346 participants (Male-259 and Female-87).

The major questions of the participants brought out during the 1st and 2nd public consultations are enumerated below. All questions, comments and suggestions are answered by DPWH ARMM, JICA Cotabato, RAP, and EIA Study team as shown in **Table 71**.

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. What will happen to the overlapping road (proposed SP 9 and existing);
g. Who will compensate the affected land, crops, and other structures;
h. What will happen to the household that depends their income to the affected land and crops;
i. What happen to the affected land, properties, tress and fruit bearings;
j. Necessary documents for claims and compensations;
k. Sultan Mastura requested to include barangay Bungabong in the alignment of SP9;
l. Sultan Kudarat suggested to assess the classification of the soil because the affected barangays are prone to landslide and include drainage in the alignment;
m. Include forester policies to protect the perennial tress and habitat area; and
n. Work force from the affected communities.

2nd Public Consultation

- Requested for the installation of water system in the barangay
- Consider the widening of our barangay road.
- Undertake close coordination to the LGU, MNLF and MILF
- Convene Meeting with RAP suggested by the Mayor of Sultan Kudarat
- Compensation of affected people
- Peace and Order during implementation

During the 1st public consultations, the women's emphasized the importance of proper compensation for the affected landowners and livelihood projects for extra income during construction. While in 2nd Public Consultation, some requested for improvements of barangay road, coordination with the LGU, MILF and MNLF and ensure that compensation and coordination to affected people be undertaken.

Overall, the proposed sub-project No. 9 is socially acceptable based on the responses and feedbacks of the stakeholders. They are willing to be compensated and suggested to implement the project early from schedule.

Table 70. CONTENTS OF STAKEHOLDER MEETING MUNICIPAL LEVEL

Date (venues)	Objectives of the meeting	Major Agenda	Participants	No. of Participants
Dec. 7, 12, and 13, 2017 1. Parang Municipal Conference Room 2. Sultan Mastura Municipal Conference Room 3. Sultan Kudarat Municipal Conference Room 4. Municipal Gymnasium of Pigcawayan	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, RAP and JICA Study Team	Parang: Male – 66, Female – 8 Sultan Mastura: Male – 33, Female - 8 Sultan Kudarat: Male – 23, Female - 14 Pigcawayan: Male – 18, Female - 12

Date (venues)	Objectives of the meeting	Major Agenda	Participants	No. of Participants
February 27, March 1 and March 2, 2018 1. Parang Municipal Conference Room 2. Sultan Mastura Municipal Conference Room 3. Sultan Kudarat Municipal Conference Room 4. Municipal Conference Room of Pigcawayan	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, and JICA Study Team	Parang: Male – 45, Female –13 Sultan Mastura: Male – 18, Female - 5 Sultan Kudarat: Male – 33, Female - 9 Pigcawayan: Male – 23, Female - 18

Table 71. MAJOR OPINIONS IN STAKEHOLDER MEETINGS MUNICIPAL LEVEL

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (RAP, and JICA Survey Team's answers has been accepted and understood basically)
Dec. 7, 12 and 13, 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 (Crops/Trees)	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.
		People	Infrastructure (Alignment)	3. (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.	3. We will request to the proponent to provide the affected community the final road alignment.
				4. (Parang) Is there any way to realign the road to another area?	4. 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.

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (RAP, and JICA Survey Team's answers has been accepted and understood basically)
					We need this road for easier access and to avoid traffic.
				5. (Parang) Where is the exact alignment of the project?	5. There are alternative options for the road alignment. The presented alignment is the feasible and will be finalized after the RAP inventory.
				6. (Parang) Can we request that the alignment avoid the cemetery of Muslim?	6. 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.
				7. (Sultan Mastura) Where is the alignment of the proposed road? What will happen to the existing road implemented by Mayor, would the proposed project is the continuation?	7. (Mayor Mastura) The proposed project is still initial, they are still in the study phase. The existing road will connect the proposed road. Barangay Bongabong is not part of the project but they are just here to inform the community that there will be a proposed project on the other municipality that we are also benefited, in terms of the easy access going to other municipality.
				8. (Sultan Mastura) Based on the showed map, we are very sad because we are not included in this project. We would like to suggest that there should	8. We will take note on the suggestions and included this on the 2nd steering committee meeting on Dec. 20, 2017. In that meeting, we

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (RAP, and JICA Survey Team's answers has been accepted and understood basically)
				be Option 5. We suggested to be included in the road alignment.	will discuss if there is a possible realignment and option. This showed map is just an initial.
			Properties	9. (Parang) What will happen to land owners without land title?	9. 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. We strictly follow the guidelines of DPWH.
				10. (Parang) Who will pay for all the structures like houses that will be affected by the project?	10. DPWH will be the implementing agency and will pay the acquisition of all affected land, structures after the inventory of RAP team.
				11. (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?	11. DPWH along with the LGU will negotiate and help those who will be affected.
				12. (Parang) What are the needed documents for claims?	12. You need to secure certificate of land title or tax declaration.
				13. (Sultan Kudarat) There will be families in barangay Matengen that might be affected by the road alignment, can we reroute instead of relocating the families? Or what are your solutions on this problem?	13. This is an initial road alignment, we will document all the affected of the alignment and submit this to DPWH and JICA. For example, the affected families has no other place to live, it might be possible that we will adjust or will be dependent on the decision of DPWH because

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (RAP, and JICA Survey Team's answers has been accepted and understood basically)
					they are the implementing agency. We will conduct an inventory to all affected and make a unit price analysis to come up with an estimated cost. This will be submitted to Municipal Assessors office, DPWH local and national offices. We will also gather prices from local supplier within the municipality for the cost estimates. We also include in the estimates the time of relocation, means of transportation to the new location. For the trees, we will include the life span. All of this will be part in our research.
				14. (Sultan Kudarat) What if the owner of the affected property or land will not issue clearance to the project? What will happen?	14. We are hoping that this will be prevented, because JICA as much as possible to avoid any problems in ROW and the possibility that this project will not be implemented.
				15. (Pigcawayan) What will be the solution of the affected private property in Barangay Manuangan?	15. All of the affected properties will be included in the inventory and will be computed (estimated cost). We will gathered data from assessor's office, from municipal and regional level. The estimated computations will be presented during the 2nd public consultations to be held in your barangay. We also have agreed value that will be suggested by the affected owners. This will be submitted to JICA and DPWH. DPWH make a compensation plan and validate in the barangay level. DPWH will determine on the true cost.

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (RAP, and JICA Survey Team's answers has been accepted and understood basically)
			Vulnerable	16. (Parang) What is the design of the road? Is it accessible to all, with signage and PWD friendly?	16. 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.
			Livelihood	17. (Pigcawayan) Local laborer must be hired from the affected barangays?	17. This is one of the requirements of DENR. Local labors will be coming from the barangay and will help the community while the project in the area is ongoing. The result of the inventory will be presented in the barangay public consultation. Also, one of the requirements of the DENR is the municipal and barangay resolution that will be signed by the community. The content of the resolution is that the community agreed on the presented estimated cost of the affected property and among others.

			Hazard	18. (Sultan Kudarat) Mr. Blaim mentioned that based on the hazard assessment conducted by DENR, the affected 3 barangays are prone to landslides. 30% are affected by landslide during heavy rains. I suggest to check the area before the constructions and at the same time we need include drainage area both side of the road. Further he added, that this project will bring many improvements in the municipality. In addition, can we request to implement the forester policies to protect the perennial tress and areas with wild animals?	18. Landslide will be included in our study, we gathered data from MGB and study on the slope and other factors that will be affected by the road alignment. This will be submitted to DPWH and JICA. We are doing a comprehensive study on this road project such as flora and fauna that will be seen during the survey. All of this will be included in the EIA study. We have experts for geology, hydrology, and marines for the coastal areas. The geohazard aspects and slope protection will be part of the study; drainage canal will be included in the environmental management plan that will be recommended so that the implementing agency (DPWH) will conduct a geotechnical investigations to know the classification of the soil. Definitely engineering measures will be done before the construction stage to prevent the precious incident like in Baguio City. Further study for geotechnology for landslide prone areas will be implemented by DPWH. We will take note all of the suggestions.

Date and Objectives	Agenda	Item on EIA		Major Opinion	Answers (RAP, and JICA Survey Team's answers has been accepted and understood basically)
			Livelihood	19. (Pigcawayan, Women Group) Can we have a business/small canteen for the laborers during construction?	19. Yes, because during construction, many job or business opportunities will come in. Such as canteen because the laborers will also need this.
February 27, March 1 and March 2, 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. (Sultan Kudarat) The project is very important to us. The most affected area are agricultural lands and farming activities of the people however will be lessened the impact to the people if negotiation and consultation to the affected be undertaken.	1. The team explained that all affected of the project can be compensated based on DPWH rules and regulation. RAP will be implemented once the project is finalized.
				2. (PIgcawayan) How about those trees that will be affected? Can the affected people get that, so we can utilize it?	2. We can request that but there is a process that is followed by DENR in terms of tree cutting. This is subject for COA Audit
		People	Utilities	3. (Parang) The source of water (dug well) will be affected. He requested for the installation of water system in the barangay. He submitted a resolution/ request to the team for consideration	3. The team stated that their concerns and requests were noted and informed them that this will be recommended to the proponent
			Infrastructure (Farm to Market Road)/Widening)	4. (Sultan Mastura) We hope that the project will pushed through which will provide benefit to majority of the communities here. We also hope that a farm to market road will be implemented to maximized the benefit of the project.	4. The team are thankful for the support of the LGU to this study. They said that their concerns and requests were noted and informed them that this will be recommended to the proponent