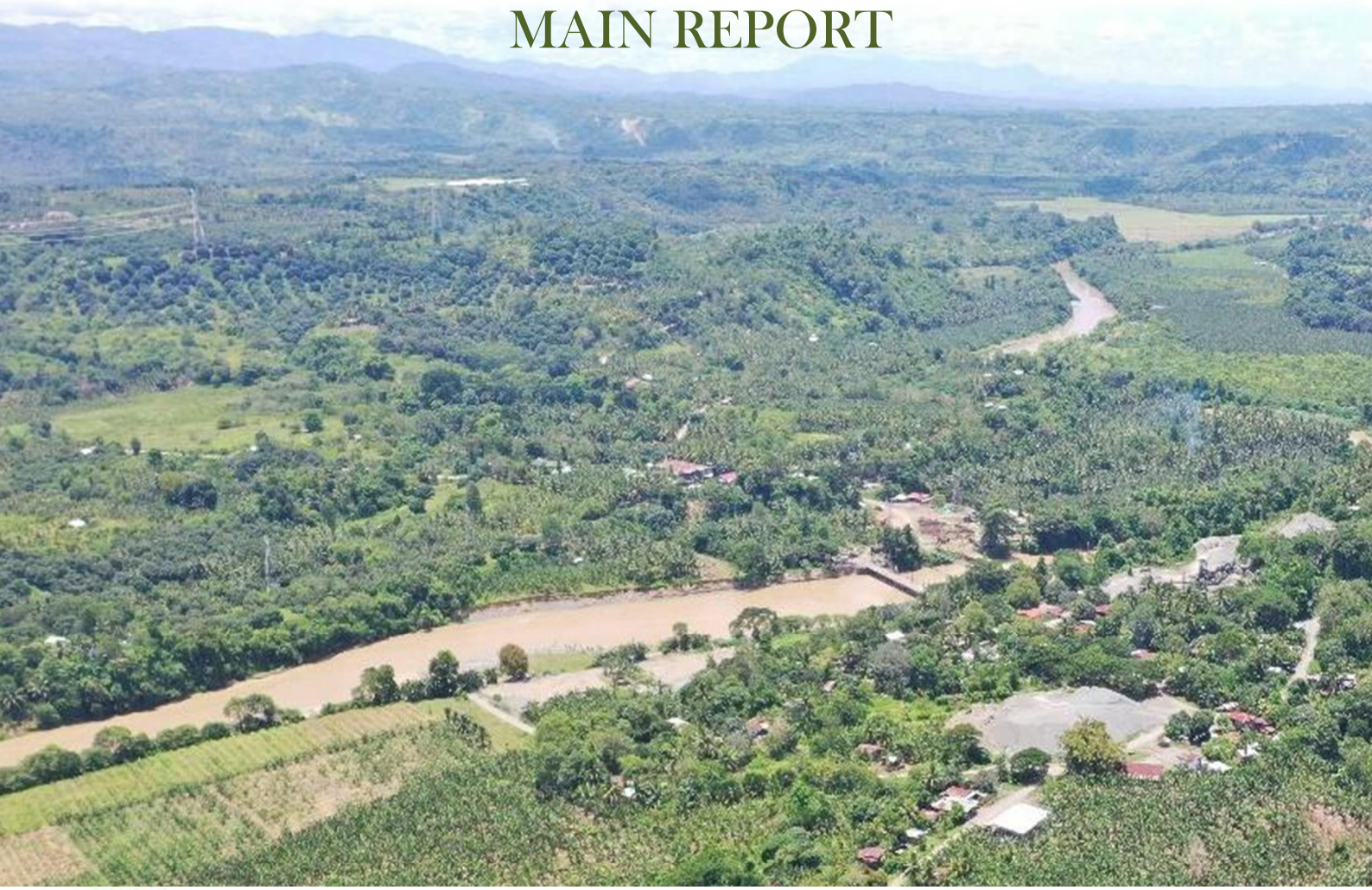
ENVIRONMENTAL IMPACT STATEMENT

Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)

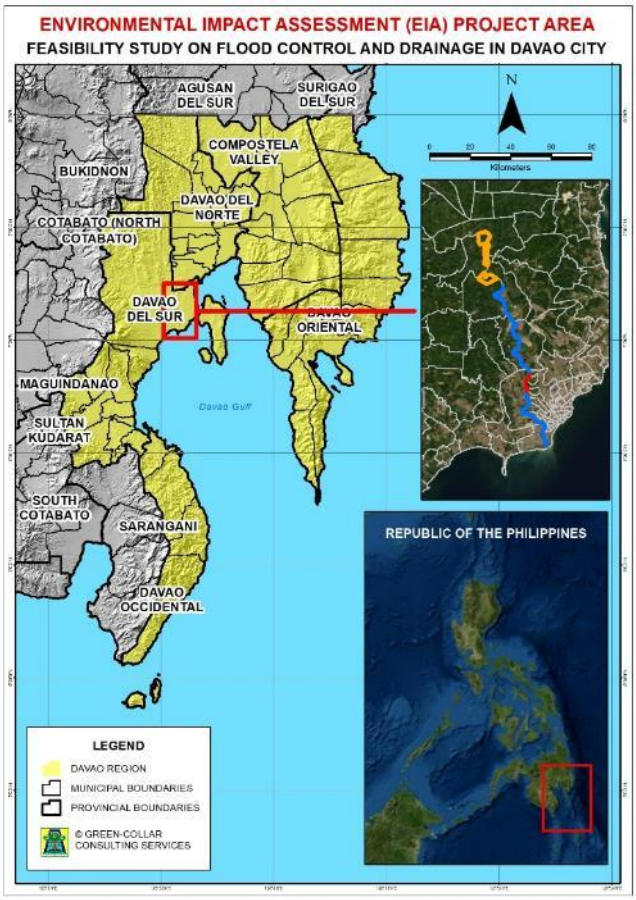
MAIN REPORT



DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
DPWH 2nd Street, Port Area, Manila
Proponent

GREEN-COLLAR CONSULTING SERVICES
Toog Avenue, Purok 4, Brgy. 2, San Francisco, Agusan del Sur
EIS Preparer

PROJECT FACT SHEET



The project for the Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River component) is aimed to mitigate water-induced disasters such as floods that affect lives and properties. It is in Davao City, Region XI. This environmental enhancement type of project specifically covers Barangays Bucana, 1, 2, 5, 8, 19-B, Ma-a, Waan, Tigatto, Mandug, New Carmen, New Valencia and Callawa. It has two stages: feasibility study and detailed engineering; and, implementation. The feasibility study and detailed engineering design will be undertaken by the Japan International Cooperation Agency (JICA) consultants since this project is a technical cooperation and grant-in-aid from the Japanese government while its implementation will be carried out by the Department of Public Works and Highways (DPWH).

The project is composed of three phases – the pre-construction phase; the construction phase; and operation phase. The construction phase consists of the construction of different structures, namely: a. 3 retarding ponds, b. cut-of-works cum bridge, and c. river dredging.

Due to the nature of the project, it is expected to have significant adverse impacts. Large volume of dredged materials and excavated soil will be generated once the project will be implemented. Disposal of dredged materials should be in accordance with DPWH DO 139-2014 and dredging master plan. A dredging master plan should be crafted first before the commencement of the dredging activities. Disposal of the excavated soils from retarding ponds and cut-off works will be disposed in accordance with the master plan and in coordination with the LGU Davao City. Siltation of Davao River (downstream) and Davao Gulf is one the major adverse environmental impacts of the project. This could be minimized using silt curtains and construction of temporary siltation ponds for the silt-laden surface run-off. Other adverse impacts to biophysical environment include air and noise pollution, removal of vegetation, habitat fragmentation, disruption of freshwater biota. People living within the retarding ponds and along the cut-off works will be displaced. Resettlement Action Plan (RAP) will be crafted in order to address the issues of the People Affected by the Project (PAPs) such as compensation, loss of agriculture, loss of livelihood, especially the sand and gravel concessionaire will be also affected by the flood control projects.

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List of Acronyms

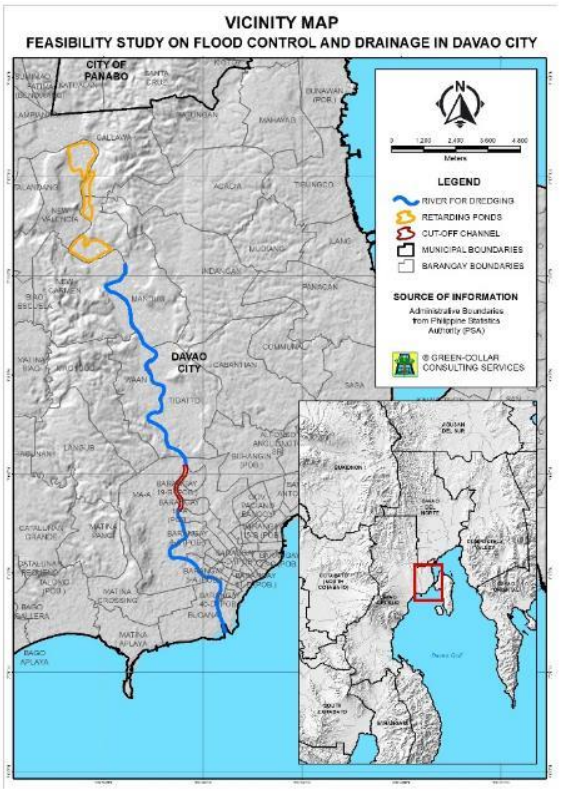
AADT	Average Annual Daily Traffic
ANR	Assisted Natural Regeneration
BHW	Barangay Health Worker
BLGU	Barangay Local Government Unit
BOD	Biological Oxygen Demand
CAPI	Computer-Assisted Personal Interview
CDRRMO	Davao City Disaster Risk Reduction and Management Office
CENRO	City Environment and Natural Resources
CEO	City Engineer's Office
CHO	City Health Office
CITES	International Union for Conservation of Nature
CLGU	City Local Government Unit
CLIRAM	Climate Information and Risk Analysis Matrix
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COW	Cut-off Works
CSSDO	City Social Services and Development Office
DAO	Department Administrative Order
DBH	Diameter at Breast Height
DCFCDMP	Davao City Flood Control and Drainage Master Plan
DCWD	Davao City Water District
DENR	Department of Environment and Natural Resources
DENR NAAQGV	Department of Environment and Natural Resources-National Ambient Air Quality Guideline Values
DepEd	Department of Education
DLPC	Davao Light and Power Company
DO	Dissolved Oxygen
DOH	Department of Health
DOST-PAGASA	Department of Science and Technology-Philippine Atmospheric, Geophysical and Astronomical Services Administration
DPWH	Department of Public Works and Highways
DSLR	Digital Single-Lens Reflex Camera
ECAs	Environmentally Critical Areas
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EIA TOR	Environmental Impact Assessment Terms of Reference
EMB	Environmental Management Bureau
EMP	Environmental Management Plan
ENE	East-Northeast
EO	Environmental Officer
EPQL	Environmental Quality Performance Level
ERL	Effects Low Range
FGD	Focus Group Discussion
FS	Feasibility Study
GIS	Geographical Information System

GPS	Global Positioning System
H_2S	Hydrogen Sulfide
IEC	Information, Education and Communication
IMP	Impacts Management Plan
ISQG	Interim Sediment Quality Guidelines
ITC	Intersection traffic count
IUCN	International Union for Conservation of Nature
IV	Importance Value
JICA	Japan International Cooperation Agency
JMC	Joint Memorandum Circular
KII	Key Informant Interviews
LGUs	Local Government Units
masl	meters above sea level
MCM	Million Cubic Meters
MPN	Most Probable Number
NAMRIA	National Mapping and Resource Information Authority
NGOs	Non-Governmental Organizations
NNW	North-Northwest
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration.
NPCC	National Pollution Control Commission
N-S	North-South
NW	Northwest
OCPDC	Office of the City Planning and Development Coordinator
PAPs	People Affected by the Project
PAST Software	Paleontological Statistic Software
PCO	Pollution Control Officer
PD	Presidential Decree
pH	Potential of Hydrogen
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PM	Particle Matter
PM_{10}	Particulate Matter less than 10 microns
$PM_{2.5}$	Particulate Matter less than 2.5 microns
PPM	Parts Per Million
PSA	Philippine Statistics Office
RA	Republic Act
RA	Relative Abundance
RAP	Resettlement Action Plan
RCPs	Representative Concentration Pathways
RP(s)	Retarding Pond(s)
SAG	Sand and gravel
SMR	Self-Monitoring Report
SO_2	Sulfur Dioxide
SWMP	Site Waste Management Plan
TCM	Tetrachloromercurate
TSS	Total Suspended Solid
UNDP	United Nations Development Programme

UPMO	Unified Project Management Office
UPMO-FCMC	Unified Project Management Office-Flood Control Management Cluster
WQMA	Water Quality Management Area
WSS	Work Sampling System

EXECUTIVE SUMMARY

Brief Project Description

Element	Description
Project Title:	Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Project Location: The project covers 13 barangays in Davao City, Davao del Sur. These barangays are (from downstream to upstream): Bucana, 5, 1, 2, 8, 19-B, Ma-a Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa.	
Project Rationale	Flooding is one of the most expensive natural phenomena in the Philippines due to its overwhelming power and destructiveness. Water-induced disaster brought about by the geographic and meteorological conditions hamper the socio-economic development of the country. Moreover, floods prevent any development or urbanization into unsafe floodplains and endanger the lives and properties of those who reside in the floodplains. Flood control is a necessary precautionary measure to ensure that the damages caused by flooding are kept to the bare minimum. Financially, they reduce the burden placed on municipalities and communities where flood damages are extensive and frequent. Flood control is a national priority since flood is considered a menace to national welfare. It is a commitment of the national government to protect people and property.

Element	Description
Project Phases:	The project has three (3) phases. These are the pre-construction, construction, and operation. **Pre-construction phase.** This phase involves the feasibility study, finalization of other related plans such as dredging plan, securing an ECC and other permits, RAP finalization and relocation of directly affected households of retarding ponds and cut-off-works. Detailed engineering design of the different infrastructure will also be done during this phase of the project. **Construction phase.** This is the construction of three retarding ponds, cut-off channel and the dredging of Davao River. Demobilization of contractor after the completion of the project is the last activity under construction phase. **Operation phase.** Since this project is environmental enhancement, the activities that will be undertaken are mainly care and maintenance of the structures to avoid collapse and other structural infirmities
Project Component and Duration 1. River Dredging (2025 – 2030)	The river dredging will cover the stretch of Davao River in 10 barangays namely; Barangay Bucana, Barangays 1, 2, 5, 8, Ma-a, Wa-an, Tigatto, Mandug and New Carmen. The dredging work will be from the mouth of Davao River up to 23 km upstream.
2. Cut-of-Works – cum - bridges (2025)	The cut-of-works – cum – bridges will be in Barangays 19-B, Ma-a and Tigatto. The cut-of-works will shorten the river line and increase river flow capacity in discharging flood water to the sea. Two access bridges will be constructed.
3. Retarding Ponds (2030 – 2035)	Three retarding ponds will be constructed to retain water during flood days. During dry season the retarding ponds will be converted to multiple uses depending on the plans of the City LGU. These ponds are in Barangays Mandug, New Carmen, New Valencia and Callawa. The three retarding ponds will cover a total area of 1.79 square kilometers or 179 hectares with a total volume capacity of 11.4 MCM. The estimated excavated material is 15.5 MCM

Element	Description
Waste generation	During the construction, solid waste (vegetal and domestic), air emissions from heavy equipment and vehicles, sediment which lead to siltation of the river and oil and grease from vehicles and heavy equipment are likely to occur. Noise and vibration will also be generated.
Manpower	The project will employ professionals (engineers,) skilled and unskilled workers. Hiring arrangement will be 60% from the affected community and 40% from the contractor (DO 130 – s2016).
Project cost	PhP 11.6 billion

Brief Summary of EIA Process

Element	Description
EIA Preparer	Green-collar Consulting Services Experts: Carmelita P. Martinez – team leader Raul R. Buñao – Terrestrial Flora & Fauna Ludivina Porticos – Water & Soil Chemistry Ana P. Ocenar – Freshwater Ecology Silverio Magallon – Social expert
Study period	Eight (8) months
EIA Methods	Combination of checklist, and GIS. Field works and surveys. Methods of analysis are in accordance with EMB guidelines.
Summary of public participation	Following the provisions in DAO 2017 – 15 and EMB MC – 2020-30, the public participation started with the information education and communication (IEC) regarding the project. The target participants are the directly affected communities, and barangay officials. Public scoping followed which was facilitated by EMB XI. The public scoping was participated by the affected community, representatives from City government, NGOs, academe, DENR and sectoral representative i.e., women, youth, senior citizens.
Conduct of EIA Study	The conduct of EIA study involved the following activities: 1. Field surveys and mapping – terrestrial, freshwater, social, air, noise and vibration 2. Collection of water and sediment samples 3. Laboratory analysis 4. Impact identification 5. Formulation of mitigating/enhancement measures, and management & monitoring plans 6. Socio economic survey, IEC and consultations

Summary of Baseline Characterization

EIA Elements	Summary of Baseline Condition
Land	- Land Use and Classification. The existing land use of the project area (retarding ponds and cut-off works) is agricultural with patches of naturally grown forest and settlement. The proposed flood control project is inconsistent with the existing land use. - The project area is located along Davao River hence it is classified as Environmentally Critical Area (ECA) as per definition in Revised DAO 30 – 03. Although the projects are within ECA, these are non-ECPs, hence ECC approval is required at the regional level. - The geologic composition of project areas falls under recent geologic epoch which are mainly sedimentary deposition, unconsolidated to loosely deposits, alluvial sand and gravel. - The different components of the flood control projects are in different elevations. Retarding ponds are situated in elevation between 20 and 50 masl, cut-off works in areas between 0.01 and 10 masl while the dredging works are spread from elevation of 20 to 50 masl. Generally, the terrain of the structural components is flat to undulating without critical slope. - The natural hazards frequenting the project sites are earthquakes, seismic and floods. The project site is in areas with high level of combined risks due to geophysical disasters.
Terrestrial Biology	- The vegetation within the project sites varies from grassland to open canopy forest and some portion of beach and mangrove ecosystem in the downstream area. The open-canopy forest is second-growth and residual forest dominated with Fabaceae, Euphorbiaceae and Moraceae family tree species. The forest floor of the open-canopy forest has poor undergrowth due to the thick forest litter (e.g., leaves, twigs, branches etc.) The open forest is relatively young with the highest recorded diameter at breast height (DBH) at only 36 cm; while majority of the individual species have DBH that fall between the 3 cm to 18 cm. The open portions are brushland which is dominated by cogon, ferns, herbs such as hagonoy, some shrubs and small trees. There are 163 species in 73 families of terrestrial flora, of which sixteen species are endemic The Shannon diversity index ranged from moderate to very high and the evenness is high to very high. Seven species are included in the red list – 2 are endangered, 4 are vulnerable and 1 is categorized as threatened. - There are four species in four families of volant mammals and only 1 non-volant observed in the project sites. Of the four volant, one is resident and 3 are endemic. Three are categorized as least concern and one species - *Eonycteris robusta* is near threatened according to the IUCN categolization. The lone non-volant is resident in the project site and of least concern. There are eighteen avifauna species

EIA Elements	Summary of Baseline Condition
	observed in thirteen families. Of the eighteen species, three are endemic and fifteen are categorized as resident. All species of avifauna are under the category of least concern (IUCN). Three species of amphibian fauna were seen. One of which is endemic and two are resident. *Limnonectes magnus* commonly known as the Giant Philippine Frog is now near threatened as per IUCN endemicity category.
Water	- Davao River is one of the largest rivers in Mindanao. The headwater is in the province of Bukidnon and the outfall is in the Davao Gulf. The proposed flood control projects are in the downstream of the basin. - The stretch of Davao River affected by the project is classified as Class A (along Mandug area) and Class B (along Waan, Ma-a and Bucana). The water quality is evaluated against the DAO 2016 – 08 standards and DAO 2021 – 19 for phosphate and fecal contents. Phosphate and total suspended solids in all stations exceeded the standards while an exceedance of chloride was found in a station along Bucana. Hexavalent chromium exceeded the standard in stations along Waan and Mandug. Mandug stations yielded oil and grease higher than the standard for Class A waters. - Sediment quality was evaluated using the Canadian and NOAA guidelines because there is no Philippine guideline available. Arsenic and mercury concentrations in river sediment were below the limits of the two guidelines while chromium in Waan, Ma-a and Bucana exceeded both guidelines. Lead was below the Canadian guideline but higher than the NOAA guideline. - All species of macro-invertebrates have no conservation status data in IUCN. Five (5) species collected – three (3) were insects and 2 crustaceans (hermit crab). Thirteen species of phytoplankton in 2 phyla were collected.
The Air	- Davao City belongs to Type IV climate category based on the Modified Coronas Classification. Type IV climate is characterized by rainfall evenly distributed throughout the year. The annual average rainfall of Davao City is 1977.19 mm with the month of October as the wettest and March the driest. The average annual daytime temperature is 31^0C and nighttime temperature is 22^0C. The warmest is April and the coolest month is July. - Climate projection using RCP 4.5 and 8.5 scenarios of greenhouse gas emissions were done by DOST-PAGASA using CLIRAM. The seasonal average temperature change in mid-21st and late- 21st century would increase and the seasonal changes of precipitation during these periods would decrease. - The 24-hour ambient monitoring revealed a good air quality because the concentrations of all parameters were below the DENR NAAQGV

EIA Elements	Summary of Baseline Condition
	criteria. Noise levels in the three stations, however, were found to be not good. Level of noise exceeded NPCC Standard except station N1 daytime period. - Vibration level in New Valencia was found to have exceeded the standard during daytime and within the standard during nighttime.
The People	- Most of the affected households are long-time residents of the area, with poor educational background, having large size of family, and living below the poverty line. Majority of them own the house they occupy and mostly lot owners. The top three (3) main issues and problems of the affected communities are flooding; landslide; and, unemployment. - Majority of the households in the direct and indirectly affected areas are aware of the proposed flood control project in Davao River. Most of them are also willing to accept the project mainly because they believed that it will address the flooding problem in the city. On the other hand, few of them oppose the project as it may dislocate them and affect their properties. Nine (9) out of ten (10) directly affected households are willing to support the project. They are appealing; however, that "just compensation" shall be given to them for the affected land, houses, and other assets. Sand and gravel concessionaire will be affected because they will lose their business when the flood control projects will be implemented.

Summary of Environmental Impacts Assessment and Mitigation

PROJECT PHASE	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT
Pre-construction	People	- Displacement and loss of livelihood especially sand ang gravel concessionaire - Fear of non-employment due to possibility of hiring of non-local laborers - Fear for their health and safety	- Develop and implement IEC to change the mind-set of affected communities toward the project - Involve the community in the design and formulation of the Resettlement Action Plan - Compensation of sand and gravel concessionaire will be based on the existing government guidelines - Hiring of locally qualified labor. - Involve the community in the design, formulation, and resettlement action plan - Provide safety measures and appropriate PPE to workers
		- Generation of employment - Improvement of local government services and of community infrastructure	- Priority to hire qualified affected people - Coordinate with the CLGU and BLGU
Construction	Land	- Generation of dredged materials and excavated soil - Removal of vegetation including economically and ecologically important species - Destruction and fragmentation of wildlife habitat - Disturbance/displacement of wildlife - Change in land use - Soil erosion	- Handling and disposal should be in accordance with DPWH DO 139 – 2014 and JMC 01 – 2019 - Formulation of dredging master plan for Davao River - Identify sufficient and suitable disposal site - Prioritize ecologically and economically important species in the conservation initiatives - Establish a nursery - Practice tree balling of endemic tree species and facilitate immediate transfer to open areas - Propagate endemic plant species - Establish buffer zone[1] - Implement appropriate land use zoning - Proper engineering design of permanent facilities - Provide buffer zone - Conduct geotechnical study

[1] The actual area will be set by the Contractor once they are mobilizaed.

PROJECT PHASE	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT
	Water	- Siltation of Davao River (downstream) - Sedimentation of Davao Gulf	- Provision of silt curtains and siltation ponds - Proper scheduling of works - Provision of temporary sewerage system for workers
	Air Quality and Ambient Noise Level	Increase in the concentration of PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO - Noise/ vibration disturbance	- Use new model low emission vehicles - Regular watering of dust generating mounds - Install cover of hauling trucks - No overloading of hauling vehicles - Provision of mufflers
	Health & Safety	- Stress due to noise pollution - Increase in road accidents due to increased vehicular traffic - Vehicular and heavy equipment emissions can cause respiratory problems - Damage to roads and bridges - Spread of COVID -19	- Implementation of a health & safety program - Close coordination with the CLGU and BLGU - Establishment of buffer zones - Tree planting in open areas - Regular maintenance of hauling trucks and heavy equipment - No overloading of vehicles - Regular maintenance of roads, e.g., re-graveling, pothole patching, scraping of droppings - Observe Health Protocol - Self-isolate if not feeling well - Observe cleanliness
	Traffic congestion	Accidents and Congestion of traffic	- Reroute access - Putting up of traffic warning signs - Establishment of construction buffer and containment barriers - Proper scheduling of hauler trucks in reference of the truck ban schedule - Provision of sufficient sidewalks and access routes - Coordinate with CTMO and BLGUs - Conduct road safety campaign - Provision of road safety equipment
	Demobilization	- Construction debris	- Dispose in accordance with RA 9003

Summary of Environmental Monitoring Plan

Environmental Aspect	Potential Impacts	Parameter	Monitoring Frequency
Water	Siltation	TSS	Quarterly
	Degradation of water quality	O&G, fecal coliform, phosphate, heavy metals	Quarterly
	Loss of freshwater biota	Biological indices	Quarterly for the 1st year and annually succeeding years
Air	Dust generation	PM10 and PM 2.5	Quarterly
	Vehicular emission	SOx, NOx, CO	Quarterly
	Noise Vibration	Noise level Direct observation and hering[2]	Quarterly
People	Spread of COVID 19	Number of cases of COVID - 19	Semi-annual random testing
	In-migration	Number of migrants	Annual
	Degrade socio-economy	Perception through hearing, public consultation	Annual

[2] Standards for vibration has not been designated in the Philippines.

1.0 Basic Project Information

Project Type	Environmental Enhancement
Project Name	Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Project Location	River dredging: Brgys Bucana, 1, 2, 5, 8, Ma-a, Waan, Tigatto, Mandug, New Carmen Cut-of - Works with bridge: Brgys 19 – B, Ma-a, Tigatto Retarding ponds: Brgys Mandug, New Carmen, New Valencia, Callawa
Total Project area	+River dredging: Excavated volume – 2.0 MCM +Cut-of- works: Excavated volume – 1.7 MCM +Retarding ponds: Excavated volume – 15.5 MCM
Project Cost	PhP 11.6 B
Proponent	DPWH Flood Control Management Cluster (UPMO - FCMC)
Company Name and Address	Department of Public Works and Highways DPWH 2nd St., Port Area, Manila
Contact Information	Ramon A. Arriola III Project Director
Contact Number Email Address	+632 – 534 – 3813 / +632 – 534 – 3752 arriola.ramon@dpwh.gov.ph
EIA Preparer	Green-collar Consulting Services Toog Ave., Purok 4, Brgy. 2, San Francisco, Agusan del Sur
Contact Person Contact Number/email	Carmelita P. Martinez 09177027356/ ryanjoyofmel@yahoo.com

2.0 Process Documentation of the Conduct of EIA

2.1 EIA TOR

The environmental impact assessment was conducted in accordance with the terms of reference of EMB – DENR and JICA Consultants. **Table 1** presents the summary of the terms of reference. Details of EMB and JICA Consultants TOR are found in the Annexes

Table 1. Summary of Terms of Reference, DFCDMP, 2021

General Requirement	EMB	JICA Consultants
Contents and format	DAO 2003 - 30	DAO 2003 – 30
Baseline condition		
1. Land	Land use and classification, geology, and geomorphology	Land use and utilization, land classification
2. Terrestrial flora and fauna	Species composition, diversity and endemism status, economically important species	Species composition, diversity, and endemism status
3. Water	Discuss hydrology and hydrogeology, collect baseline water quality	Site measurements – 4 points. Frequency – once. Parameters: TSS Total N, Total P, Turbidity, BOD, Oil & grease, temperature, fecal coliform, heavy metals (cadmium, arsenic, lead, chromium hexavalent, mercury*.
4. Air	Meteorology – rainfall, temperature, climate extremes. Air quality and Noise.	Site measurements for air and Noise – 3 points. Frequency – once (24-hour sampling). Parameters: CO, NO2, SO2, PM10, and PM2.5. Vibration – 1 point (24-hour measurement).
5. Sediment quality		Site measurement – 4 points (same points as water quality). Parameters: heavy metals (cadmium, arsenic, lead, chromium, and mercury) and sulfide.
6. Freshwater ecosystem	Freshwater biology	Sampling on aquatic ecology same location as water quality. Frequency – once. Parameters: fish, plankton, and benthos
7. People[3]	Public consultation. Present analysis of socio-	Public consultation, perception survey, traffic survey. Socio-economic situation, gender,

[3] The item "People" include "Involuntary resettlement" "Poor/Vulnerable", "Indigenous Peoples/Minorities" "Local economies", "Water usage", "Existing social infrastructures and services", Social institutions", "Community severance", "Cultural heritage", "Local conflicts of interest", "Utilization of land and local resources",Landscape",

	economic situation per barangay, perception survey	rights of children, presence of infrastructures, etc.

*: Since Difference of weather condition between rainy and dry season is not so significant; water quality and aquatic biota surveys were undertaken one time in the rainy season.

2.2 EIA Team

Environmental Impact Assessment is a multi-disciplinary undertaking which investigate the potential effects of the project into the bio-physical environment and to the people. In order to carry out the activities in EIA, a multidiscipline team was organized. **Table 2** shows the EIA team members and respective expertise.

Table 2. EIA Team and Field of Expertise, DCFCDMP, 2021

EIA Team Member	Field of Expertise/Module
Carmelita P. Martinez, MSETM, PhD	Team Leader/Environmental Specialist,
Ludivina M. Porticos, PhD	Water and Soil Chemistry
Silverio Magallon, PhD	Socio Expert
Ana Ocenar, PhD	Freshwater Ecology
Raul R. Buñao, RPF, EnP	Forester, Terrestrial
Berkman, Inc	Air, Noise and vibration

2.3 EIA Study and Schedule

The Environmental Impact Assessment was conducted for a period of eight (8) months. The work started with the coordination with the local government and community. After which, the site visit to the area was conducted. The provisions of DAO 30 series of 2003 were used as the guideline in identifying the potential areas that will be impacted by the project. The impact areas are categorized as direct, which is defined as area of the retarding ponds and cut-off works while other areas are considered indirect impact. The EIA study covered the assessment of the bio-physical and the socio-economic aspects of the project. In the analysis of socio-economic impact, secondary data were used.

"Gender", "Children's rights", "Infectious diseases", "Labour conditions"and "Accidents" which are indicated in the JICA-GL.

The details of the activities and the timetable are presented in the following Gantt Chart (Aug 2021 – Mar 2022):

ACTIVITY	WEEK/MONTH																											
	AUG				SEP				OCT				NOV				DEC				JAN				FEB				MAR			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Commencement Date	▲																															
1. Preliminaries and Project Inception																																
Preliminaries	■																															
Collection of Secondary Data from various Sources	■																															
Courtesy Calls and Project Briefing to Stakeholders	■																															
Site Inspection	■																															
Preparation and Submission of Implementation Plan and Project Description Report	■	■	■	■																												
2. Public and Technical Scoping																																
Technical Scoping with EIA Review Committee and EMB Case Handler					■																											
Meetings with Stakeholders					■	■	■	■																								

ACTIVITY	WEEK/MONTH																											
	AUG				SEP				OCT				NOV				DEC				JAN				FEB				MAR			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Public Consultations																																
3. Social and Environmental Impact Assessment																																
Baseline Data Gathering (Air, Water, Noise, Soil, Flora, Fauna, Traffic, Socio-economic)																																
Preparation of EIS																																
4. Issuance of ECC																																
EIS Submission to the DENR-EMB (includes preliminary attachments)																																
EIS Review with the Review Committee																																
Preparation and Submission of Additional Information required by the Review Committee																																
Final Review and submission of EIS																																

ACTIVITY	WEEK/MONTH																											
	AUG				SEP				OCT				NOV				DEC				JAN				FEB				MAR			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Securing of ECC																																
5. Preparation of Final Report																																
Preparation and Submission of Draft Project Report																																
Preparation and Submission of Final Project Report																																
Follow-up Review Process																																

2.4 EIA Study Area

The study area is confined along Davao River and the areas for dredging, retarding ponds and cut-off works -cum – bridges (**Figure 1).** Social perception survey was conducted in the thirteen (13) barangays that will be directly affected by the project.

2.5 EIA Methodology

In assessing the potential impacts of priority flood control projects of Davao River, standard procedures based on the Guidelines stipulated in the revised DAO 30-03 were followed. Since the proposed project is supposed to be developed with a loan assistance by the Government of Japan; the results of the EIS shall meet the requirement stated in "the Guideline for Environmental and Social Considerations (April 2010)"; the study methodology was formulated based on it. Gaps of rrquirement between the Guideline and Philippine legal framework are summarized in Appendix.

The secondary and primary data were gathered from the City LGU of Davao City, BLGU and concerned agencies. The sampling methodologies adopted in the conduct of the various assessments and in the collection of samples are presented in **Table 3**.

Table 3. EIA Methodology by Module, DCFCDMP, 2021

EIA Elements			**Methodology**
	(Items in the JICA-GL*)		
Land	Wastes Soil contamination Subsidence Protected areas Ecosystem Geology/ Topography	Land Use	- Gathering of secondary data - Review of secondary data - Site observation and validation
		Natural Hazards	- Gathering of secondary data - Review of secondary data
		Pedology/sediment	- Soil sampling - Chemical and physical analyses
		Terrestrial Biology	- Site observation - Transect walk - Quadrat sampling
Water	Water quality Hydrology	Hydrology/Hydrogeology	- Review of secondary data - Site observation - GIS
		Freshwater biota	- Field sampling - Site observation
		Water Quality	- Water sampling and Lab analysis - In-situ analysis of pH, DO and temperature - Site observation
Air	Air quality Noise and vibration	Meteorology	- Review of secondary data
		Air Quality	- Ambient air sampling

EIA Elements			Methodology
	(Items in the JICA-GL*)		
	Odor Global warming	Vibration study	- Direct measurement
		Noise level Measurement	- Direct measurement using standard noise level meter
The People	Involuntary resettlement Poor/Vulnerable Indigenous Peoples/Minorities Local economies Water usage Existing social infrastructures and services Social institutions Community severance Cultural heritage Local conflicts of interest Utilization of land and local resources Landscape Gender Children's rights Infectious diseases Labor conditions Accidents	Socio-economic Profile	- Review of secondary data, KII, FGD

*: Guidelines for Environmental and Social Considerations (April, 2010)

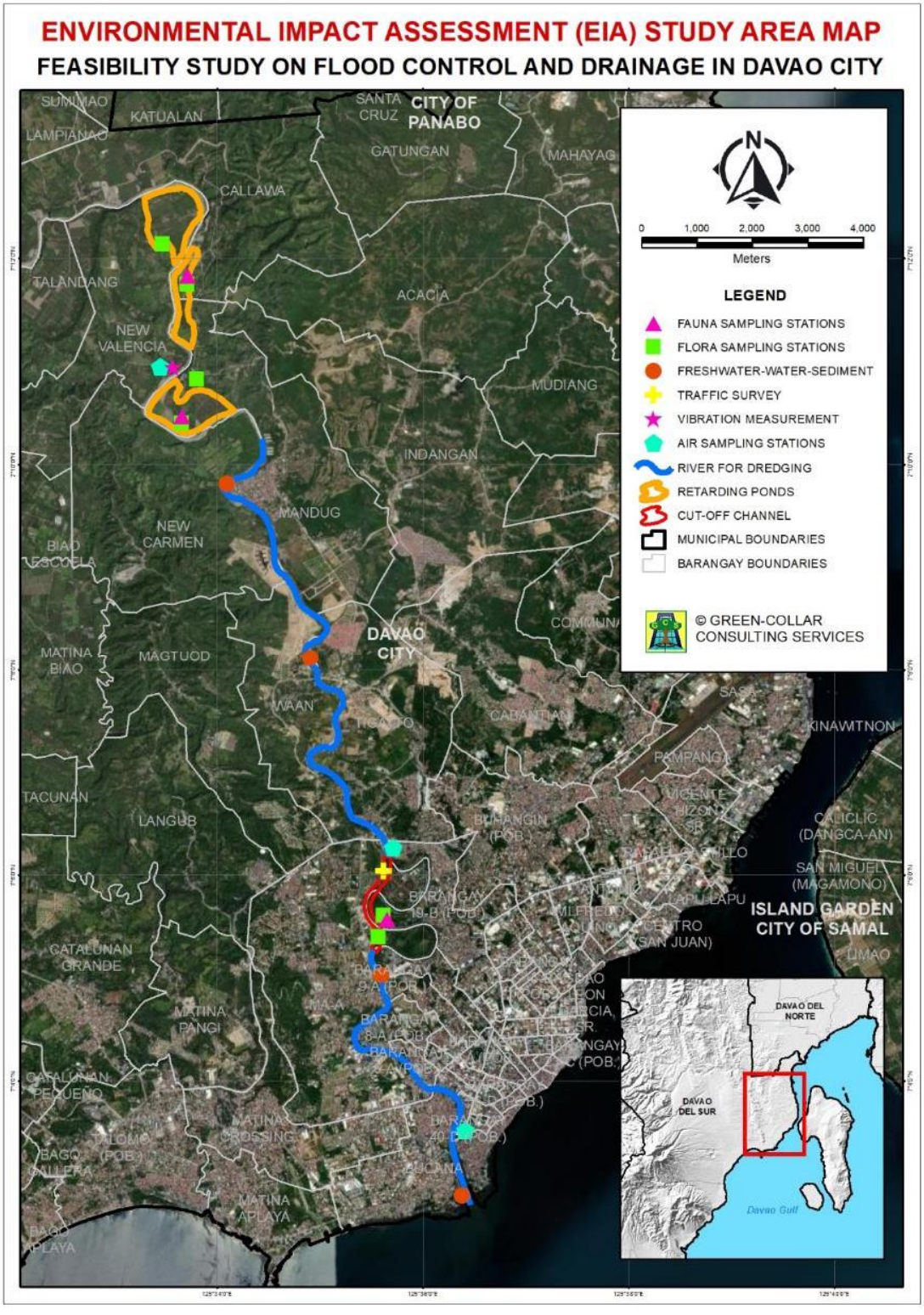


Figure 1. EIA Study area, DFCDMP, 2021

2.6 Public Participation

Public participation was conducted in accordance with the provisions of revised DAO 2033 - 30 and DAO 2017 – 15. The schedule of the Public consultation meetings were noticed through public announcement, board at the barangay halls, etc. to widely invite the stakeholders regardless their gender, occupation, income level, ethnic profile etc. The chronology of public participation activities is shown in **Table 4**.

Table 4. Chronology of Events of Public Participation, DFCDMP, 2021

Activity	Date
Conduct of IEC campaign and preliminary perception survey	September 29 – 30, 2021
Public scoping	December 7, 2021
Technical scoping	January 5, 2022
Conduct of perception survey	January 6 – 10, 2022
Processing of survey results	January 11 – 15, 2022

The public scoping was conducted on December 7, 2021. It was a well-attended public scoping. The list of attendees is in Annex C. Combination of methods was employed – online for the concerned agencies and government officials and face-to-face for the community. The issues and concerns raised and the resolution/agreement are summarized in Table 5. All issues and concerns raised were valid.

Table 5. Summary of issues and concerns raised during Public Scoping, DCFCDMP, 2021

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
1.	The cut-off works and bridges would entail costs to the Government.	Mr. Philip Dizon, President, Davao Crocodile Park, Inc.	The project is considered to lessen the flow of water in the river. Therefore, based on JICA experts, the project is feasible. Retarding ponds will be established to control water flow and volume.	Engr. Jeric Nuguid, UPMO
2.	The shape of the River Front buffers the velocity of the water going to Ma-a. Once diverted, there will be a sudden flash of water to Ma-a and the riverside, causing people to drown. Muslim brothers in downstream areas are also against the proposed project.		This project is similar to Monkayo. Cut-off works were done in Monkayo to solve the constriction of water flow. Based on the simulation, water from upstream will be temporarily stored in the retarding ponds, thereby reducing the magnitude of the river flow going downstream.	Engr. Allan Dela Pena, DPWH XI
3.	How to access the Flood Control Master Plan?	Mags Maglana-NGOs/Cos, Konsyensya Davao	The master plan is not yet the final master plan. The interim report was offered to be shared.	Engr. Jeric Nuguid, UPMO
4.	Is there a retarding pond in Ma-a? What is the capacity in terms of size, volume, etc.?	Shane Maglasang, BLGU-Bgry Ma-a	There is no retarding pond in Ma-a, only cut-off works, and river dredging	Engr. Allan Dela Pena, DPWH XI
			Complementary projects will be implemented in 2045 onwards.	Engr. Allan Dela Pena, DPWH XI
5.	Location of the proposed retarding ponds	Romulo Nicdao, DA Region XI	The proposed location was presented	Engr. Allan Dela Pena, DPWH XI
6.	What is the schedule of the dredging project (if included in the master plan)? Is there a	Emmanuel Cifra, San Lorenzo Ruiz Socio-Economic Development Foundation, Inc.	The consultants will determine the schedule of dredging depending on the width and depth. What is essential is the maintenance of the flood control	Engr. Allan Dela Pena, DPWH XI

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
	study on the maintenance schedule?		mechanisms. Non-structural measures were proposed by controlling erosion upstream and reducing sediment transport during floods. This is not only the concern of DPWH but also by other agencies.	
			JICA consultants are studying the dredging frequency, including excavation and other technical analyses.	Jeric Nuguid, UPMO
7.	Expound the efficacy of retarding pond	Victoria Horfilla, NGOs/Cos, Grassroots United for Integral Development and Empowerment (GUIDE), Inc.	RP will store the water upstream to prevent flooding downstream	Jeric Nuguid, UPMO
	Was the volume of water that will flow in Ma-a areas measured? How will it be addressed by the RP? Will ponds on the portions of the river where you intend to straighten them be put up?		There will be three (3) RP upstream, 4.7M cm3, 2.2M cm3, 0.67 M cm3… 7.57M cm3 total capacity. The locations of the retarding ponds were determined by studying the characteristics of the Davao River	Atty. Alain Sotto, DPWH XI
	Was the experience in the typhoon Vinta before considered in the plan?		Not all water will be contained in the retarding ponds. To prevent flooding, other activities are cut-off works and dredging.	Engr. Allan Dela Pena, DPWH XI
			Japan consultant used Typhoon Vinta incidence as the basis for the simulation. In addition, the 100-year flood was used to calculate the design capacity of flood control systems.	
8.	Public hearing and information campaign by barangay is vital to raise community awareness and	Miralou Blanco, EMB XI	Public consultations were conducted even during the conceptualization of this plan.	Engr. Allan Dela Pena, DPWH XI

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
	acceptance of the proposed project		DPWH will hold a series of public consultations in the future.	
9.	Old river beds should not be used as relocation sites, and these should be planted with trees and no structures. No relocation or community be allowed within the old river bed.	Danilo Gonzales, DENR Region XI	The comments and suggestions will be thoughtfully considered.	Jeric Nuguid, UPMO
10.	Is the straightening of the meandering portion a sensible idea?	Victoria Horfilla, NGOs/Cos, Grassroots United for Integral Development and Empowerment (GUIDE), Inc.	It cannot be avoided. Ideally, for people not to be affected by the flood, they should be situated away from the river. They should not be allowed to occupy the flood plain.	Engr. Allan Dela Pena, DPWH XI
			As contained in the Interim Report, the RP will arrest the water from upstream to avoid flooding downstream. Justifications and reasons were explained there in the master plan.	Engr. Allan Dela Pena, DPWH XI
11.	The concern of Mr. Dizon was not discussed in the previous consultations.	Romulo Nicdao, DA Region XI	No design yet in previous consultations. These countermeasures came out later. These are recommendations made by the study team. This option has a high benefit-cost ratio based on analysis.	Engr. Allan Dela Pena, DPWH XI
			That was an early stage of master plan development. We surveyed mountain areas affected by Typhoon Vinta. JICA considered that scenario; that is why they came up with these components.	Jeric Nuguid, UPMO
12.			Yes, Sir. IEC should be done.	Jeric Nuguid, UPMO

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
	Will there be series of public consultations to raise awareness before project implementation?	Norzannah Orbe, BLGU, Brgy Tigatto	This is only the first stage. After this, there will be an EIA to be done, including the IEC plan. The plan will include details of the different strategies for public consultations. Therefore, public participation is assured in the entire process of EIA	Ma'am Miralou Blanco, EMB XI
13.	Is Retarding Pond be established in Barangay Callawa?	Jasper Lacida, BLGU, Brgy Callawa	There will be one (1) RP in Callawa near the Garay quarry, one (1) in Mandug, and another one in New Valencia using the map.	Dam Vertido, Interdev
14.	The proponent should consider the following: - Meeting with Mr. Dizon, - Clustered public consultations by barangay - Constant river dredging	Romulo Nicdao, DA Region XI	DPWH, being the proponent of this project, is responsible for the series of consultations.	Miralou Blanco, EMB XI
			The suggestion was well taken.	Jeric Nuguid, UPMO
			The designated RPs were pointed in the map	Atty. Alain Sotto, DPWH XI
15.	Clarification about the flow of water map What are the plans for the affected quarry concessioners? Possibility of extending and creating other cut-off works in 6.4 – 4.4km areas?	Rique Barral, BLGU, Brgy Maa	It was explained on the map that only very few people and houses would be affected. The experts will be asked on the technical project design. Public participation is needed.	Jeric Nuguid, UPMO
16.	River cutting will indeed be very costly. These will need	Lemuel Lloyd Manalo, *Interfacing Development*	We will take note of your comments.	Jeric Nuguid, UPMO

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
	additional mitigating measures after, such as pumping stations to pump/discharge water immediately to Davao Gulf (likely the same to Singapore's Marina Barrage pumping tech/mechanism at the river mouth). We might as well reallocate the budget and focus more on securing/developing a network of retarding ponds (restoration of wetlands as nature-based solutions). Retarding ponds are very efficient; they help capture-convey-infiltrate floods. What are other measures considered to mitigate the potential adverse effects of cut-off works? An example is the effects of the pumping station in Singapore. Is this projected?	*Interventions for Sustainability*	JICA will take note of this notwithstanding that the technical analysis of the cut-off works is not yet completed.	
			There is no need for a pumping station because the RP's design will use gravity. As of now, there is no mention of putting a pumping station in the Davao River. Loss of wetlands is one of the causes of flooding in urban areas. The countermeasure of urban flooding is constructing artificial storage like box culverts.	Engr. Allan Dela Pena, DPWH XI
17.	What about in the inner part of Davao City? What is the status of the Pumping stations?	Romulo Nicdao DA Region XI	No proper maintenance. It is recommended to maintain the drainage facilities/canals to minimize flooding properly.	Engr. Allan Dela Pena, DPWH XI

3.0 Project Description

3.1 Project location and area

The priority projects for flood control in Davao River are located along the Davao River, Davao City (**Figure 2**). The locations of the three components are summarized in **Table 6** and the coordinates are presented in **Table 7**.

Table 6. Location of the major structures, Davao River, DCFDMP

Project Component	Project Location
Component A: River Dredging	Barangay Bucana
	Barangay 1
	Barangay 2
	Barangay 5
	Barangay 8
	Barangay Ma-a
	Barangay Tigatto
	Barangay Wa-an
	Barangay Mandug
	Barangay New Carmen
Component B: Cut-Off Works with bridge	Barangay 19 – B
	Barangay Ma-a
	Barangay Tigatto
Component C: Retarding Ponds	Barangay Mandug
	Barangay New Carmen
	Barangay New Valencia
	Barangay Callawa

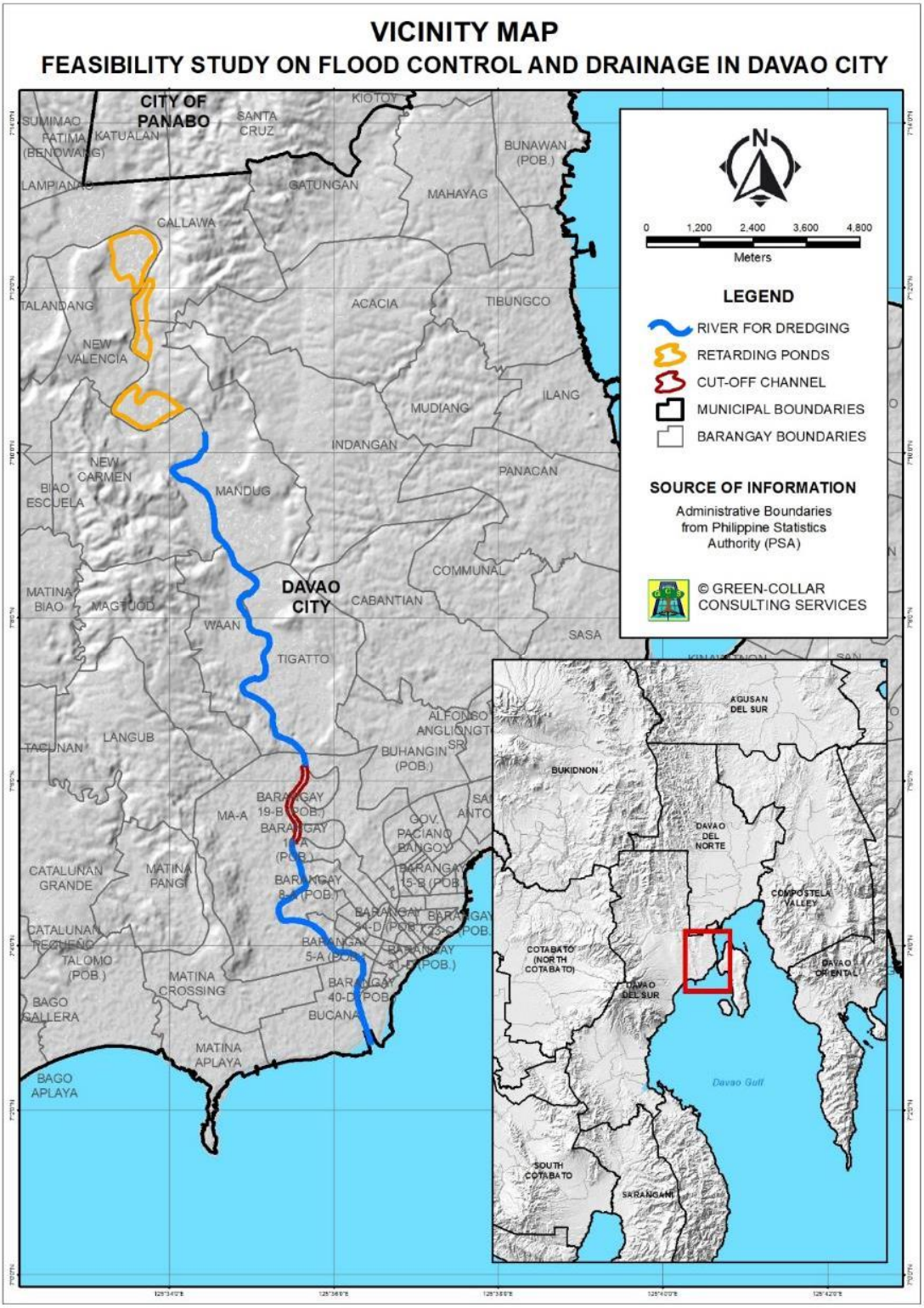


Figure 2. Location and vicinity map, DFCDMP

Table 7-a. Coordinates of the location of retarding ponds, DFCDMP, 2021

No.	Latitude	Longitude
RETARDING POND 8		
1	7° 11' 57.018" N	125° 33' 34.883" E
2	7° 12' 1.411" N	125° 33' 34.390" E
3	7° 12' 5.132" N	125° 33' 33.842" E
4	7° 12' 8.918" N	125° 33' 31.174" E
5	7° 12' 6.322" N	125° 33' 24.230" E
6	7° 12' 9.902" N	125° 33' 21.458" E
7	7° 12' 16.061" N	125° 33' 19.113" E
8	7° 12' 23.287" N	125° 33' 19.826" E
9	7° 12' 29.134" N	125° 33' 17.997" E
10	7° 12' 34.973" N	125° 33' 17.513" E
11	7° 12' 37.527" N	125° 33' 22.440" E
12	7° 12' 40.162" N	125° 33' 31.608" E
13	7° 12' 40.554" N	125° 33' 35.282" E
14	7° 12' 41.205" N	125° 33' 39.010" E
15	7° 12' 40.044" N	125° 33' 43.347" E
16	7° 12' 36.252" N	125° 33' 47.256" E
17	7° 12' 31.125" N	125° 33' 49.710" E
18	7° 12' 28.332" N	125° 33' 50.418" E
19	7° 12' 26.578" N	125° 33' 50.150" E
20	7° 12' 24.719" N	125° 33' 49.984" E
21	7° 12' 20.096" N	125° 33' 45.614" E
22	7° 12' 12.629" N	125° 33' 41.590" E
23	7° 12' 2.725" N	125° 33' 39.466" E
24	7° 11' 59.024" N	125° 33' 36.394" E
RETARDING POND 9		
1	7° 12' 6.155" N	125° 33' 44.971" E
2	7° 12' 5.362" N	125° 33' 48.173" E
3	7° 12' 1.796" N	125° 33' 48.670" E
4	7° 11' 56.596" N	125° 33' 45.693" E
5	7° 11' 51.187" N	125° 33' 43.284" E
6	7° 11' 44.577" N	125° 33' 42.988" E
7	7° 11' 36.205" N	125° 33' 43.924" E
8	7° 11' 30.067" N	125° 33' 42.596" E
9	7° 11' 24.587" N	125° 33' 43.600" E
10	7° 11' 21.629" N	125° 33' 46.014" E
11	7° 11' 15.790" N	125° 33' 46.498" E
12	7° 11' 10.425" N	125° 33' 45.486" E
13	7° 11' 8.158" N	125° 33' 44.387" E
14	7° 11' 12.011" N	125° 33' 38.927" E
15	7° 11' 13.840" N	125° 33' 35.111" E
16	7° 11' 15.803" N	125° 33' 34.915" E
17	7° 11' 17.924" N	125° 33' 34.461" E
18	7° 11' 18.588" N	125° 33' 35.654" E

No.	Latitude	Longitude
RETARDING POND 11		
1	7° 10' 48.856" N	125° 33' 35.729" E
2	7° 10' 46.783" N	125° 33' 37.114" E
3	7° 10' 45.018" N	125° 33' 38.655" E
4	7° 10' 41.365" N	125° 33' 36.256" E
5	7° 10' 38.372" N	125° 33' 35.722" E
6	7° 10' 36.609" N	125° 33' 37.057" E
7	7° 10' 36.752" N	125° 33' 39.074" E
8	7° 10' 38.136" N	125° 33' 40.995" E
9	7° 10' 41.377" N	125° 33' 43.289" E
10	7° 10' 43.064" N	125° 33' 46.401" E
11	7° 10' 43.401" N	125° 33' 50.695" E
12	7° 10' 42.290" N	125° 33' 55.446" E
13	7° 10' 40.518" N	125° 33' 58.332" E
14	7° 10' 38.329" N	125° 34' 1.888" E
15	7° 10' 31.831" N	125° 34' 9.505" E
16	7° 10' 29.939" N	125° 34' 6.081" E
17	7° 10' 28.315" N	125° 34' 0.953" E
18	7° 10' 24.528" N	125° 33' 54.623" E
19	7° 10' 21.451" N	125° 33' 50.831" E
20	7° 10' 18.949" N	125° 33' 45.646" E
21	7° 10' 17.942" N	125° 33' 40.986" E
22	7° 10' 19.197" N	125° 33' 38.201" E
23	7° 10' 22.323" N	125° 33' 33.305" E
24	7° 10' 25.134" N	125° 33' 29.443" E
25	7° 10' 27.013" N	125° 33' 25.833" E
26	7° 10' 28.902" N	125° 33' 20.569" E
27	7° 10' 30.971" N	125° 33' 20.012" E
28	7° 10' 33.086" N	125° 33' 20.386" E
29	7° 10' 35.866" N	125° 33' 21.953" E
30	7° 10' 39.104" N	125° 33' 24.815" E
31	7° 10' 42.963" N	125° 33' 27.526" E
19	7° 11' 27.462" N	125° 33' 37.359" E
20	7° 11' 31.956" N	125° 33' 37.177" E
21	7° 11' 46.691" N	125° 33' 34.415" E
22	7° 11' 50.201" N	125° 33' 34.797" E
23	7° 11' 53.593" N	125° 33' 37.867" E
24	7° 11' 59.713" N	125° 33' 42.349" E
25	7° 12' 3.115" N	125° 33' 43.558" E

Table 7 – b. Coordinates of the Location of Cut-off works, DFCDMP, 2021

No.	Latitude	Longitude	No.	Latitude	Longitude
1	7° 6' 10.399" N	125° 35' 36.889" E	12	7° 5' 18.723" N	125° 35' 34.694" E
2	7° 6' 3.969" N	125° 35' 37.418" E	13	7° 5' 25.066" N	125° 35' 36.004" E
3	7° 5' 58.063" N	125° 35' 34.875" E	14	7° 5' 31.308" N	125° 35' 34.586" E
4	7° 5' 53.007" N	125° 35' 30.781" E	15	7° 5' 36.496" N	125° 35' 30.690" E
5	7° 5' 47.786" N	125° 35' 27.056" E	16	7° 5' 42.828" N	125° 35' 29.565" E
6	7° 5' 41.447" N	125° 35' 25.784" E	17	7° 5' 48.727" N	125° 35' 31.973" E
7	7° 5' 35.182" N	125° 35' 27.357" E	18	7° 5' 53.694" N	125° 35' 36.176" E
8	7° 5' 29.935" N	125° 35' 31.184" E	19	7° 5' 59.000" N	125° 35' 39.929" E
9	7° 5' 23.652" N	125° 35' 32.043" E	20	7° 6' 5.317" N	125° 35' 41.240" E
10	7° 5' 17.191" N	125° 35' 29.870" E	21	7° 6' 11.773" N	125° 35' 40.490" E
11	7° 5' 15.107" N	125° 35' 33.115" E			

Table 7 – c Coordinates of the Location of River Dredging works, DFCDMP, 2021

No.	Latitude	Longitude	No.	Latitude	Longitude
1	7° 10' 15.059" N	125° 34' 25.607" E	19	7° 6' 46.089" N	125° 35' 15.670" E
2	7° 10' 0.273" N	125° 34' 23.512" E	20	7° 6' 32.168" N	125° 35' 21.286" E
3	7° 9' 51.585" N	125° 34' 10.648" E	21	7° 6' 23.869" N	125° 35' 34.955" E
4	7° 9' 42.063" N	125° 34' 6.633" E	22	7° 6' 11.406" N	125° 35' 39.589" E
5	7° 9' 35.181" N	125° 34' 21.021" E	23	7° 5' 16.497" N	125° 35' 30.891" E
6	7° 9' 22.770" N	125° 34' 30.726" E	24	7° 5' 1.863" N	125° 35' 34.619" E
7	7° 9' 6.786" N	125° 34' 33.001" E	25	7° 4' 46.394" N	125° 35' 39.241" E
8	7° 8' 53.484" N	125° 34' 40.760" E	26	7° 4' 35.252" N	125° 35' 29.362" E
9	7° 8' 39.063" N	125° 34' 47.952" E	27	7° 4' 23.875" N	125° 35' 20.139" E
10	7° 8' 29.442" N	125° 35' 0.909" E	28	7° 4' 18.339" N	125° 35' 32.843" E
11	7° 8' 16.908" N	125° 34' 57.681" E	29	7° 4' 12.590" N	125° 35' 47.758" E
12	7° 8' 4.969" N	125° 34' 53.851" E	30	7° 4' 0.057" N	125° 35' 57.697" E
13	7° 7' 50.878" N	125° 35' 0.565" E	31	7° 3' 54.638" N	125° 36' 11.982" E
14	7° 7' 42.845" N	125° 35' 13.047" E	32	7° 3' 43.339" N	125° 36' 21.748" E
15	7° 7' 27.955" N	125° 35' 9.194" E	33	7° 3' 28.109" N	125° 36' 17.048" E
16	7° 7' 14.303" N	125° 35' 5.490" E	34	7° 3' 12.285" N	125° 36' 19.740" E
17	7° 7' 7.353" N	125° 34' 53.776" E	35	7° 2' 56.781" N	125° 36' 24.533" E
18	7° 6' 58.631" N	125° 35' 6.718" E	36	7° 2' 47.657" N	125° 36' 27.770" E

3.1.1 Direct and Indirect Impact Areas

The areas that will be impacted by the Flood Control project either directly or indirectly were delineated (Figure 3). By definition, direct impact or primary areas are the areas of operation, i.e. areas where the infrastructures will be constructed. Davao Gulf is considered direct impact area because it is the outfall of Davao River Indirect impacted areas are those areas outside the area of operation but within the political jurisdiction of Davao City. The direct impact areas are the

barangays presented in Table 6 while the indirect impact areas are the other urban barangays of Davao City.

3.2 Project Rationale

3.2.1 National Level

The Philippines has suffered devastating damage from natural disasters. During the 10 year-period from 2005 until 2015, a total of 20,000 people were dead and missing, 75 million people have been affected, and the economic loss has reached 182 billion pesos. The main cause of disaster is strong wind and flooding in which 70 per cent of the affected people suffered damage by typhoons and monsoons, and 24 per cent suffered damaged by storm surges and high waves. The national government has formulated a National Framework for Physical Planning to orient the policy and direction for economic and infrastructure development including flood control. The objective of the policy framework is to promote economic development and poverty reduction through the implementation of several flood control projects.

3.2.2 Local Level

The Project site, Davao City, located in the southern part of Mindanao Island, is the third largest city in the Philippines,and the largest city on Mindanao Island. Davao City had been less affected by flooding in the past, but flood damage has recently increased due to changes in typhoon tracks. In 2011, 30 people were killed by the flooding of the Davao and Matina Rivers, more than 2,500 people were affected by the flooding of Davao River in 2013, and 22,911 families were affected by flooding due to Typhoon Vinta in December, 2017. In addition, there are several problems such as inland flooding, insufficient drainage systems, and storm surges due to the geographical features of the 60 km coastline. Even though flood disaster occurs frequently in Davao City, a Master Plan for integrated flood control has not been formulated. Although the budget for flood control in the Department of Public Works and Highways (hereinafter referred to as DPWH) has increased, the budget has not been fully utilized due to the absence of a Master Plan.

Ten of the 18 major river basins in the Philippines have developed Master Plans for flood control from the 1980s to the early 1990s. After that, five (5) rivers (Cagayan, Agusan, Pasig-Marikina-Laguna Bay, Tagoloan, and Cagayan de Oro) have reviewed and updated their Master Plans. The preparation of the Master Plan and Feasibility Study for the 5 rivers was conducted by DPWH with the support of JICA through the technical cooperation projects. For the improvement of drainage systems, although a Master Plan for the six districts inside Davao City had been developed by Davao City, a Master Plan for flood control in Davao River has not been formulated. Furthermore, it is highly expected to formulate Master Plans for flood control of major rivers/principal rivers including Davao River, and to enhance DPWH's capacity to formulate Master Plans for flood control.

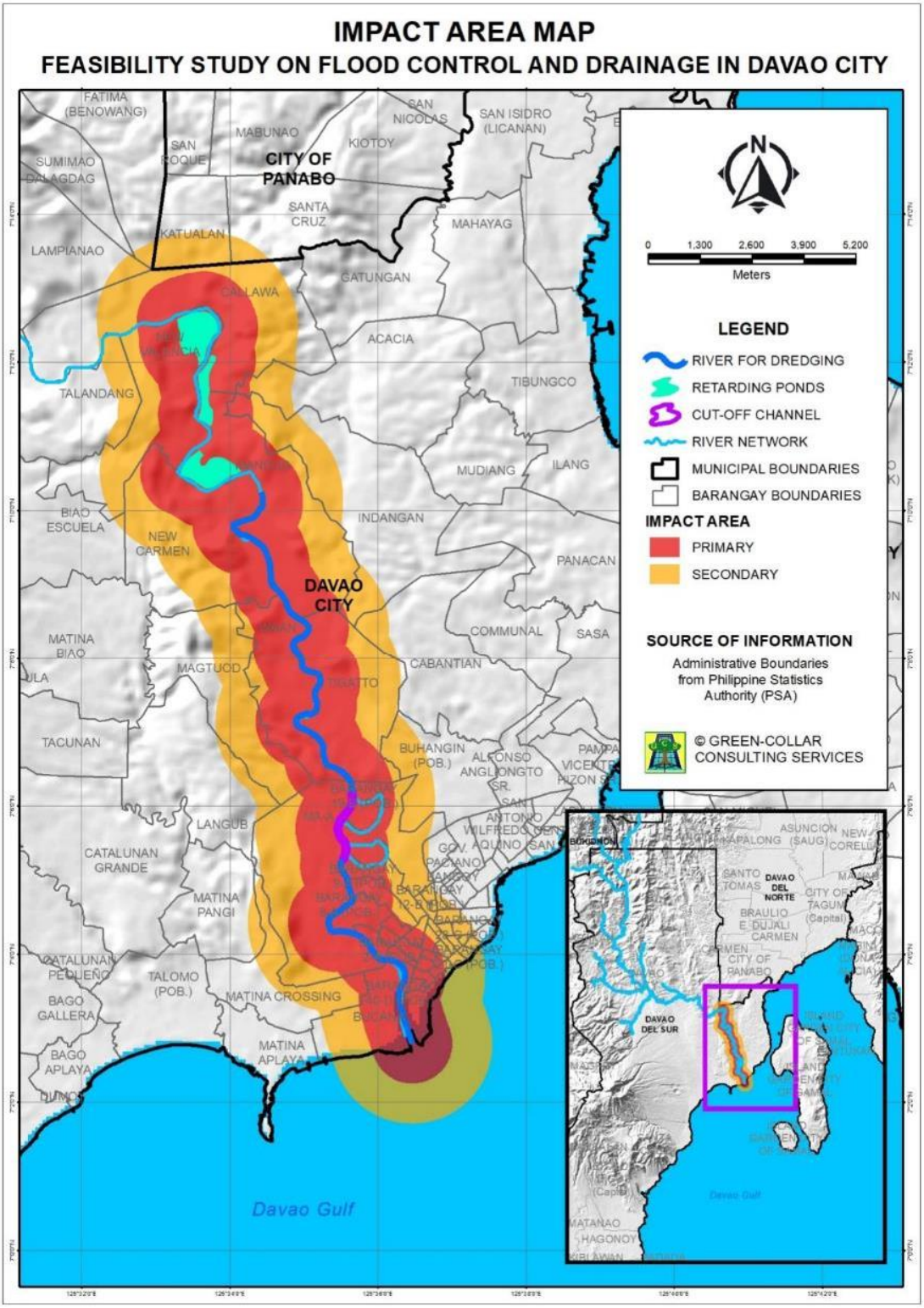


Figure 3. Impact map, DFCDMP, Davao City

3.3 Project Alternatives

The JICA Consultants have evaluated four alternatives before coming up the best option to mitigate the flooding of Davao River during the process of formulation of the Master Plan. The evaluation of the four (4)) alternatives is presented in **Table 8**. Alternative 4 is recommended and the subject of this EIA because it has the lowest cost, and less household that will be relocated. JICA Consultants is still studying to further reduce the environmental impacts of retarding ponds.

Table 8. Three project alternatives, DFCDMP, 2021

Plan	Without Project	Alternative 1	Alternative 2
Description	No measures	River dredging (approx. 23kmfrom the river mouth) High flood wall (max. 6.7mheight)	River dredging (approx. 23kmfrom the river mouth) Dam (approx. 45m height and 58MCM reserve)
Cost	0 billion PHP	Approx. 18.2 billion PHP	Approx. 39.3 billion PHP
Safety Level	-	5-10 year scale flood	5-10 year scale flood
B/C	-	1.3	0.6
Environment	Environmental aspect could keep current condition.	Minimal environmental impacts while risk of overflow or dyke break is predicted.	Dam site is located in environmentally critical area(high elevation/ slope and protected forest)
Social issues	Social aspect coule be same level as the current condition. Citizens must have still been suffered by flood problem landslide as well.	Possible smaller scale of land occupation and resettlement are predicted.	Dam site is also located in the ancestral domain area. Natural resources for eco-tourism, agro-forest, and community development could be damaged.
Evaluation result	Not recommended It would be not sufficient to only undertake non-structural measures to meet the proposed goal.	Not recommended Although environmental risk willbe lowest; extensive disaster is predicted in case of dyke break. Advanced design, construction, maintenance technology as well are required.	Not recommended Dam site is located in environmentally sensitive area.

Plan	Alternative 3	Alternative 4
Description	River dredging (approx. 23kmfrom the river mouth) Cut-off works Retarding pond (1 location, totalof 2.2 km^3)	River dredging (approx. 23km from the river mouth), Cut-off works Retarding ponds (3 locations, total of 2 km^3)
Cost	Approx. 13.8 billion PHP	Approx. 11.6 billion PHP
Safety Level	5-10 year scale flood	5-10 year scale flood
B/C	1.7	2.04
Environment	Usual pollution by constructionworks, spreading turbid water, change of land cover,	Usual pollution by construction works, spreading turbid water, change of land cover,
Social issues	Scale of resettlement is bigger than proposed plan (approx. 180PAHs or more), loss of agricultural product.	Certain scale of resettlement (approx. 100 PAHs), loss of agricultural products
Evaluation result	Not recommended Scale of resettlement, necessaryland and cost are bigger than proposed plan. Maintenance cost and measurement would be smaller than Alternative 1 and 2.	Recommended Environmental risk could be smaller than other plans. Maintenance cost and measurement would be smaller than Alternative 1 and 2.

Source: JICA Consultants

As for the base of the above evaluation, the JICA Consultants had carried out examination of alternatives for the Master Plan and for selection of the priority projects, which are mentioned below:

A. Master Plan Evaluation (Examination of Alternatives)
- Evaluation of Davao River Flood Countermeasures -

(1) Zero Option

The option of no implementation of the M/P is not recommended based on the following reasons:

- Annual loss of economy is estimated approximately 10.8 billion pesos.
- Davao City has highly prioritized flood controls as one of the urgent issues.

The Environmental Assessment Law, Japan defines “Zero Option” as Option of no implementation of the project, or alternative which does not cause environmental impact”.

Proposed projects in the M/P are multiple project based on the combination of possible flood control measures. Alternatives are designed through evaluation of combinations. The followings are the results of evaluation on each measure:

- Improvement of dyke, flood wall:
  This control measure must not cause significant environmental impact; but it is difficult to reach the project goal by solo implementation.
- Retarding ponds:
  Solo implementation of the retarding ponds could reach the project goal; however certain level of significant impacts are anticipated. In addition increase of risk on accidental cases (dyke breach, washout, e.g.), and increase of cost must be key issues.
- Non-structural measures will not cause significant impacts; however Implementation without structural measures could not expect sufficient effects. Non-structural measures shall be obtained with combination and supplement of structural measures so as to expect increase of the project effect.
- Other possible flood controls which could reach the project goal will be “control of land use of the flood prone area through resettlement”, “land reclamation/ leveling of flood prone area”, “switch of housing to high floored houses, e.g.”, e.g. However these are not affordable and realistic to a wide urbanized city such as Davao City.

(2) Evaluation of Flood Countermeasures (Structural) for Davao River

The following alternatives were assessed by using the evaluation criteria set for this Project.

Table 8-1. Evaluation of Flood Countermeasures (Structural) for Davao River

Evaluation Axis	Alt.1: Combination of Reinforcement of Present Dike and Flood Water Detention Facilities	Alt.2: Combination of New Dike and Flood Water Detention Facilities	Alt.3: Combination of River Widening and Flood Water Detention Facilities (Alt. 4 in Table 8)
Combined Countermeasures	Dike Reinforcement (1,200 m^3/s) Retarding Pond (1,200m^3/s) Dam (1,000m^3/s)	Dike Construction (1,700 m^3/s) Retarding Pond (1,700m^3/s)	River Widening (1,700 m^3/s) Retarding Pond （1,700m^3/s）
A. Flood Protection Level (Expected damage reduction)	2032:W=1/5~10 ; 2045:W=1/25 (the selected Alt.3: 1/100) ; M/P:W=1/100		
B. Economic Effectiveness	Direct construction cost + land acquisition cost + compensation cost for building = PhP 38 Billion	Direct construction cost + land acquisition cost + compensation cost for building = PhP 36 Billion	Direct construction cost + land acquisition cost + compensation cost for building = PhP 28 Billion
C. Feasibility in regards with legal and social restrictions	Relocated Houses: 600	Relocated Houses: 1,600	Relocated Houses: 1,600
D. Feasibility from the technical viewpoint to construct countermeasures	Gradual implementation of countermeasures is feasible.	Gradual implementation of countermeasures is feasible.	Gradual implementation of countermeasures is feasible.
E. Sustainability	Sustainable	Sustainable	Sustainable
F. Flexibility	-	-	The river channel can accommodate 10-year flood, and in the unlikely event that large-scale floods occur continuously, it is more advantageous for river channels to have a large flow capacity. Furthermore, the risk (water level rise) at the time of flood occurrence including the worst case flood exceeding the target design level can be minimized.
G. Environmental and social impacts	Since dam site is located in the protected forest, ancestral domains area; environmental and social impacts are significant.	Large scale involuntary resettlement will occur.	In addition to **Alt. 2**, loss of land along the river must cause significant social impact.
Others	The construction of a structure of MSL + 3.0m (design high tide level 1.53m + wave component about 1.0m + free board about 0.5m) as countermeasures against storm surge and waves (a flood wall along the river at the same height as the storm surge dike) is required. For this dike at the river mouth, it was not included in the M/P since the construction of the dike and promenade downstream of the Bolton Bridge is currently being constructed by DPWH DEO (planned to be connected to the coastal road).		
Evaluation Results			Although large scale resettlement is required; risk of accidental cases (dyke breach, washout, e.g.) by unexpected floods could be minimized. ◎

Source: JICA Consultants

B. Selection of Priority Projects

(1) Evaluation axis for selecting the Priority Project

The priority projects are selected from the structural measures for the M/P using the following evaluation axes.

- High urgency
- Fast effects
- High effects
- Good coordination with priority projects of Non-structural measures (Riverine flood in the Davao River)
- Even if only the structural measures for riverine flood are implemented in advance, they will not have a negative effect or have a positive effect on other types of flood (inland flood, coastal flood)
- Low risk on environmental and social consideration (No risk of increasing environmental and social impacts, or mitigation effects can be expected.)

(2) Selection of the Priority Projects

Based on the evaluation axis mentioned above, the structural measures for the riverine flood in the Davao River were evaluated. The evaluation results are shown in the following table.

Table 8-2. Evaluation of Priority Projects of Structural Measures in Davao River

Measures		Evaluation Axes					
		High urgency	Fast effects	High effects	Good coordination with priority projects of Non-structural measures	No negative effect or have a positive effect on other types of flood	Low risk on environmental and social consideration
Short-Term	Dredging	◎	◎	◎	○	○	△
	Cut-off works	◎	△	△	○	○	△
	Installation of Retarding Ponds (three)	◎	○	△	○	○	△
Mid-Long Term	River Widening	△	△	○	○	○	△
	Installation of Retarding Ponds (four sites)	△	○	△	○	○	△

Note: ◎: Well applicable, ○: Applicable, △: Limited / Not applicable

Source: JICA Consultants

As the result of the above evaluation and discussion with relative organizations, the following three projects (Alt. 4 in Table 8) were selected as the priority projects targeted for the F/S.

- Dredging (It is easy to improve the river flow capacity, the effect is quick, the cost-effectiveness is high, and the urgency is high.)
- Cut-off work (This may lead to the creation of a relocation area. High urgency.)

- Retarding Ponds (three locations) (High urgency.)

3.4 Project Development and Project Components

The flood control priority projects considered under the feasibility study consisted of three (3) retarding ponds, cut-off works-cum-bridge and river dredging & widening (**Figure 4).** The major components of the flood control projects are:

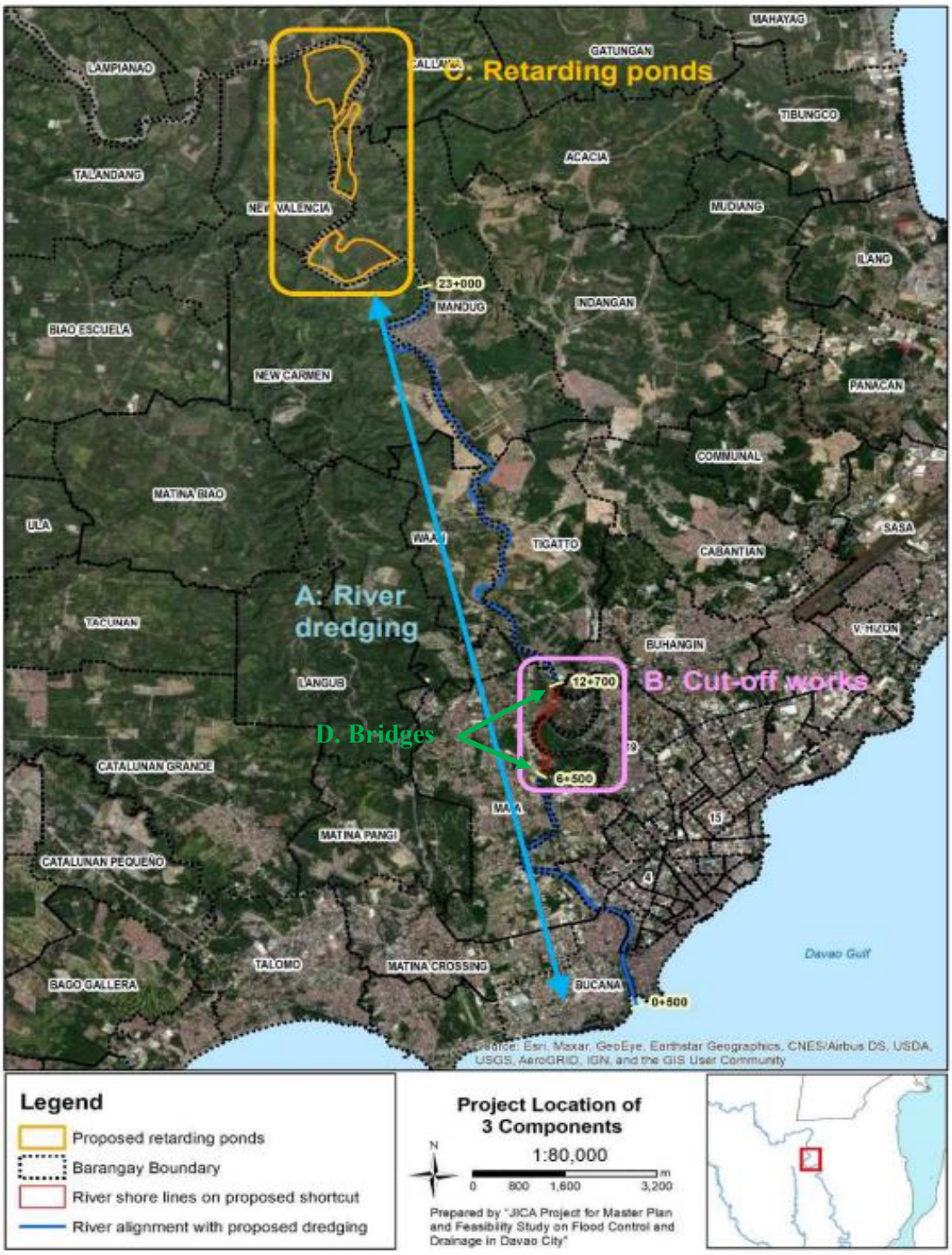
1. Dredging works
2. Cut-off works -cum-bridge
3. Retarding ponds

Dredging works

River dredging work aims to secure appropriate river flow in order to reduce risk of over flow. Dredging work will be taken from Davao River mouth (0+500) to 23km upstream. River soil in the existing river will be dredged; approximate volume is estimated two (2) million m^3. **Figure 5** illustrates the image of dredging. The dredged materials will be disposed in accordance with the Dredging Master Plan to be formulated before the implementation of the project. Further study will be conducted as to the disposal of the dredged materials. One option is to donate the dredge materials to be used by BLGUs.

Source: JICA Consultants

Figure 5. Brief image of dredging work

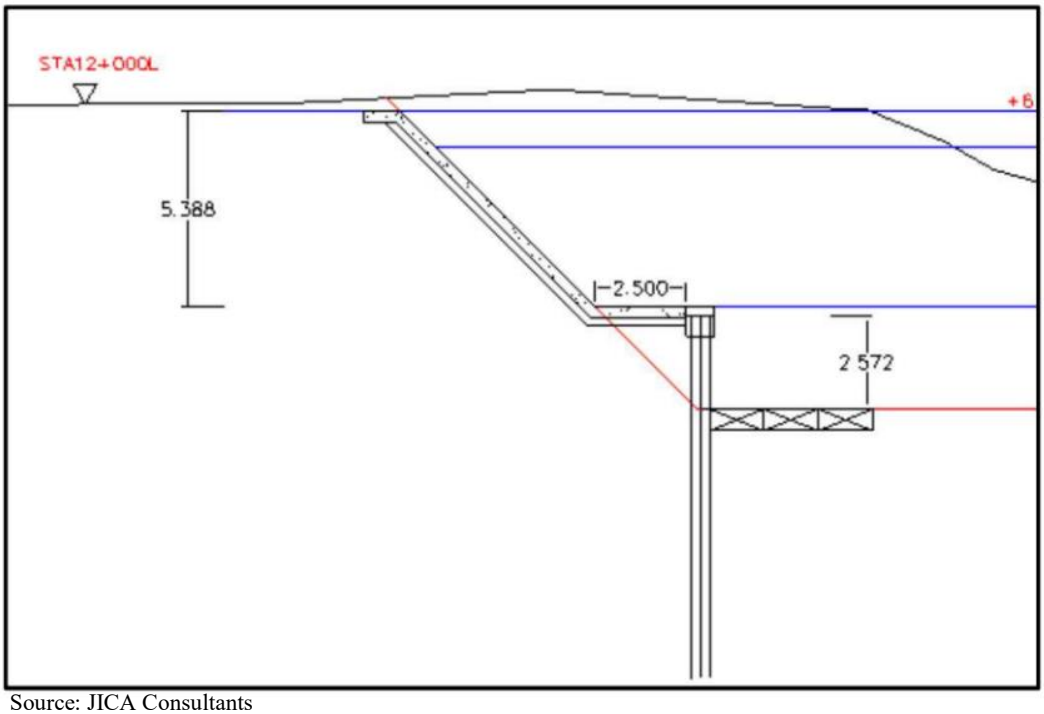


Source: JICA Consultants

Figure 4. Flood Control Components, DFCDMP

Cut-off works – cum - bridges

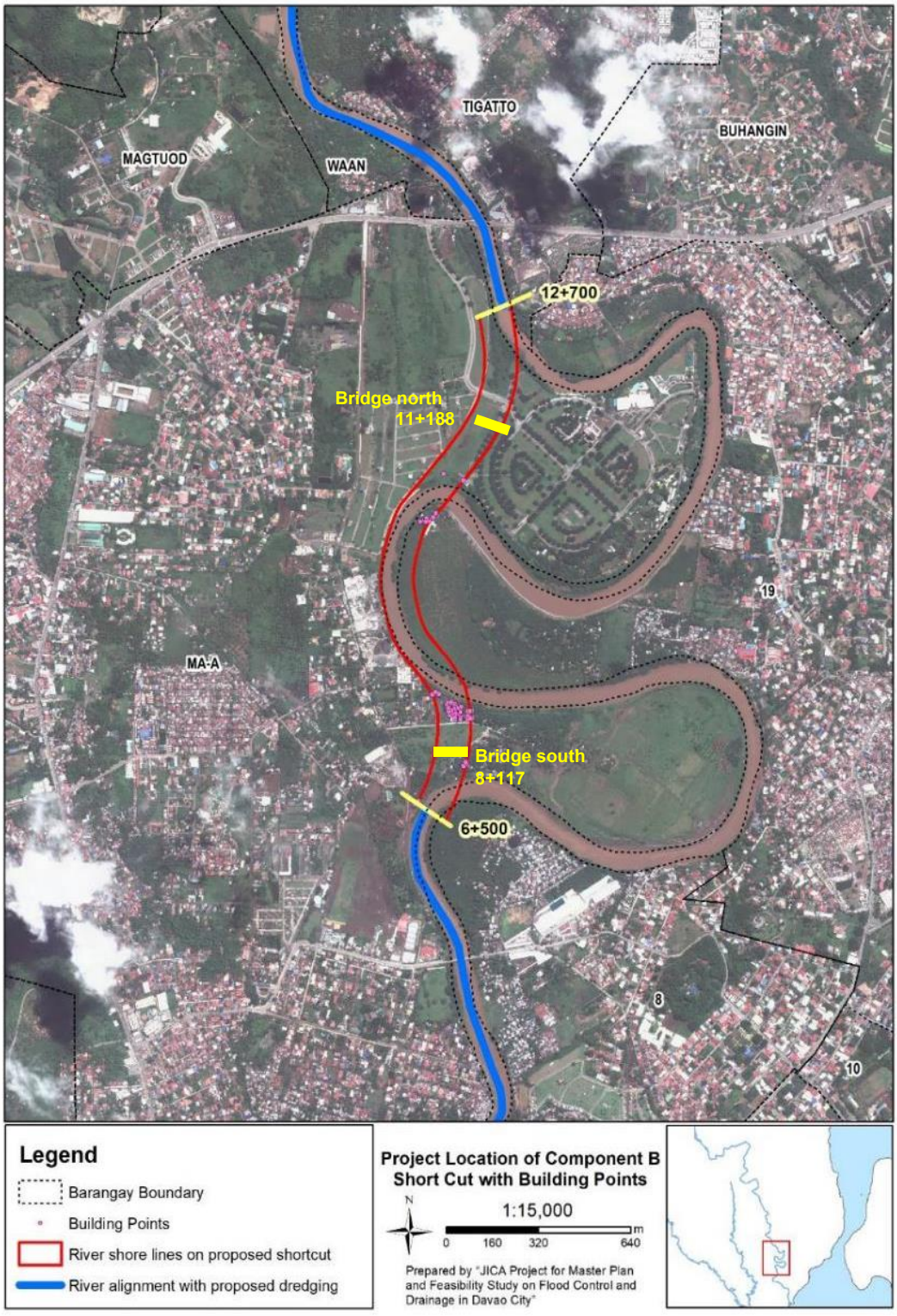
Cut-off works, will be installed at downstream of near Crocodile Park to shorten the river line; it is expected that flood water is quickly discharge to the sea and to increase flow capacity. Actual design will be examined in the feasibility study. As of now, the standard revetment structure after widening of the river should preferably be a combination of concrete revetment (above mean water level, H=approx. 5 m) and steel sheet pile (below mean water level) (see **Figure 6**). It is also necessary to have a platform behind the crest of steel sheet pile in order to reduce the embankment load that affects the steel sheet pile. The specific locations of cut-off works and bridges are shown in **Figure 7**. Two bridges will be constructed as access for the community that will be affected. The two bridges are located in barangay Ma-a with the upstream bridge (near Crocodile Park) at Sta. 11+188 while the other bridge is located downstream at Sta. 8+117. The excavated materials will be disposed of properly. The proposed location of the disposal site is under study and the design will be included in the detailed engineering design stage.



Source: JICA Consultants

Figure 6. Type of standard revetment for Cut-off works of River

The cut-of-works are located near the area for the Davao city expressway Project. It is highly recommended that both project teams (by the DPWH) make a coordination link to harmonize for raise of benefit, and to avoid significant overlap.



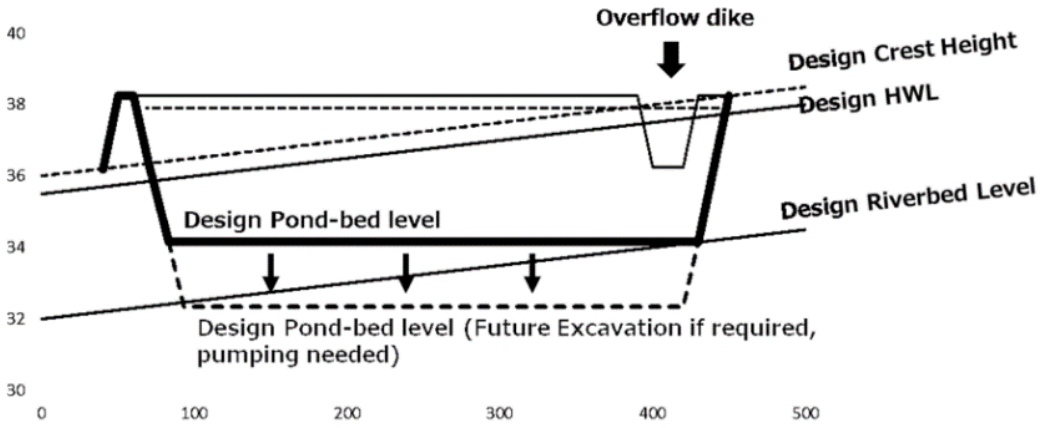
Source: JICA Consultants

Figure 7. Cut-off works and bridges

Retarding ponds

Three (3) retarding ponds are planned to be constructed to temporarily store flood water during large-scale flood. Location of these ponds is the upper stream of proposed dredging area at 24km, 27km and 29km from the river mouth, which are located in four (4) barangays.

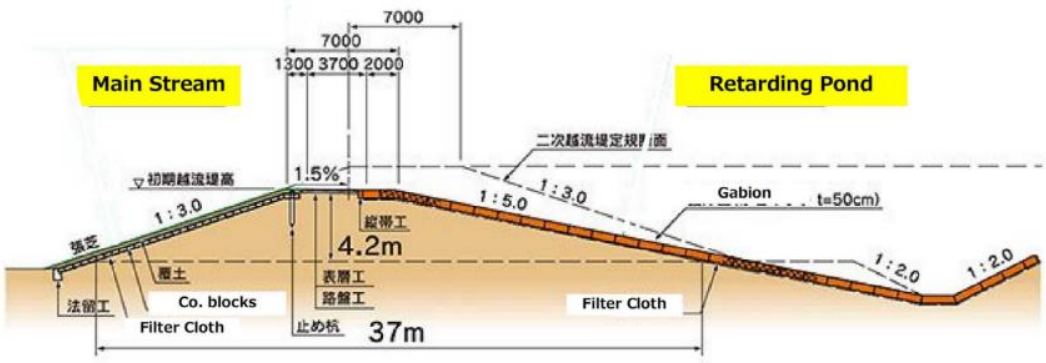
Retarding ponds are composed of various structures, such as overflow dike, surrounding levee and drainage gate. In the facility planning of retarding pond, natural drainage is to be considered so that planned basin-bed elevation will be equal to the planned/ current riverbed elevation of the Davao River. The height of surrounding levees should be the same with Davao River's design levee height taken at the upstream end of the pond. Excavation of the ground down to the planned pond elevation is necessary, if the existing ground level of the candidate site is high, which is the case here. **Figure 8** illustrates the concept for the facility planning of the retarding pond.



Source: JICA Consultants

Figure 8. Concept for facility planning of retarding ponds

For the structure of the overflow dike, gabion-type structure with gentle slope is the most commonly adopted one, which is considered to be suitable for Davao River since i) the structure is flexible and adapts to potential settlement; ii) easy procurement of materials and less costly; iii) same structure with the existing revetment along Davao River (gabion pile-up revetment) and thus there will be a continuity of the structure; and iv) requires regular unweeding but easy to monitor and maintain (**Figure 9**).



Source: JICA Consultants

Figure 9. Section of overflow dike

The details of the three (3) retarding ponds are presented in **Table 9**. The three (3) retarding ponds will occupy approximately an area of 1.79 square kilometers with a total service capacity of 11.40 MCM. The estimated total volume to be excavated will be 15.5 MCM.

Table 9. Details of the retarding ponds, DFCDMP, 2021

Revised design as of October 2021			
Retarding Pond	**Area (km2)**	**Service capacity (MCM**	**Excavated volume (MCM)**
RP 08	0.75	4.7	6.3
RP 09	0.37	2.2	3.0
RP 11	0.67	4.5	6.2

Source: JICA Consultants

The M/P for flood control measures F/P and M/P have a long planning period, so it is necessary to consider the impact of future climate change. For adaptation to climate change, analyzing the latest research results of the Philippines and target areas and referencing the policies of the Philippines and DPWH's policy (DGCS), the impact of climate change is estimated.

This concept is incorporating into the design or planned upgrade to determine the necessary design capacity of each component. The conditions of climate changes in 2036-2065 which was set as the planning conditions for the M/P with the target year of 2045 are as follows:

- Mean Temperature: to increase by 1.2 degrees compared to the condition in 2000.
- Rainfall: the probable rainfall for annual maximum daily rainfall increases by 10% from the climate condition in 2019.
- Mean sea level: to be 0.2m higher than the level in 2000, and 0.1m higher than the level in 2019.

Using the above concept and geological features at each location of the retarding pond, the area and retaining capacity were estimated.

The proposed RPs will have an earthen floor, multiple uses will be considered such as sport utilities, park, and recreation place. It can also be used as green and habitat for wildlife species. The actual design, however, will be considered in the detailed engineering stage.

Construction of the retarding ponds will generate huge volume of excavated soil. Disposal of the excavated soil should be done properly. Study of the manner of disposal, disposal sites and the design will be studied during the next stage, i.e., detailed engineering design.

3.5 Description of Project Phases

The proposed project comprises of three phases, namely; a) pre-construction, b) construction and c) operation. Since this is an environmental enhancement project, the abandonment, decommissioning, and rehabilitation are not considered as one of the project phases but as part of the construction phase. In addition, the proposed project once completed, does not have time prescription as to utility. The retarding ponds and cut-of-channel will be continually used.

Pre-construction phase

The pre - construction phase is vital to the success of the implementation of a project. It involves series of tasks necessary prior to the construction. These tasks include the feasibility study, finalization of the design and related plans i.e., dredging master plan, land acquisition, resettlement action plan, and securing needed project documents like environmental compliance certificate and permits. Feasibility analysis evaluates the project's potential success; therefore, perceived objectivity is an essential factor in the credibility. Various studies are conducted in order to ensure credibility. These studies include the environmental assessment, crafting of resettlement action plan for the directly affected people, technical and engineering study of the three components of flood control project. The JICA Consultants are responsible for the feasibility study of the project. JICA consultants subcontracted the environmental assessment to Green-collar Consulting Services and the resettlement action plan to Inter-Dev Incorporation. Detailed engineering design will be undertaken during this phase of the project before the implementation of the project.

Construction phase

This is the physical process of building the retarding ponds, cut-off-channel and the implementation of dredging Davao River. This phase will be implemented by the DPWH UPMO – FCMC in coordination with the Local Government of Davao City. The flood control projects that will be constructed are three (3) retarding ponds, cut-of works – cum - bridge and river dredging. River dredging involves the removal of silts and sediments deposited in the river. The dredging activities will be in accordance with the dredging master plan which is one of the outputs of the feasibility study. The last activity that would be undertaken in construction phase is the

demobilization of contractors. Demobilization includes clearing of the site construction debris, dismantling of temporary facility and removal of other related construction structures.

Operation phase

The operation activities for this project are mainly care and maintenance of retarding ponds and cut-off channel. Continuous tree planting around the retarding ponds and buffer zones are also done during this phase of the project.

3.6 Manpower Requirement

The construction of the different structural component of the flood control project for Davao River will require professionals such as civil engineers, skilled workers and unskilled workers. The directly affected qualified people will be given priority in the hiring of manpower. The number of people that will be hired could not yet be estimated at this time because the project is still in feasibility study stage. However, hiring of workers will be based on the DPWH Department Order 130 series of 2016.

To ensure that the environmental control programs and conditionalities stipulated in the ECC, the DPWH will designate an Environmental Officer (EO) to oversee the implementation of all environmental impact controls and measures during the construction.

3.7 Project cost

The total project cost is estimated to be about PhP 11.6 billion.

3.8 Project duration and schedule

The timeline of project implementation is presented in **Table 10.** The flood control infrastructures will be expected to be completed in 2035.

Table 10. Schedule of the implementation, DFCDMP, Davao City

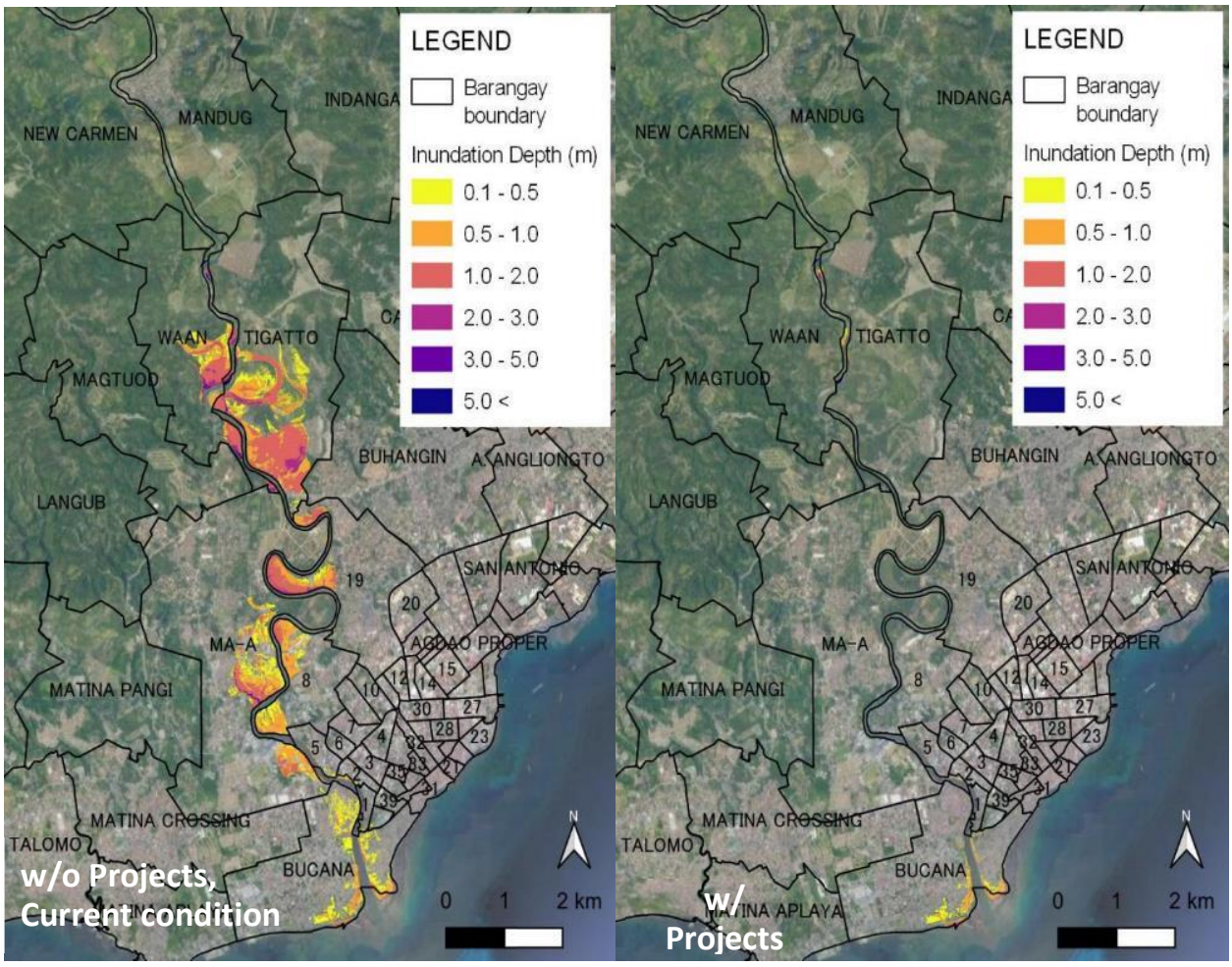
Work Items etc.			Required Period (year)	2020	2025					2030						2035				
					1	2	3	4	5	6	7	8	9	10	11	12	13			
Dredging	Preparation	Detail Design	1.0		1															
	Work	Temporary Facilities	1.0			1														
		Dreging/Dredged Soil Dosposal	7.0				1	2	3	4	5	6	7							
Retarding Pond (RP-8,9,11)	Preparation	Detail Design	2.0		1	2														
		Resettlement Action Plan (RAP) & Right of Way Acquisition	2.0				1	2												
	Procurement		1.0					1												
	Work	Temporary Facilities	0.5						1											
		Excavation/Remained Soil Disposal	5.0							1	2	3	4	5						
		Revetment/Dike Work	2.9							1	2	3								
		Overflow Dike Work	1.8								1	2								
		Drainage Facility Work	0.5							1										
River Widening (Preparation& Cut-off Work)	Preparation	Detail Design	1.0		1															
		Resettlement Action Plan (RAP) & Right of Way Acquisition	1.0		1															
	Procurement		1.0		1															
	Work	Temporary Facilities	0.5			1														
		Cut-off Work (Excavation) 6-13km	1.0				1													
		Cut-off Work (Dredging) 6-13km	1.0				1													
		Cut-off Work (Revetment) 6-13km	0.8				1													

Source: JICA Consultants

3.9 Environmental Condition With and Without the project

As can be seen from Figure 10, with the project, the flooding in the influenced areas by Davao River will be greatly reduced by 94% and there will be a reduction of the number of people that will be affected by 87%. With the abatement of flood, it will be expected that economic activity will improve. There will be more investors that will be interested in doing business in Davao City because the environmental condition will now be favorable to investment.

Without the project, Davao City will continue to experience flooding which will hamper the economic growth of City. Due to climate change, flood incidence will be frequent and more severe thus affecting more people.



	W/o Projects	w/ Projects	Reduction Rate
Total flood area (ha)	Approx. 480	Approx. 30	94%
Total no. of affected persons	Approx. 43K	Approx. 5.6K	87%

Figure 10. Environmental Condition With and Without the Project

4.0 Baseline Environmental Condition, Impact Assessment and Mitigation

4.1 The Land

4.1.1 Land Use and Classification

The land use of the affected areas of the Flood Control Project is presented in **Figure 11**. The land use of the proposed retarding ponds is floodway mitigation sub-zone, and prime agricultural land with very high susceptibility to flood. The cut-off works site is within the high and medium density sub-zone, planned unit development zone (PUD), open space easement zone (OSE) and floodway mitigation sub-zone with very high susceptibility to flood (Annex F).

Change/Inconsistency in Land Use

The proposed flood control project will be inconsistent with the existing land classification and use. The change and inconsistency of the land use can be resolved by local ordinance (City) declaring the areas of the structural components as special use which will allow these activities/project.

4.1.2 Encroachment in Environmentally Critical Areas (ECAs)

The Environmentally Critical Areas in the Philippines as stipulated in the Revised Procedural Manual DAO 30 series of 2003 of the Philippine Environmental Impact Statement System are categorized into twelve (12). As can be seen in Figure 4, the project site is adjacent to Davao River making it an ECA; while no designated land protection area such as national park, IBA/ KBA are confirmed. However, under the Revised Procedural Manual, however, the projects are grouped as follows: a. Group I - ECPs in either ECAs or NECAs. b. Group II – NECPs in ECAs and c. Group III – NECPs in NECAs. The flood control project is environmental enhancement and mitigation belongs to Group II that is NECP in ECAs. Section 10 of the Revised Procedural Manual stipulates decision on EIA application of NECP in NECAs is on EMB Regional level. In addition, EMB Central Office has recategorized this flood control project as category B requiring regional action. In addition, EMB MC 2014 – 005 stipulates that environmental enhancement falls under Category C with component under Category B, hence, ECC is required. The environmental impacts of the project to the environmentally critical areas are discussed in section 4.1.7 Terrestrial Biology and section 4.2 Water module.

4.1.3 Land Tenure Issues

The locations of retarding ponds and cut-of-work are not within CARP, CADT or on any tenurial instruments issued by the DENR.

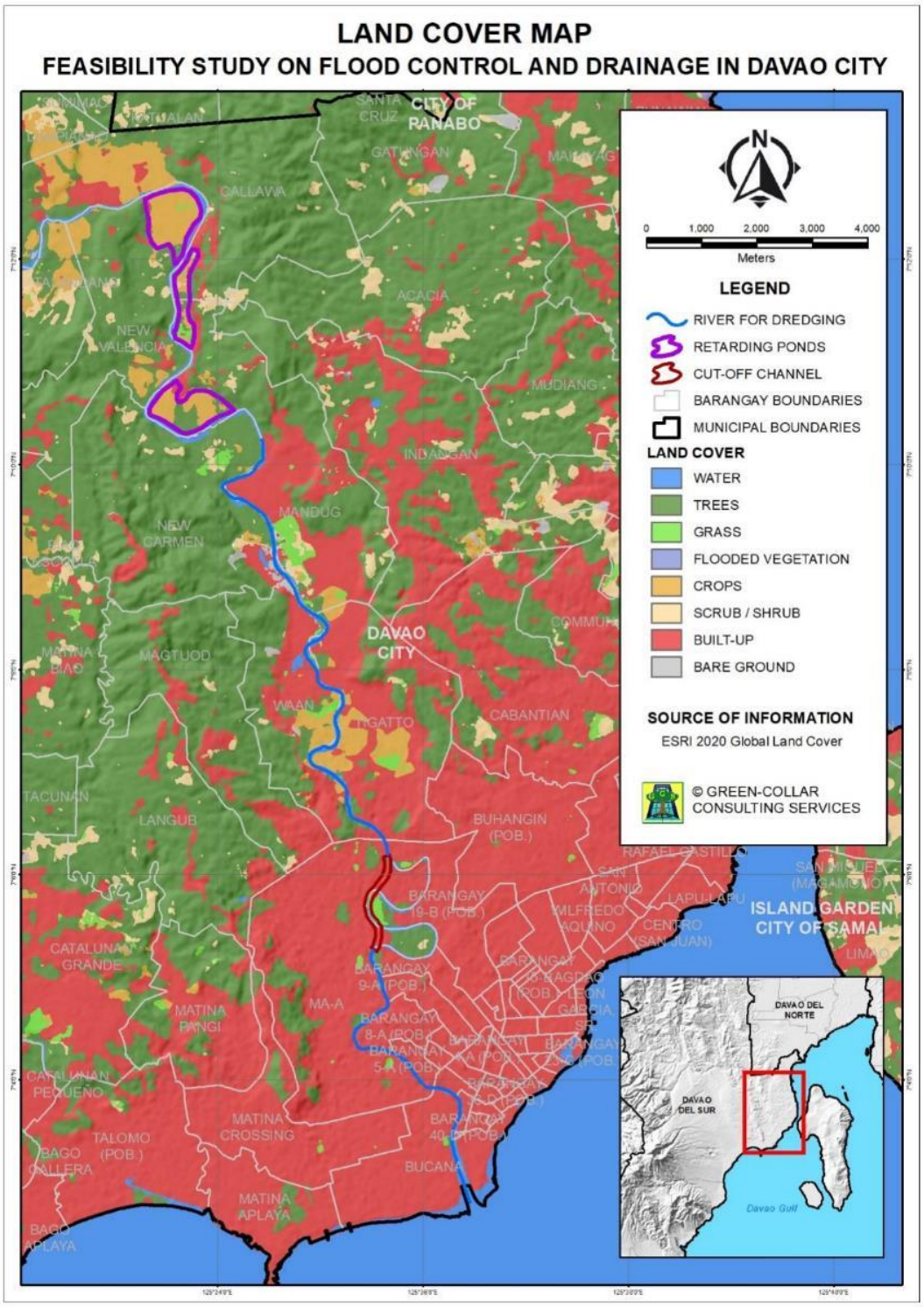


Figure 11. Land Cover/Land use map

4.1.4 Geology and Geomorphology

4.1.4.1 Geology

Figure 12 presents the geologic map of the project site. The geologic composition of the proposed priority project sites namely, the retarding ponds and cut-off works fall under recent geologic epoch. Recent deposits represent sedimentary deposition taking place during the most recent period in earth's history, including the present day. These geologically recent deposits include unconsolidated to loosely stratified stream channel and floodplain deposits, alluvial sand and gravel, lacustrine, paludal and beach deposits, raised coral reefs, atolls and beach-rock.

Regional Tectonic Setting

Tectonic activities in the Philippines are influenced by movements of three (3) major tectonic plates, namely the Pacific Plate, the Eurasian Plate, and the Indo-Australian Plate. The most recent manifestations of these tectonic movements are the 1990 Luzon earthquake and the Mt. Pinatubo eruption in 1991. Pacific Plate moves north-westward at the rate of 7- 10 cm/year and subducts towards Philippine –Japan Trench. The Eurasian Plate, basically a continental plate, is moving at the rate of 3mm/year and maybe considered as fixed plate. The Indo –Australian plate is moving NW at a rate of 7-9 cm/year and is presently colliding with the Eurasian Plate in the Himalayas with its oceanic portion subducting along the Sumatra - Java Trench.

4.1.4.2 Geomorphology

Two distinct anomaly directions that intersect in eastern Mindanao, namely: (1) Numerous NNW anomalies in the intra arc basin of Agusan-Davao and both Pacific and Central Cordilleras appear as young features in the morphology and are due to strike-slip faults of the arc-continent collision. Some of the faults have proven to be reactivated Middle Miocene faults, related to the initial rifting of the Agusan-Davao Basin. (2) N-S anomaly directions are transgressive ridges due to the collision except one anomaly which corresponds to the trace of the Philippine Fault Zone and connects with the collisional features. In contrast, the Cotabato Basin in western Mindanao lies between two terranes of different nature. In the Cotabato Basin area, the NW and NNW anomaly directions are also present and similarly correspond to strike-slip faults and thrust related folds, respectively. Pull-apart basins occur in places where sagging is evidenced. An additional set of anomalies trends ENE and corresponds to the active extensional field. Below the Quaternary sediments, some of the "en echelon" features corresponding to blind flat-and-ramps structures were identified.

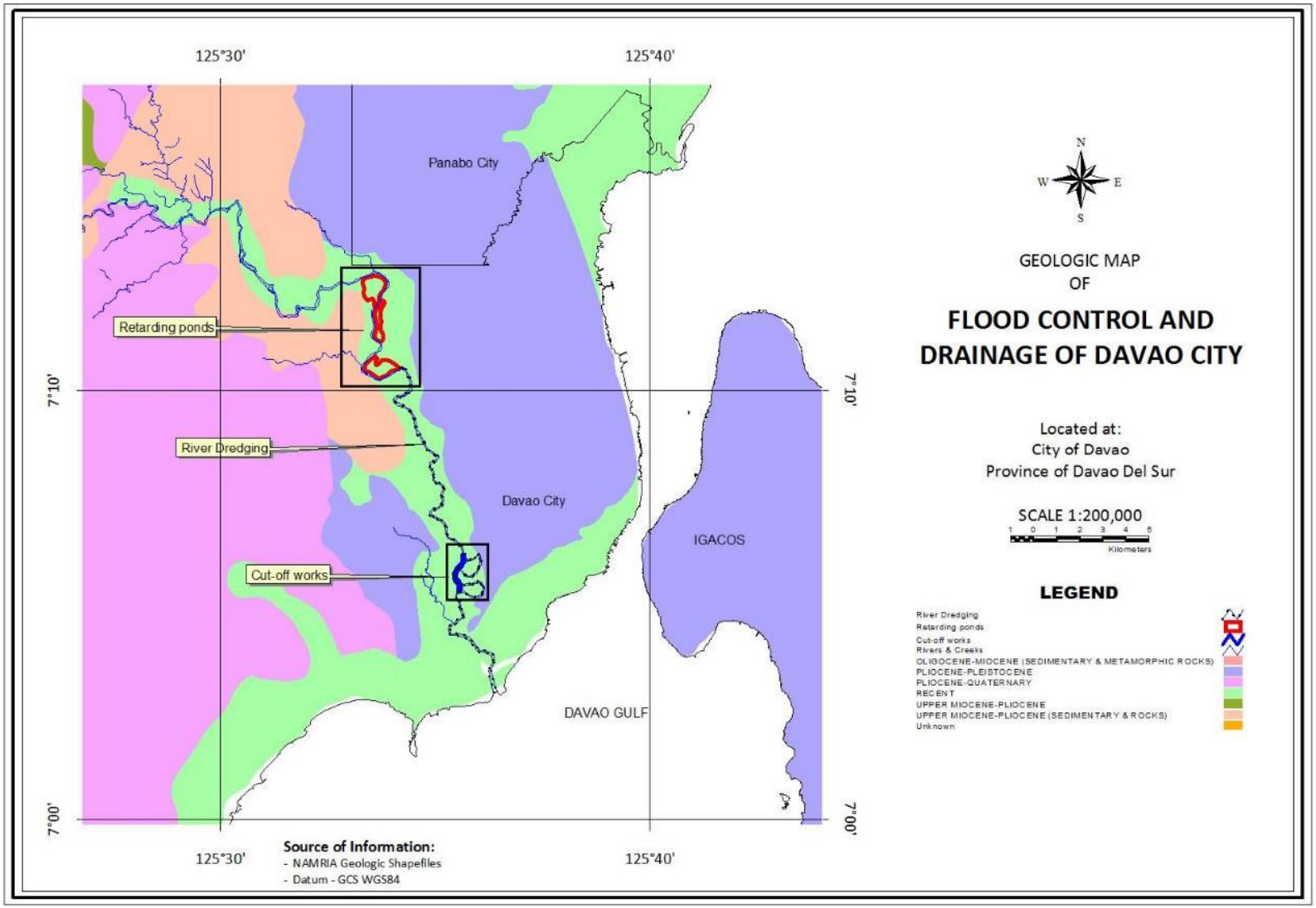


Figure 12. Geologic Map, DFCDMP, Davao City

4.1.4.3 Slope and Elevation/Topography

The retarding ponds and cut-off works will affect a total of thirteen (13) barangays. These barangays sit on different elevations. As can be seen from **Figure 13**, the retarding ponds are located upstream at an elevation between 20 and 50 meters above sea level (masl). Cut-off works are concentrated at elevation of 0.01 to 10 masl. The dredging works are spread from elevation of 20 – 50 masl to zero (at the mouth of Davao River).

The terrain of the structural components sites is flat to undulating with non-critical slope. As can be gleaned from **Figure 14**, the retarding ponds although located in higher elevation is generally flat while the cut-off works downstream is also in a flat terrain.

4.1.5 Pedology

4.1.5.1 Soil Erosion/Loss of Soil/Overburden

The proposed retarding ponds sit on San Manuel series type of soil while the soil in cut-of-works area belongs to Matina series as shown in **Figure 15 and Figure 15a,** respectively. The San Manuel series represents soil of alluvial formation and are found mostly along courses of rivers. The different soil materials deposited during its formation include loose and friable loam, silt loam and sandy loam.[4] The Matina series on the other hand, is found in broad alluvial plain.

The erosion potential of the proposed sites of retarding ponds and cut-of-works is presented in **Figures 16 and 16a.**[5] Both the RPs and CoW areas have low erosion potential. The proposed flood control infrastructures are in areas highly vulnerable to floods. The geologic characteristics are recent deposits which are mainly sedimentary, loose, and unconsolidated. The erodibility of the banks of the new river channel is high considering the geologic characteristics.

4.1.5.2 Change in Soil Quality/Fertility

Some areas of the flood control infrastructure specifically in retarding ponds sites are zoned as prime agricultural land sub-zone because the soil is fertile and agriculturally productive. Some agricultural crops were observed during the field assessment.

Although the flood control infrastructures are physical in nature, the contraction may alter soil quality especially in areas where the temporary facilities of the contractors will be located. Soil contaminants that will generate include oil and grease from the vehicle maintenance and operation.

[4] Natural Resources. Provincial Government of Negros Oriental. https://negor.gov.ph/natural-resources/. Date retrieved: April 23, 2022.
[5] National Mapping and Resource Information Authority. https://namria.gov.ph/. Date accessed April 21, 2022

Impacts on Geology, Geomorphology and Pedology

The Flood Control structures will cause varied effects to morphology. The construction will entail massive earthworks that will result to permanent alteration of the topography. Earthworks will loosen the soil structure, if it is not properly controlled, which will render it more susceptible to erosion. In addition, loose soil is easily transported to nearby Davao River and Davao Gulf during heavy rains resulting to siltation.

Since geological condition does not show soft ground, and installment of heavy materilas for reclamation, e.g. is not planned; land subsidence risk wil not be expected.

Clearing activities during site preparation will result to permanent removal of vegetation which will eventually cause habitat fragmentation, destruction, and loss to agriculture. In addition, removal of vegetation will increase the soil erosion potential of the area. The new river banks which are composed of unconsolidated recent deposits are susceptible to erosion and collapse. The oil and grease that will be spilled on the ground will kill the soil biota and will alter the quality and fertility.

Mitigating Measures

Conduct of geotechnical site investigation prior to earthworks and construction could minimize the impact to geology, geomorphology and pedology of the area. Management of the adverse effects can be done through the formulation and implementation of suitable engineering measures and sound geotechnical design based on local geology and geomorphology. Loose soils have high potential for erosion. Immediate measures to prevent siltation of nearby bodies of water from silt-laden surface run-off are the provision of silt fences and diversion canals. There are now technologies available to treat the soil contaminated with oil and grease. The contractor should ensure that the soil is properly treated before leaving the area.

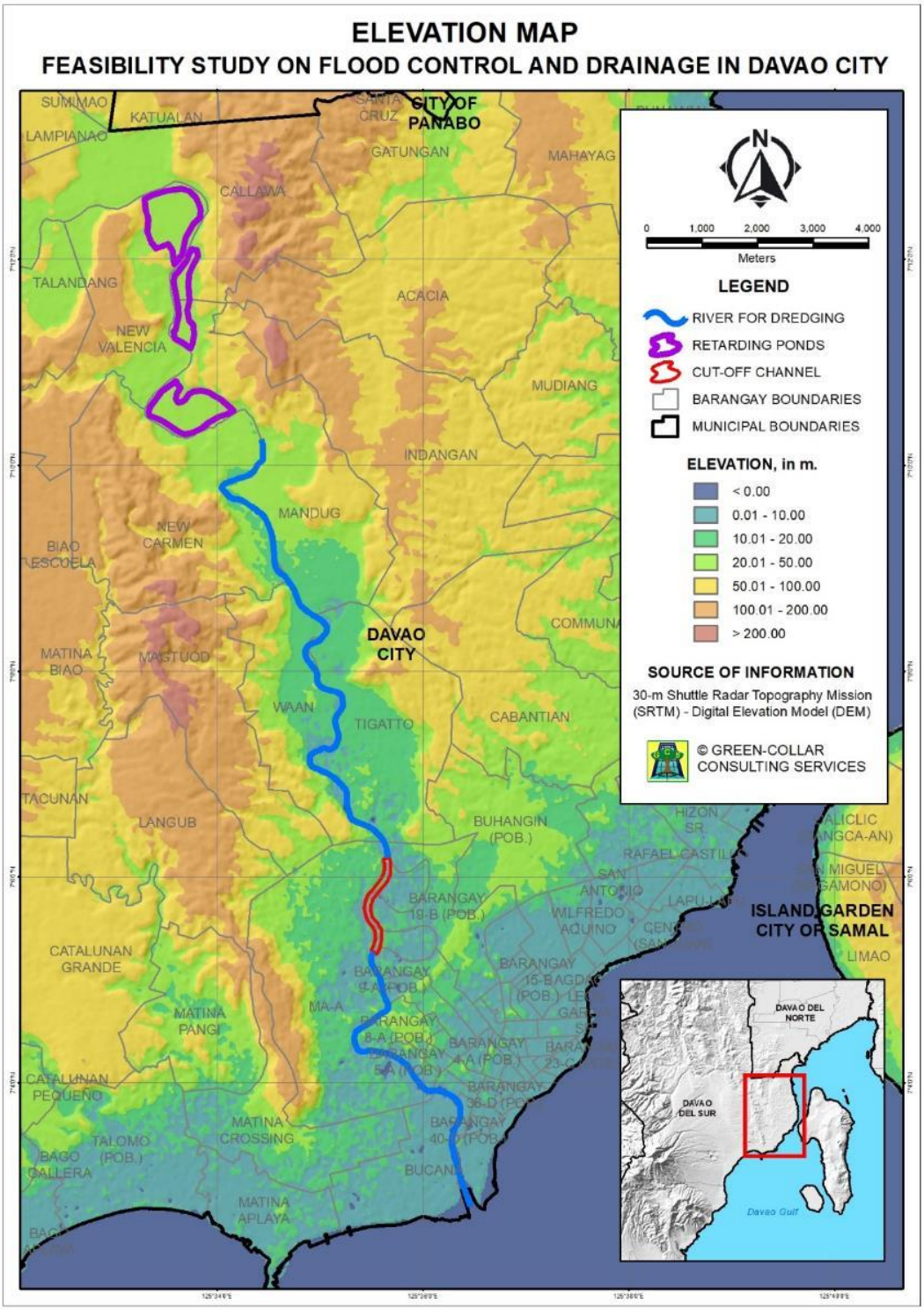


Figure 13. Elevation map, DFCDMP, 2021

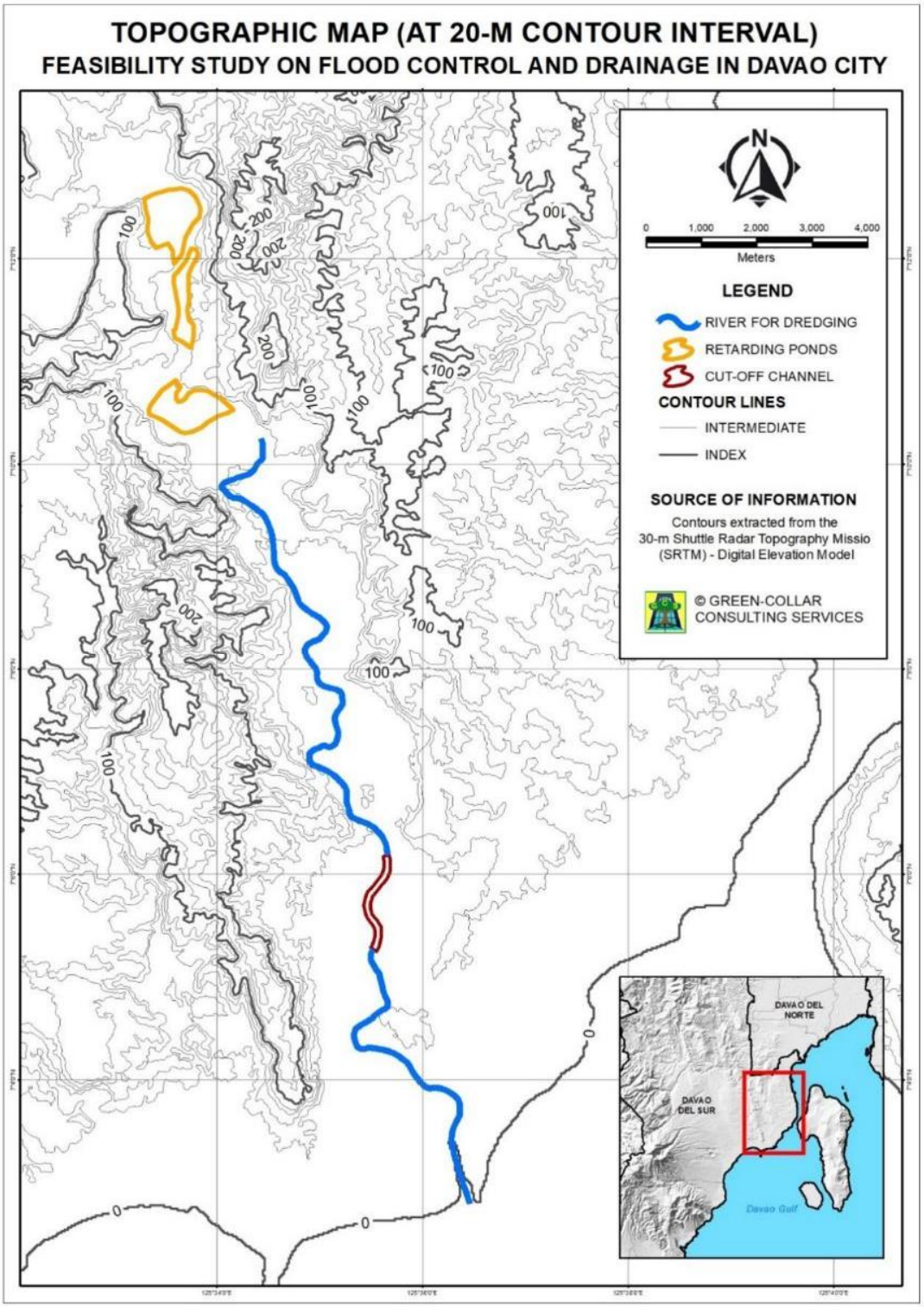


Figure 14. Topographic map, DFCDMP, 2021

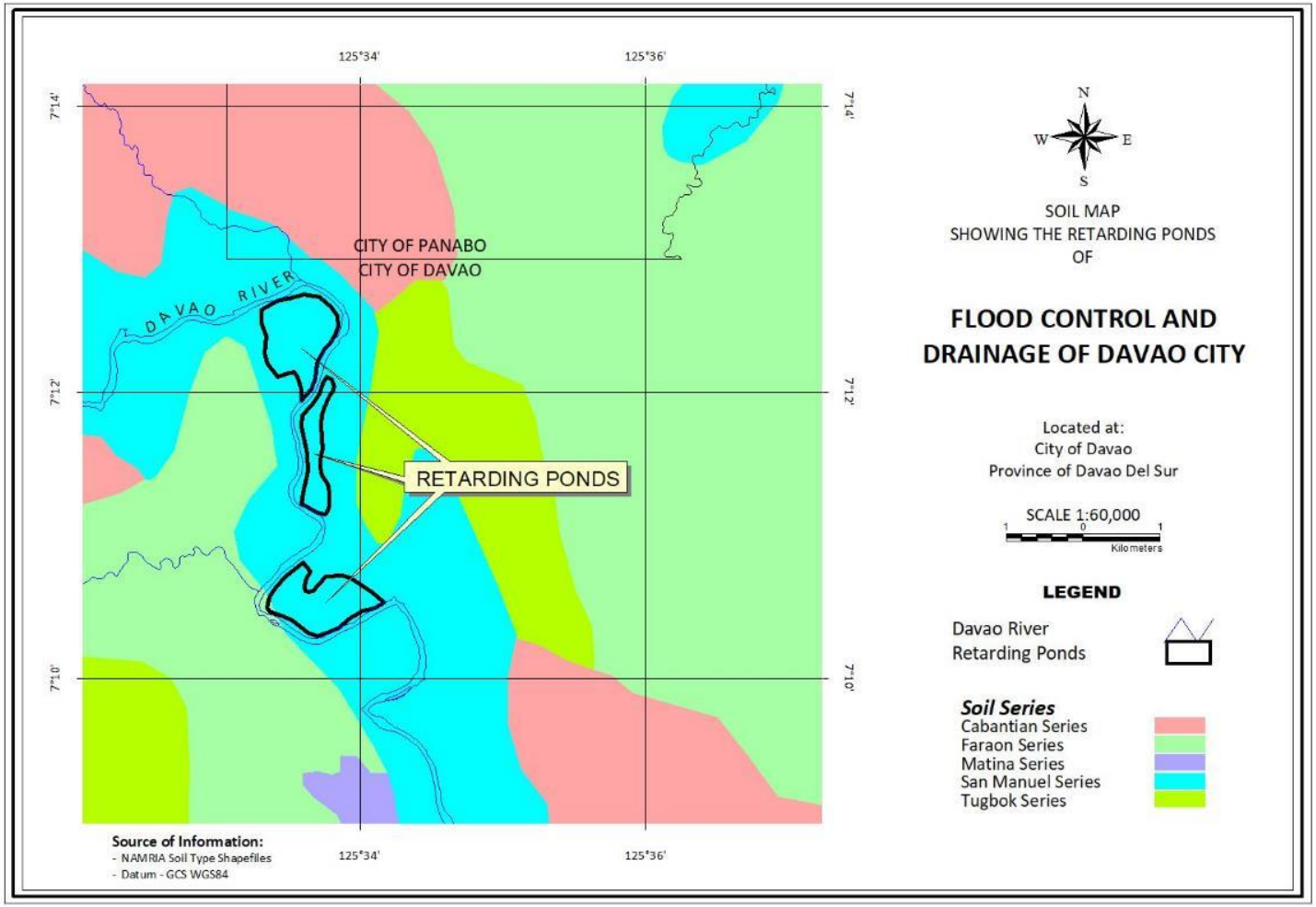


Figure 15. Soil Map of Retarding Ponds, DFCDMP, 2021

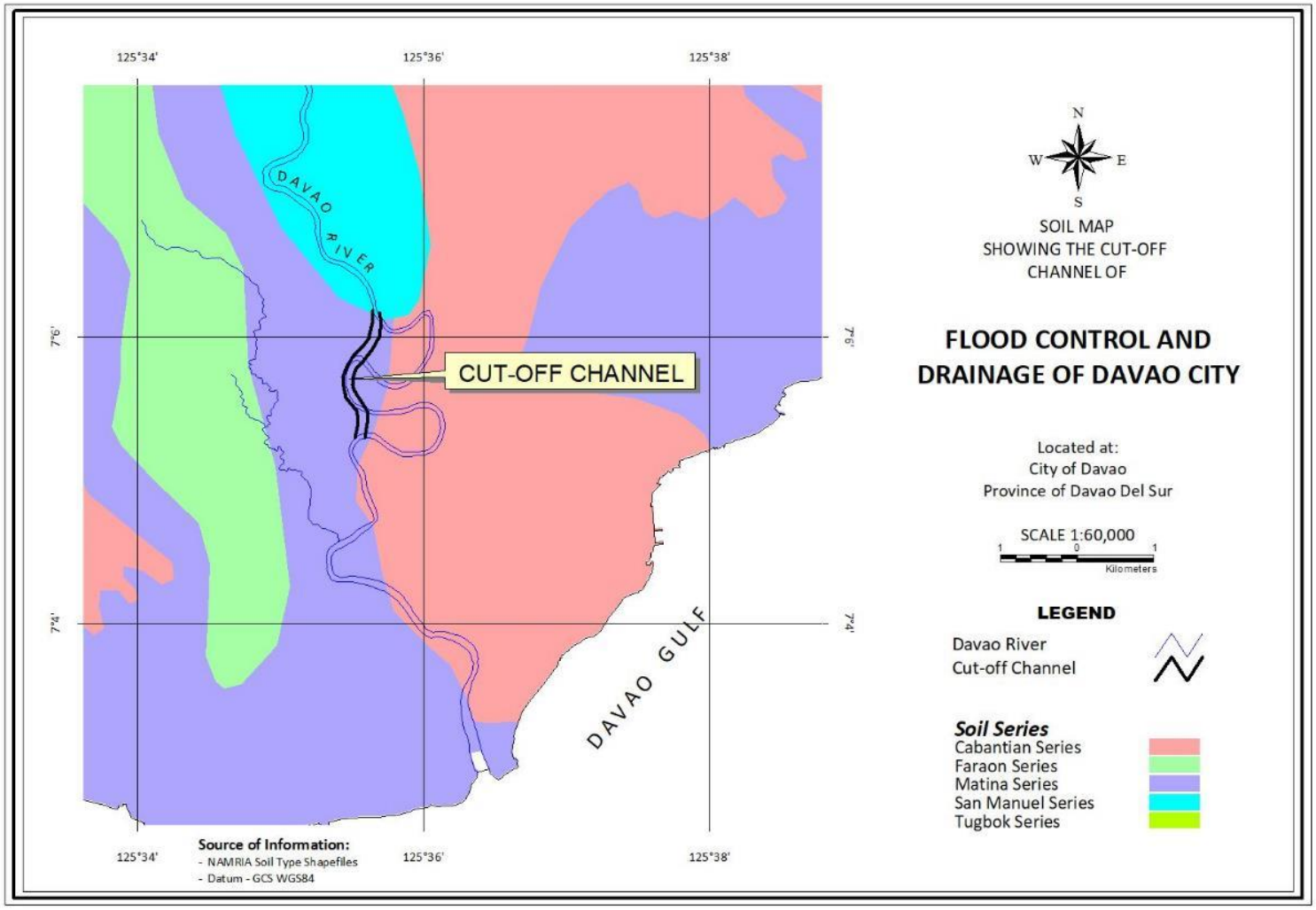


Figure 15a. Soil Map of Cut-of-Works, DFCDMP, 2021

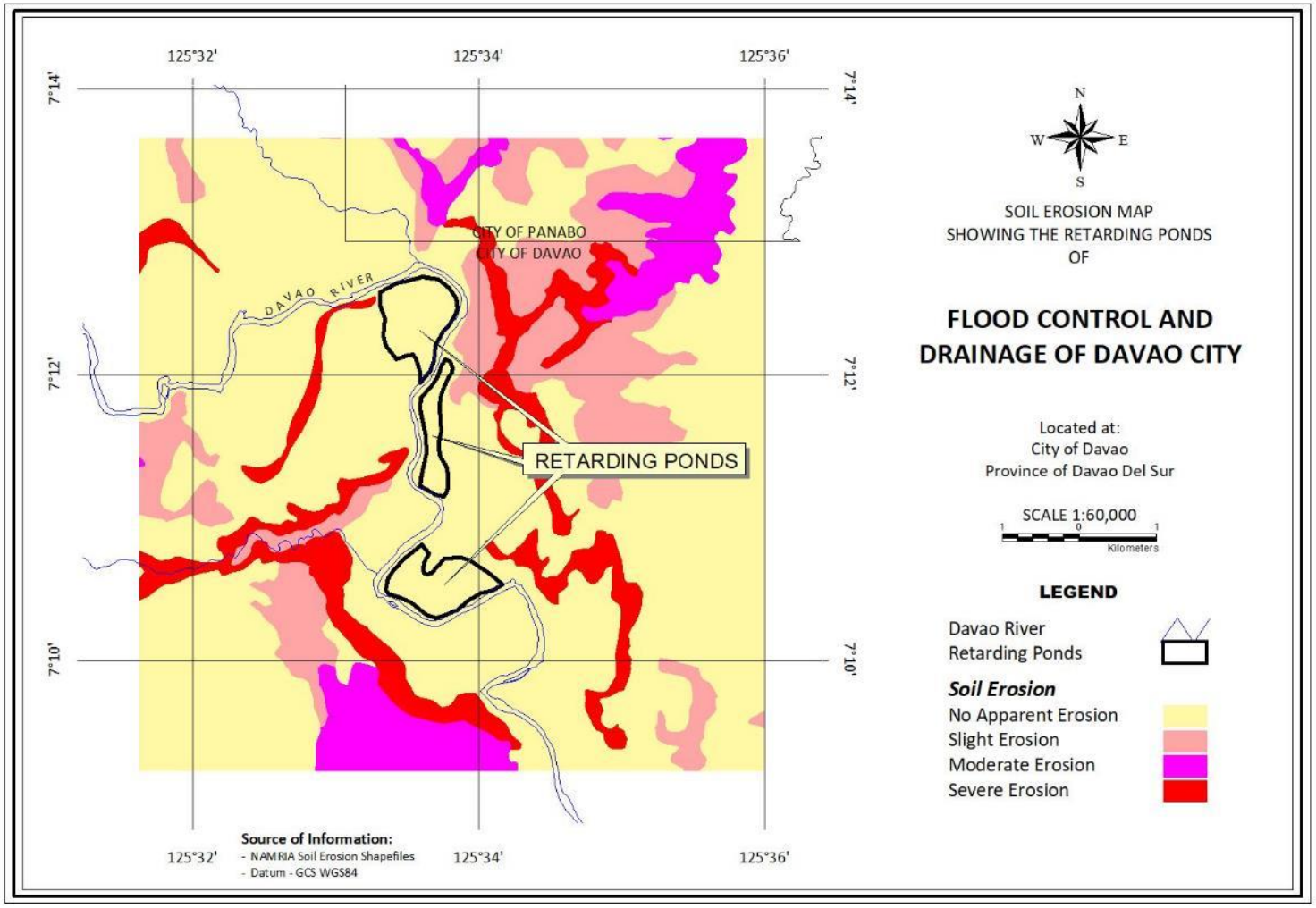


Figure 16. Soil Erosion Map of Retarding Ponds, DFCDMP, 2021

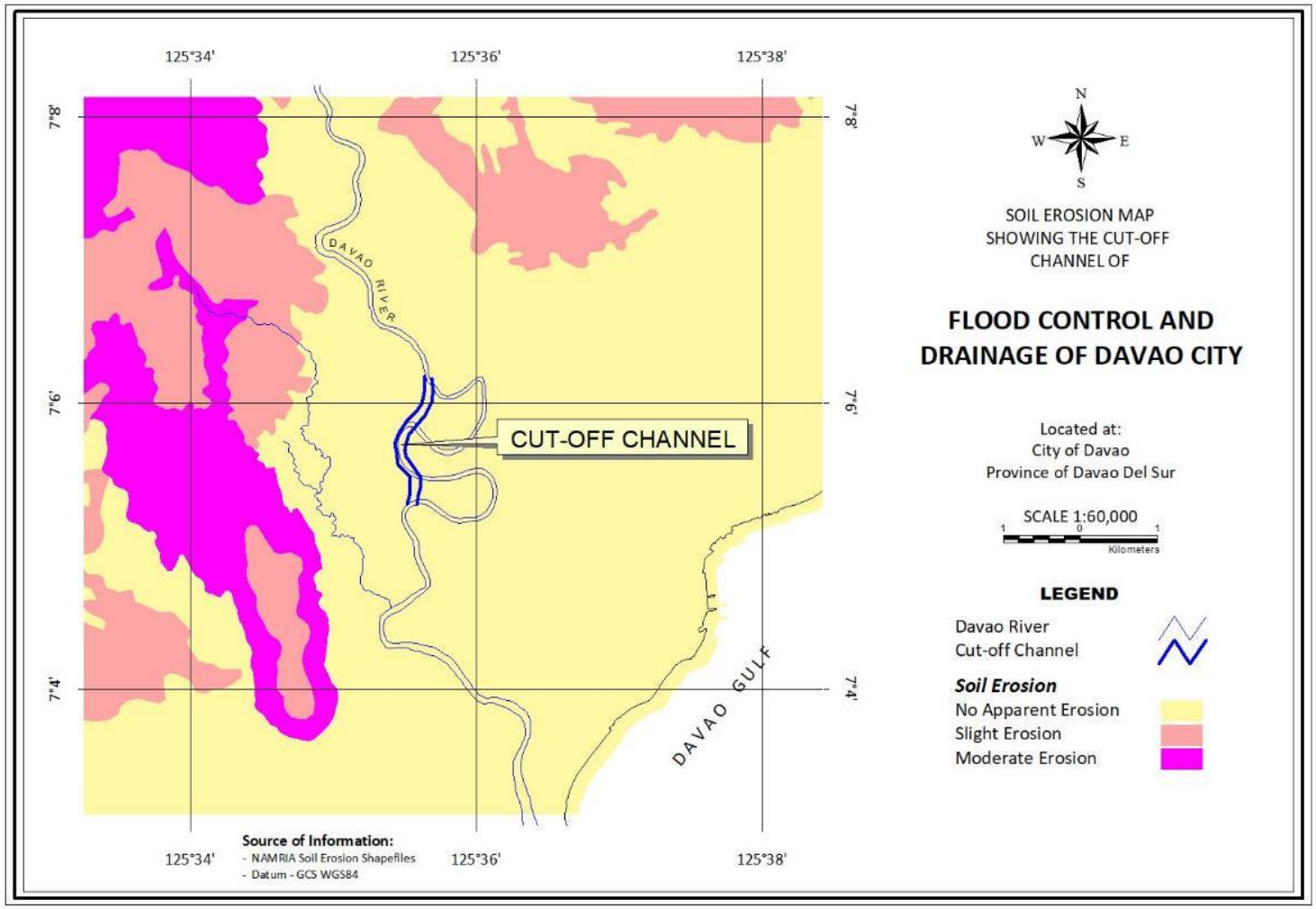


Figure 16a. Soil Erosion Map of Cut-of-Works, DFCDMP, 2021

4.1.5 Natural Hazards

By its location in the tropics, the Philippines is normally hit by natural hazards. Geologic phenomena such as earthquakes, volcanic eruptions and tsunamis that are incurring devastating impacts are very common. The presence of active volcanoes, active faults and trenches in the Philippines places the country to be naturally vulnerable to environmental disasters. This situation plus human and developmental factors compound the incapacity of the communities to cope with the disasters.

4.1.5.1 Seismic Hazards

The tectonic setting of the Philippines is characterized by two major tectonic plates namely the Pacific Plate which is moving northwestward and the Eurasian Plate which is slow moving and subducted along western side of Luzon and Mindoro. The Philippines is bounded by various subduction zones – on the east are the East Luzon Trench, Philippines Trench and on the southeastern is the Davao Trench. The Philippine trench is the most active subduction area and the host a big percentage of earthquakes that happened in Mindanao.

4.1.5.2 Earthquakes

Figure 17 shows that the sites of structural component specifically the retarding ponds are near an active fault. Because of the presence of active faults, occurrence of earthquake in Davao City is expected to be frequent. Davao City has experienced shallow focus earth quakes and depth with magnitude between 2 and 7. And most of the earthquakes that occurred in these areas were caused by the movement of the Philippine Trench (Cabanlit, 2010).

The seismic map **(Figure 18)** of the Philippines shows that the project site falls within zone 3. Zone 3 is described as zone of major damage and earthquake corresponding to intensity VII and higher of the Modified Mercalli Intensity Scale (M.M.” scale).

4.1.5.3 Flood

Flood susceptibility of the project sites (retarding ponds and cut-off works) varies from low to very high. The susceptibility of retarding pond 8 and small portion of retarding 9 is very high. Majority of the area of retarding pond 9 is not susceptible to flooding. Retarding pond 11 is susceptible to low and high flooding incidence. The area of cut-off works and its vicinity is susceptible to high and very high flooding (**Figure 19**).

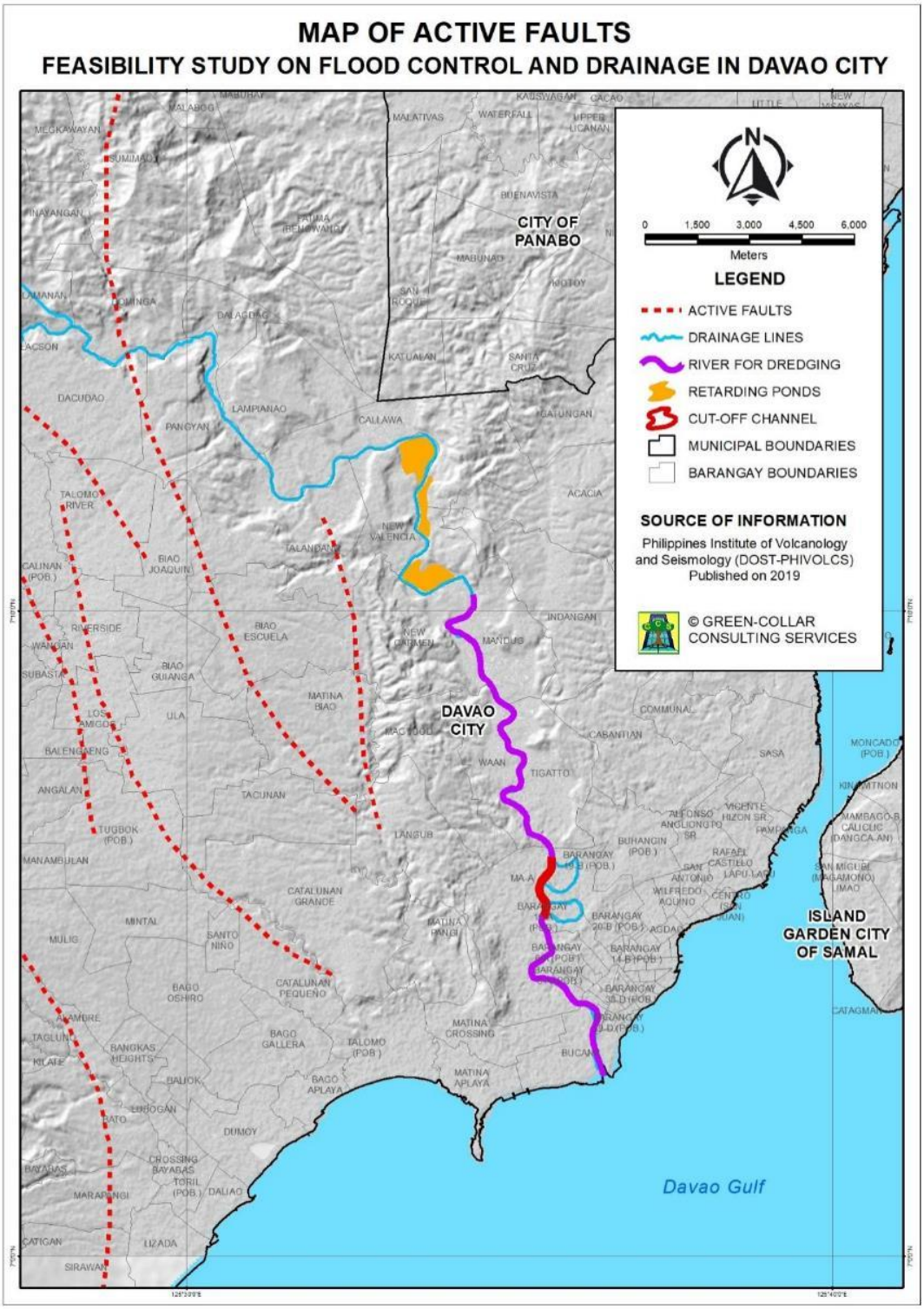


Figure 17. Faultline Map, DFCDMP, 2021

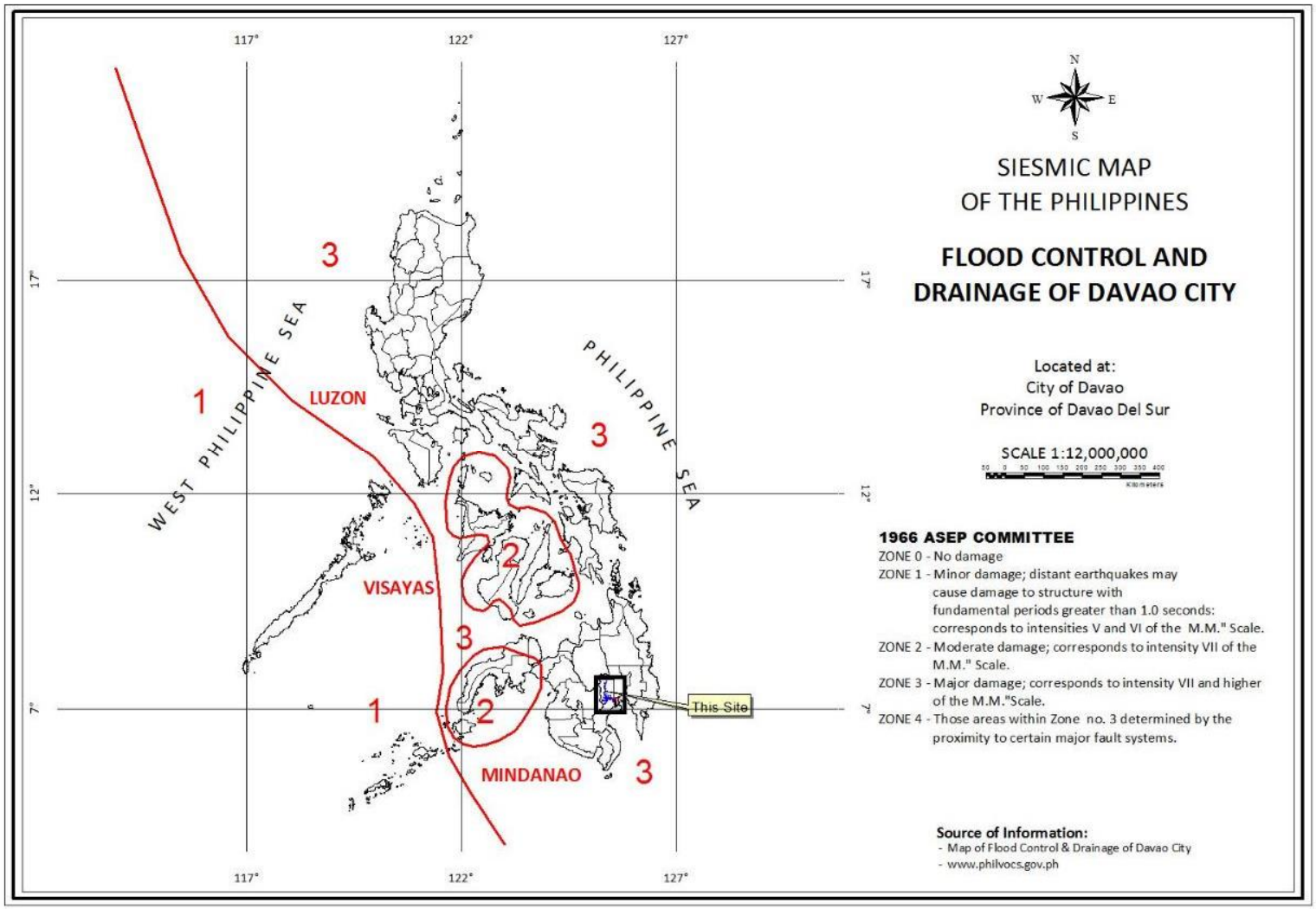


Figure 18. Seismic Map of the Philippines

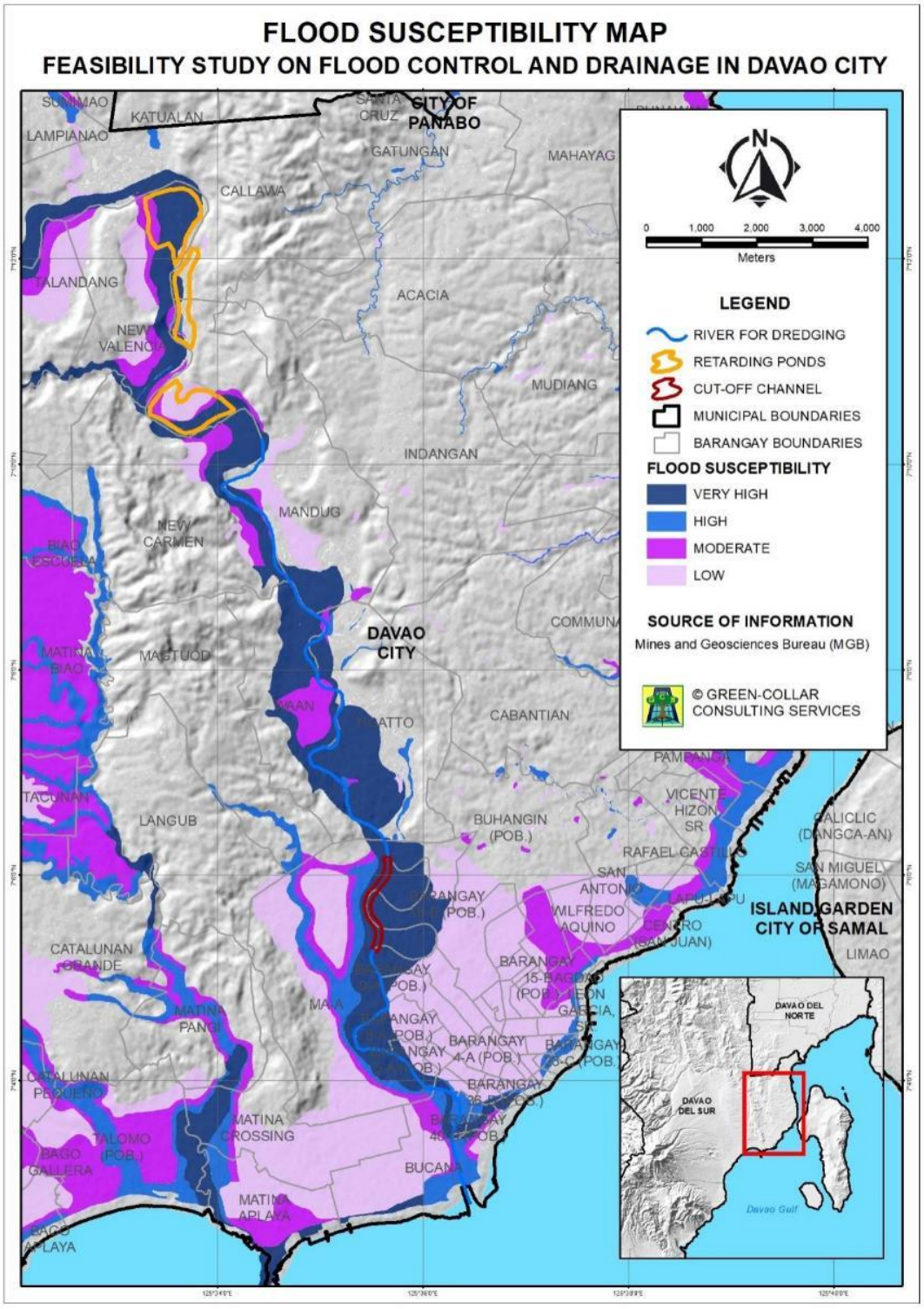


Figure 19. Flood Susceptibility Map, DFCDMP, Davao City

4.1.5.4 Combined Risk to Geophysical Disasters

The PHIVOLCS together with the NAMRIA of the Department of Environment and Natural Resources evaluated the vulnerability of flood control project sites to natural disasters and calculated the risks using the formula proposed by UNDP;

Risk = Hazard x Exposure x Vulnerability

The combined risk represents the sum of the normalized provincial risks to earthquakes, earthquake-induced shallow landslides, and floods. As shown in **Figure 20**, the level of combined risk to geophysical disaster is high.

4.1.6 Potential Environmental Impacts and Mitigating Measures

The flood control project activities are not perceived to aggravate the effects of natural hazards hitting the site. The design of structures, however, should consider the risk level as mapped by PHIVOLCS and NAMRIA. There should be a localized disaster risk mapping within the project site in order to determine the effects of the presence of the project. A disaster management framework should be formulated in accordance with RA 1021 considering possible collateral hazards, livelihoods as well as lives exposed, multiple vulnerabilities and efforts at adaptation, prevention and mitigation that may reduce the level of risk.

4.1.7 Terrestrial Biology

4.1.7.1 Scope: Baseline and Impact Assessment

Terrestrial floristic and faunal investigation of the Project Site was carried out during September 3 to 6, 2021 in order to identify the possible impacts of the proposed construction and implementation of flood control project for Davao River to local ecological conditions, assess the level of impacts, and propose measures to mitigate these impacts. Specifically, the assessment sought to:

1. Conduct ecological measurements of the floral and faunal assemblages of the proposed project Site and its vicinity;
2. Assess the conservation status of flora and fauna documented in the area based on national legislation and IUCN/CITES criteria; and,
3. Identify, assess, and propose mitigation measures of the potential impacts of the Project to local biodiversity and ecological conditions.

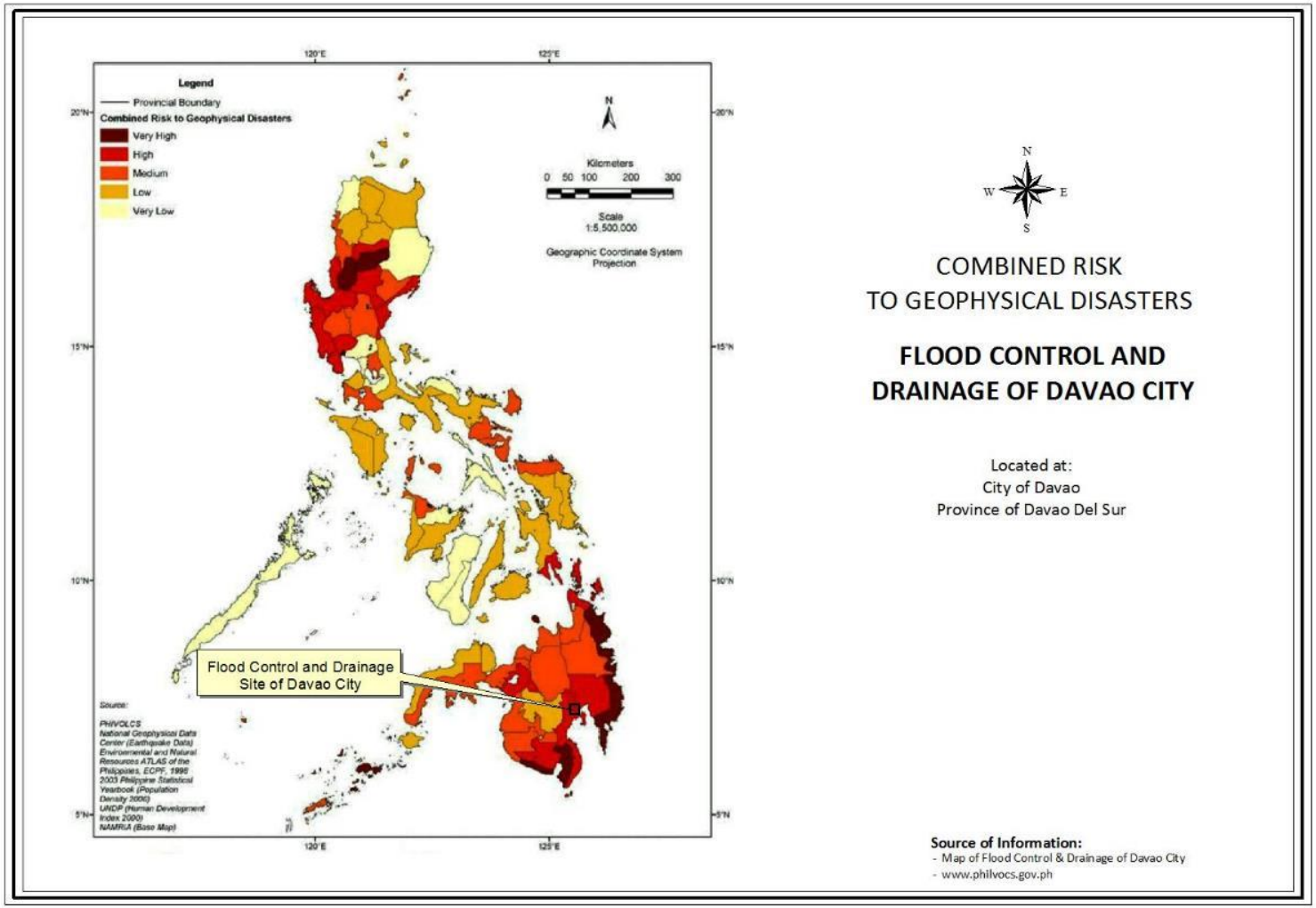


Figure 20. Combined Risk Map, DFCDMP, 2021

The threatened Philippine flora and fauna are covered by various national legislations, notably:

1. Wildlife Resources Conservation and Protection Act (2001);
2. DENR Memorandum Circular 2007-2 (Critical Habitats);
3. Republic Act No. 7586 – the National integrated Protected Areas System Act
4. DAO 2004-15 and DAO 2007-1 amended in DAO 2007-24 defining conservation categories for Philippine flora and fauna as Threatened Species, Critically Endangered Species, Endangered Species, Vulnerable Species, Other Threatened Species and Other Wildlife Species.
5. DENR Administrative Order no, 2017-11- Updated National List of Threatened Philippine Plants and Their Categories.
6. DENR Administrative Order no, 2019-09- Updated National List of Threatened Philippine Fauna and Their Categories

4.1.7.1 Terrestrial Flora

4.1.7.1.1 Methodology

A combination of quadrat sampling technique and transect survey was used to assess the terrestrial flora within the vicinity of the proposed Davao River Flood Control Project located at Brgy.1, 2, 5, 8, 19, Bucana, Tigatto, Ma-a, Mandug, New Carmen, Callawa, and Waan, Davao City. The team selected the six (6) quadrats along the transect lines of two (2) kilometers during the transect walk survey (**Table 11** and **Figure 21**). The quadrats were distributed in such a way that all existing vegetation cover was represented. Generally, the area has three vegetation types namely; open forest, brushland, and mangroves ecosystem. For trees, individual species with diameter-at-breast height (DBH) or greater than three centimeters inside the 100m x 100m plots were assessed. In addition, 10m x 10m subplots were established for the intermediate growth or plants with DBH less than 3 cm (i.e., poles, saplings) and 1m x 1m subplots for the understorey vegetation (i.e., seedlings, grasses). Information gathered in the field were tabulated and analysed to characterize floral composition within the study area. The relative density, relative dominance and relative frequency values for each tree species were determined to obtain their Importance Value (IV), which is the standard measurement in forest ecology to determine the rank relationships of species.

Table 11. Location of terrestrial sampling and observation sites, DFCDMP, 2021

Site Code	Name of Sampling Observation Sites	Elevation (masl)	Geographic Coordinates	
			Latitude	Longitude
Q 1	Purok Saging Sitio Bungan, Brgy.New Carmen	30	7° 12' 8.418" N	125° 33' 28.111" E
Q 2	Sitio Ilihan Upper Fatima, Brgy. Callawa	29	7° 10' 24.127" N	125° 33' 39.080" E
Q 3	Sitio Lapuy, Brgy. Mandug,	47	7° 11' 44.971" N	125° 33' 42.505" E
Q 4	Brgy. Mandug	24	7° 10' 49.684" N	125° 33' 47.943" E
Q 5	Brgy. 19-B	10	7° 5' 36.583" N	125° 35' 37.076" E
Q 6	Brgy. Maa, Davao City	8	7° 5' 23.955" N	125° 35' 34.092" E

The relative frequency, relative density and relative dominance indicate different aspect of the species importance in a community. Importance values were determined using the following formula:

$$Density = \frac{Number\ of\ Individuals}{area\ sampled}$$

$$RelativeDensity = \frac{Density\ of\ a\ species}{total\ density\ of\ all\ species} x\ 100$$

$$Frequency = \frac{Number\ of\ plots\ where\ species\ occur}{total\ number\ of\ plots\ sampled}$$

$$Relative\ Frequency = \frac{Frequency\ value\ for\ a\ species}{Total\ frequency\ values\ of\ all\ species}\ x\ 100$$

$$Dominance = \frac{Basal\ area\ or\ volume\ for\ a\ species}{Area\ sampled}$$

$$Relative\ Dominance = \frac{Dominance\ for\ a\ species}{Total\ dominance\ of\ all\ species}\ x\ 100$$

Importance Value = Relative Density + Relative Frequency + Relative Dominance

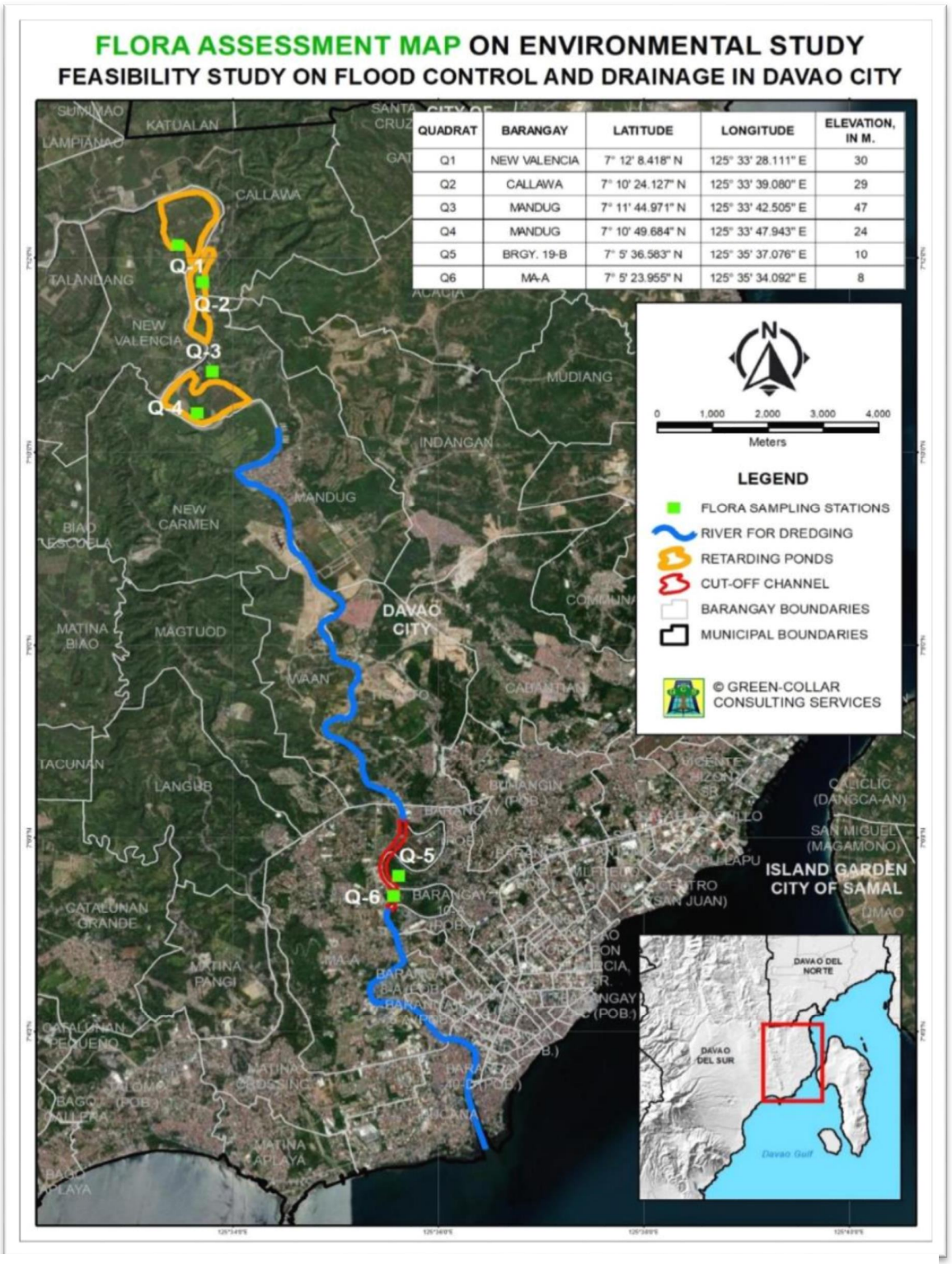


Figure 21. Floristic sampling map, DFCDMP

The diversity indices of the different sampling areas, which include the Shannon index (H) and Evenness index (J), were also computed. The indices were computed using the following formula:

$$Shannon - Weiner\ Index\ [H] = -\sum \left(\frac{ni}{N}\right) ln \left(\frac{ni}{N}\right)$$

where:

ni = the total number of individuals in each species

N = the total number of all individuals

$$Pielou's\ Evenness\ Index\ (J) = \frac{H1}{ln\ S}$$

where:

S = total number of species

An opportunistic survey was done to assess the status of fauna in the proposed project site. This part of the study was done primarily through forest hiking, bird watching, transect counts, and point observations. Various suspected microhabitats (i.e., puddles, sections of streams and rivers, tree holes, forest floor with significant decaying leaf litter cover, tree buttresses, decaying logs, leaf axils, epiphytes, tree ferns and others) were thoroughly examined with help from the guides and the porters. Interviews were also performed but were limited only to conspicuous and easily identifiable species (e.g., birds, monitor lizard, snake, insects, etc.).

4.1.7.1.2 Results and Discussions

4.1.7.1.2.1 General Situation

The proposed area for Davao City Flood Control and Drainage Project is located at Barangays Brgy.1, 2, 5, 8, 19, Bucana, Tigatto, Ma-a, Mandug, New Carmen, Callawa, and Waan. The terrain of the area is flat and rolling with elevation ranging from 10 to 120 meters above sea level. Generally, the vegetative cover of the project area varies from grassland to open canopy forest and some portions of beach and mangrove ecosystem in the downstream area. The open-canopy forest is second-growth and residual forest dominated with Fabaceae, Euphorbiaceae and Moraceae family tree species. The forest floor of the open-canopy forest has poor undergrowth due to the thick forest litter (e.g., leaves, twigs, branches etc.) The open forest is relatively young with the highest recorded diameter at breast height (DBH) at only 36 cm; while majority of the individual species have DBH that falls between the ranges of 3 cm to 18 cm. The open portions are brushland which is dominated by cogon, ferns, and herbs such as hagonoy, some shrubs and small trees.

Photo 1. Establishment of transect lines and quadrats

Photo 2. Measurement of Diameter at Breast Height (DBH) of trees sighted

The proposed project area is within the floodplain of the Davao River. The vicinity and project site were already inhabited and most portions of the land are already cultivated and planted with agricultural crops such as cassava, banana, durian, mango, and coconut. Vegetation and trees sighted in the proposed project site were mostly non-endemic and dominated with planted tree species such as cacao, coffee, falcata, mahogany, mangium, gmelina, and Ipil-ipil. The whole area can be considered as Agro-ecosystem already because most of the vegetation in the proposed project site was agricultural crops. Portion of the proposed project were mangroves and beach ecosystems in Brgy. Bucana, Davao City.

4.1.7.1.2 .2 Species Diversity

A total of one hundred sixty-three (163) species were recognized belonging to the seed plants, ferns and their allies from the ten quadrats sampled. **Table 12** below shows the number of families and species per plant type recorded in the project area.

Table 12. Summary of species composition, DFCDMP, 2021

Plant Type	No. of Families	No. of Species
Trees	33	91
Grass/shrubs/herbs/vines	28	62
Ferns/pterophytes	8	7
Epiphytes/mosses	3	3
Palms	1	6
Total	**73**	**163**

Photo 3. Aerial photos of Quadrat 1 (RP11)

Photo 4. Aerial photo of Quadrat 2

Photo 5. Aerial shot of Quadrat 3 Sitio Lapuy, Brgy. Mandug, Davao City

Photo 6. Aerial of Quadrat 4 Davao River at Brgy. Mandug, Davao City.

Photo 7. Aerial drone photo Quadrat 5 at Brgy. 19-B, Davao City.

Photo 8. Aerial photo of Quadrat 6 (proposed cut-off works), Brgy. Maa, Davao City

The most speciose (having several species) of all seventy-three (73) families recorded are *Moraceae* with thirteen (13) species followed by *Euphorbiaceae, Fabaceae* and *Poaceae* with eleven (11) species each. **Tables 13** and **14** present the complete list of all the species recorded in the project site.

Table 13. Lists of tree species recorded in the project area

Local /Common Name		Scientific Name	Family Name
1	Mangapaho	*Mangifera monandra*	Anacardiaceae
2	Mangga	*Mangifera indica Linn*	Anacardiaceae
3	Dao	*Dracontomelon dao*	Anacardiaceae
4	Ylang- ylang	*Cananga Odorata*	Anonaceae
5	Guyabano	*Annona muricata*	Anonaceae
6	Batino	*Alstonia macrophylla*	Apocynacea
7	Dita	*Alstonia scholaris*	Apocynacea
8	Lanete	*Wrightia laniti*	Apocynacea
9	Malapapaya	*Polyscias nodosa*	Araliaceae
10	African Tulip	*Spathodea campanulata*	Bignoniaceae
11	Hagdan Uwak	*Oroxylum indicum*	Bignoniaceae
12	Banai-banai	*Radechmachera pinnata*	Bignoniaceae
13	Kapok	*Ceiba pentadra*	Bombaceae
14	Anonang	*Cordia dichotoma*	Boraginaceae
15	Bitaog	*Calophyllum inophyllum*	Clusiaceae
16	Mangosteen	*Garcinia mangostana*	Clusiaceae
17	Lanipao	*Terminalia copelandii*	Combretaceae
18	Kalumpit	*Terminalia microcarpa*	Combretaceae
19	Talisay-gubat	*Terminalia foetidissima*	Combretaceae
20	Talisay	*Terminalia catappa*	Combretaceae
21	Katmon	*Dillenia philippinensis*	Dilleniaceae
22	Binunga	*macaranga tanaris*	Euphorbiaceae
23	Bignai	*Antidesma bunios*	Euphorbiaceae
24	Lumbang	*Aleurites moluccana*	Euphorbiaceae
25	Pararubber	*Hevea brazilensis*	Euphorbiaceae
26	Hamindang	*Macaranga bicolor*	Euphorbiaceae
27	Tuba-tuba	*Jathropa cutcas*	Euphorbiaceae
28	Sampaloc	*Tamarindus indica L.*	Fabaceae
29	Narra	*Pterocarpus indicus*	Fabaceae
30	Madre de cacao	*Glericidia sepium*	Fabaceae
31	Caballero	*Caesalpinia pulcherrima*	Fabaceae
32	Ipil-ipil	*Leucaena leucocephala*	Fabaceae
33	Bahai	*Ormosia calvensis*	Fabaceae
34	Aure	*Acacia aure*	Fabaceae

Local /Common Name		Scientific Name	Family Name
35	Mangium	*Acacia mangium*	Fabaceae
36	Falcata	*Paraserianthes falcataria*	Fabaceae
37	Rain Tree	*Samanea saman*	Fabaceae
38	Ulayan/ulaian	*Lithocarpus llanoisii* (A.DC.) Rehd.	Fagaceae
39	Bago	*Gnetum gnemon L.*	Gnetaceae
40	Paguringon	*Cratoxylum sumatranum*	Hypericaceae
41	Gmelina	*Gmelina arboria*	Lamiaceae
42	Avocado	*Persea gratissima*	Lauraceae
43	Banaba	*Lagerstroemia piriformis*	Lythraceae
44	Malubago	*Hibiscus tiliaceus*	Malvaceae
45	Durian	*Durio zibethinus*	Malvaceae
46	Bitan-ag	*Kleinhovia hospita*	Malvaceae
47	Barobo	*Diplodiscus paniculatus Turc*	Malvaceae
48	Sayapo	*Trichospermum eriopodum*	Malvaceae
49	Lanzones	*Lansium domesticum*	Meliaceae
50	Bagalunga	*Melia dubia*	Meliaceae
51	Santol	*Sandoricum koetjape Merr*	Meliaceae
52	Colo	*Dysoxylum decandrum*	Meliaceae
53	Mahogany	*Swietenia macrophyla*	Meliaceae
54	Marang Bangohan	*Artocarpus odoratissima blanco*	Moraceae
55	Anubing	*Artocarpus cumingiana*	Moraceae
56	Kamansi/Rimas	*Artocarpus communis*	Moraceae
57	Himbabao	*Alleanthus luzonicus*	Moraceae
58	Antipolo	*Artocarpus blancoi*	Moraceae
59	Nangka	*Artocarpus heterophylla lam.*	Moraceae
60	Is-is	*Ficus odorata*	Moraceae
61	Balete	*Ficus balete*	Moraceae
62	Labnog	*Ficus hawili*	Moraceae
63	Tibig/Tubog	*Ficus nota*	Moraceae
64	Hagimit	*Ficus minahassae*	Moraceae
65	Niyog-niyogan	*Ficus pseudopalma*	Moraceae
66	Hawili	*Ficus septica*	Moraceae
67	Malunggay	*Moringa Oleiferam Lam.*	Moringaceae
68	Guava	*Psidium guajava*	Myrtaceae
69	Tambis	*Syzygium aqueum*	Myrtaceae
70	Makopa	*Syzygium samarangense*	Myrtaceae
71	Balimbing	*Averrhoa carambola*	Oxalidaceae
72	Iba	*Averrhoa bilimbi*	Oxalidaceae
73	Buyo-buyo	*Piper abbreviatum*	Piperaceae
74	Ikmo	*Piper betle*	Piperaceae
75	Mansanitas	*Ziziphus jujube (Linn.) Lam.*	Rhamnaceae

Local /Common Name		Scientific Name	Family Name
76	Hambabalod	*Nauclea formicaria*	Rubiaceae
77	Kahoi Dalaga	*Mussaenda frondosa*	Rubiaceae
78	Doña Aurora	*Mussaenda philippica*	Rubiaceae
79	Bangkoro/Noni	*Morinda citrifolia*	Rubiaceae
80	Bangkal	Nuclea orientalis	Rubiaceae
81	Kape	Coffea Arabica Linn.	Rubiaceae
82	Pomelo	Citrus grandis	Rutaceae
83	Caimito	Chrysophyllum cainito Linn.	Sapotaceae
84	Rambutan	*Nephelium lappaceum*	Sapindaceae
85	Cacao	*Theobroma cacao*	Stercullaceae
86	Anabiong	*Trema orientalis*	Ulmaceae
87	Alagasi	*Leucosyke capitellata*	Urticaceae
88	Rami-rami	*Boehmeria nivea*	Urticaceae
89	Alagau	*Prema odorata blancoi*	Verbenaceae
90	Kulipapa	*Teijsmanniodendron ahernianum*	Verbenaceae
91	Molave	*Vitex parviflora*	Verbenaceae

Table 14. List of other plants (herbs, ferns, epiphytes, shrubs, grasses, palms, vines)

No.	Local /Common Name	Scientific Name	Family Name
A. Epiphytes			
1.	Broom pork moss	*Homalothecium sericeum*	Brachytheciaceae
2.	Pocket moss	*Fissidens taxifolius*	Fissidentaceae
3.	Wild waling-waling	*Vanda sanderiana*	Orchidaceae
B. Pterophytes/Ferns			
1	Pakpak Lawin	*Asplenium nidus*	Aspleniaceae
2	Pakong Alakdan	*Blechnum oriente L.*	Blechnaceae
3	Pako-pako	*Blechnum fraseli L.*	Blechnaceae
4	Tree fern/Anotong	*Cyathea contaminans (Hook.)*	Cyatheaceae
5	Kilob	*Gleichenia linearis* Burm	Gleicheniaceae
6	Pako	*Athyrium esculentum*	Polypodiaceae
7	Bird's nest fern	*Asplenium nidus Linn.*	Psilotaceae
C. Palms			
1	Coconut	*Cocos nucifera*	Arecaceae
2	Bunga	*Areca catechu L.*	Arecaceae
3	Kaong	*Arenga pinnata Merr.*	Arecaceae
4	Pugahan	*Caryota cumingii Lodd.*	Arecaceae
5	Buri	*Corypha utan Lamk.*	Arecaceae
6	Anahaw	*Saribus rotundifolius*	Arecaceae
7	Palmera	*Chrysalidocarpus lutenscens H. Wendel*	Arecaceae
8	Manila Palm	*Adonidia merrillii*	Arecaceae
D. Grasses/Shrubs/Herbs/Vines			

No.	Local /Common Name	Scientific Name	Family Name
1.	Nees	*Hemigraphis premulaefolia*	Acanthaceae
2.	Kulitis	*Amaranthus spinosus L.*	Amaranthaceae
3.	Kudiapa	*Celosia argentea L.*	Amaranthaceae
4.	Ligas	*Semecarpus cuneiformis Blanco*	Anacardiaceae
5.	Gabi-gabi	*Caladium bicolor*	Araceae
6.	Palau	*Cryptosperma merkusii (Hassk.) Schott*	Araceae
7.	Badyang/Elephant Ear	*Colocacia esculenta*	Araceae
8.	Hagonoy	*Chromolaena odorata*	Asteraceae
9.	Kokog-bungog	*Pseudoepahntophys spicatus (Juss)*	Asteraceae
10.	Pisau-pisau	*Bidens pliosa L.*	Asteraceae
11.	Kalintuhod	*Synedrella nodiflora L.*	Asteraceae
12.	Pineapple	*Ananas comosus*	Bromeliaceae
13.	Elepante/Erysipela plant	*Heliotropium indicum L.*	Boraginaceae
14.	Dilang baka	*Nopalea cochenillifera (Linn.) Salm-Dyck*	Cactaceae
15.	Kapayas/Papaya	*Carica papaya*	Caricaceae
16.	Damong Maria	*Artemisia vulgaris Linn.*	Compositae
17	Kamu-kamuti	*Ipomea triloba L.*	Convolvulaceae
20.	Daat	Scleria scrobiculata	Cyperaceae
21.	Fork Fimbry	*Fimbristylis dichotoma (L) Vahl.*	Cyperaceae
22.	Matang-hipon	*Breynia rhamnoides*	Euphorbiaceae
23.	Chinese malunggay	*Sauropus androgynus (Linn.) Merr.*	Euphorbiaceae
24.	Cassava	*Manilot esculenta*	Euphorbiaceae
25.	Tawa-tawa	*Euphorbia hirta L.*	Euphorbiaceae
26.	Tangan-tangan/Castor Plant	*Ricinus communis Linn.*	Euphorbiaceae
27.	Tagum	*Ingdigofera tinctoria*	Fabaceae
28.	Agpoi	*Phanera integrifolia L.*	Fabaceae
29.	Bago	*Gnetum gnemon*	Gnetaceae
30.	Mayana	*Coleus scutellarioides (L.) Benth*	Lamiaceae
31.	Pansi	*Hyptis capitata Jacq.*	Lamiaceae
32.	Akapulko/Asunting	*Cassia alata Linn.*	Leguminosae
33.	Bamban	*Donax cannaeformis (Forst. f.) K. Schum.*	Maranthaceae
34.	Hantutuknaw/ malatungao	*Melastoma malabathricum L.*	Melastomataceae
35.	Kapa-kapa	*Medinilla magnifica*	Melastomataceae
36.	Makabuhay puti	*Tinospera reticulata*	Menispermaceae
37.	Ambal	Pyenarrhena manillensis	Menispermaceae
38.	Makahiya	*Mimosa pudica Linn.*	Mimosaseae
39.	Abaca	Musa Textilis	Musaceae
40.	Banana	*Musa acuminata*	Musaceae
41.	Hantutuknaw/ malatungao	*Melastoma malabathricum L.*	Melastomataceae

No.	Local /Common Name	Scientific Name	Family Name
42.	Kapa-kapa	*Medinilla magnifica*	Melastomataceae
43.	Makabuhay puti	*Tinospera reticulata*	Menispermaceae
44.	Ambal	Pyenarrhena manillensis	Menispermaceae
45.	Saging	*Acgecarus condoniculatum*	Myrsinaceae
46.	Baliw	*Pandanus tectorius*	Pandaceae
47.	Corn/Maize	*Zea mays*	Poaceae
48.	Palagtiki/Wire grass	*Eleusine indica L*	Poaceae
49	Tambu/Tiger Grass	*Thyanolaena latifolia (Hornem)*	Poaceae
50.	Amor seco	*Andropogon aciculatus Retz.*	Poaceae
51.	Bila-bila/wire grass	*Eleusine indica L*	Poaceae
52.	Cogon	*Imperata cylindrica*	Poaceae
53.	Kawayan Tinik	*Bambusa spinosa Roxb.*	Poaceae
54.	Kawayan Kiling	*Bambusa bulgaris Schrad.*	Poaceae
55.	Climbing Bamboo	*Arthrostylidium Longiforum*	Poaceae
56.	Tigbi	*Coix lachryma-jobi L.*	Poaceae
57.	Talahib/Bugang	*Saccharum spontaneum Linn.*	Poaceae
58.	Nito	*Lagodium circinnatum*	Schizaeaeceae
59.	Kanding-kanding /Elepante	*Stachytarpheta jamaicensis Linn.*	Verbenaceae
60.	Tambabasi	*Callicarpa formosana Rolfe*	Verbenaceae
61.	Alimpuyas	*Curcuma zedoaria (Berg.) Rose*	Zingiberaceae
62.	Tagbak	*Kolowratia elegans*	Zingiberaceae

Photo 9. Some of the forest tree species sighted at the proposed project area

Photo 10. Some of the moraceae trees sighted at the study area

Photo 11. Some of tree species sighted in the study area

Photo 12. Some of fruit tree species sighted in the study area

Photo 13. Species of herbs, shrubs, grasses, and vines recorded in the study site

Photo 14. More species of herbs, shrubs, grasses, and vines

Photo 15. Common ferns and palms encountered at the study area.

From the 6 quadrats established along transects per location, a total of 430 individuals belonging to 92 species of trees were recorded to have a diameter of > 5 cm. The average density is 0.0430 tree/sq.m, or roughly 4 trees for every 100 square meters. The Importance Value is a measure of how dominant a species in a given forest area.[6] Based on the computed importance value (IV), the most important tree species is Anabiong (*Trema o*rientalis) with computed value of 20.701 (**Table 15**). It implies that the Anabiong tree is the most dominant species in the proposed flood control project sites. The top ten tree species with high IV listed in Table 15 are the recommended tree species to be planted for future rehabilitation of disturbed areas during construction and re-vegetation works.

The intermediate and undergrowth layers have almost the same species richness at 12.11 and 12.05 species, respectively. The most frequent species at the intermediate layer is *Chromolaena odorata (*Hagonoy) which is present in all 6 quadrats. The most numerous is the *Paspalum conjugatum (*Carabao Grass*)* which had recorded 54 individuals and followed by *Blechnum oriente L. (*Pakong Alakdan) with 48. At the understory, the most dominant vegetation is *Paspalum conjugatum (*Carabao Grass*)*.

Table 15. List of the recorded tree species with highest Importance Value (IV)

Rank	Common Name	Scientific Name	Family Name	Importance Value (IV)	IUCN Category	Location
1	Anabiong	*Trema orientalis*	Ulmaceae	20.701	-	All stations
2	Balete	*Ficus balete*	Moraceae	18.768	LC	Q1, Q4, Q5
3	Narra	*Pterocarpus indicus*	Fabaceae	18.538	EN	All stations
4	Gmelina	*Gmelina arborea*	Lamiaceae	16.552	LC	Q1, Q3, Q4, Q5, Q6
5	Mangga	*Mangifera indica Linn*	Anacardiaceae	15.443	-	Q1, Q3, Q4, Q5, Q6
6	Ylang-ylang	*Cananga odorata*	Anonaceae	13.166	LC	Q1, Q2, Q4, Q5
7	Antipolo	*Artocarpus blancoi*	Moraceae	12.807	LC	Q1, Q3, Q5 Q6
8	Falcata	*Paraserianthes falcataria*	Fabaceae	12.657	-	Q5, Q6
9	Mahogany	*Swietenia macrophylla*	Fabaceae	11.797	-	Q1, Q3, Q5, Q6
10	Durian	*Durio zibethinus*	Malvaceae	11.473	-	Q3, Q4

Note: Q1 – RP8, Q2 – RP9, Q3 – between RP9 and RP11, Q4 – RP11, Q5 – COW, Q6 - COW

4.1.7.1.2.3 Diversity Indices

[6] Prasad, Anantha, Louis Iverson, Steve Mattews and Matt Peters (undated) USDA Forest Service Climate Change Tree Atlas as cited by Tom Kimmerer. https://kimmerer.com/trees/importance-value/. Date accessed: 12 April, 2022.

The diversity of the sampling areas was analyzed using the PAST software to compute for the Shannon-Weiner Index and the Pielou's Evenness Index (**Table 16**). The Shannon index assumes that individuals are randomly sampled from a large population and that all species are represented in the sample. It gives an estimate of the species richness and distribution. The Evenness index is the ratio of the observed diversity to maximum diversity. Diversity indices represent the health of an ecosystem. High diversity implies a healthy ecosystem. The maximum value of Shannon-Weiner Index is 1. The diversity indices of the proposed sites of flood control structures have low to very low diversity with location of RP8 has the lowest. The different species, however, are evenly distributed. The low diversity and high in evenness in the proposed flood control sites can be attributed to the anthropogenic activities such as agricultural practices e.g., banana and cacao plantation, and settlement development.

Table 16. Diversity indices and number of species, DFCDMP, 2021

Sampling Quadrats	Location	Biodiversity Indices				Number of Individuals
		Shannon (H)	Description	Evenness (J)	Description	
(Q1)	RP8	4.166	Very low	0.8595	Very High	130
(Q2)	RP9	3.337	Very low	0.7034	High	69
(Q3)	Bet RP 9 and RP 11	3.330	Very low	0.7999	Very High	64
(Q4)	RP 11	3.235	Moderate low	0.7471	High	71
(Q5)	COW	2.901	Moderate low	0.6740	High	56
(Q6)	COW	2.864	Low	0.7967	Very High	41

Note 1: *Ordinal Classification of Species Richness and Dominance Indices (adopted from Fernando et. Al..1998). The higher the value the lower is the diversity*

Relative Value Rating	Species Diversity (H')	Evenness (E)
Very High (VH)	3.50-5.00	0.75-1.00
High (H)	3.00-3.49	0.50-0.74
Moderate (M)	2.50-2.99	0.25-0.49

4.1.7.1.2.4 Endemism

Out of the total one hundred sixty-three (163) species identified, there are Sixteen (16) Philippine endemics (only found in the Philippines) that were found in the six (6) sampling sites (**Table17**). Before the start of excavation works, these endemic species should be transferred to adjacent site thru balling. Balling is commonly practiced in dealing with endemic and endangered species that will be affected by development activities. In addition, it is recommended to propagate these species in the nursery for future greening programs. Some of the identified endemic tree species found in the retarding ponds are wild (those found in the secondary forest

area) and some are planted by the land owners (those found in cultivated area). Those endemic tree species sited along the CoW were planted by the residents.

Table 17. List of endemic species recorded, DFCDMP, 2021

Local /Common Name		Scientific Name	Family Name	IUCN Category	Location
1	Mangapaho	*Mangifera monandra*	Anacardiaceae	NT	RP 9
2	Pugahan	*Caryota cumingi*	Arecaceae	DD	RP 9, Bet RP 9 & 11
3	Tree fern/Anotong	*Cyathea contaminans (Hook.)*	Cyatheaceae	LC	RP 9, Bet RP 9 & 11
4	Katmon	*Dillenia philippinensis*	Dilleniaceae	NT	RP 8, RP 9, CoW
5	Hamindang	*Macaranga bicolor*	Euphorbiaceae	LC	RP 11, CoW
6	Narra	*Pterocarpus indicus*	Fabaceae	EN	All stations
7	Barobo	*Diplodiscus paniculatus Turc*	Malvaceae	LC	RP 8, RP 11
8	Antipolo	*Artocarpus blancoi*	Moraceae	LC	RP 8, Bet RP 9 & 11, CoW
9	Anubing	*Artocarpus cumingiana*	Moraceae	-	RP 8, RP 11
10	Kamansi/Rimas	*Artocarpus communis*	Moraceae	-	All stations
11	Is-is	*Ficus odorata*	Moraceae	LC	RP 8, Bet RP 9 & 11, CoW
12	Niyog-niyogan	*Ficus pseudopalma*	Moraceae	-	All stations
13	Hambabalud	*Neonauclea formicaria*	Rubiaceae	LC	RP 8, Bet RP 9 & 11, CoW
14	Kahoi Dalaga	*Mussaenda philippica Merr*	Rubiaceae	LC	RP 8, Bet RP 9 & 11, RP11, COW
15	Molave	*Vitex parviflora*	Verbenaceae	LC	RP 8
16	Tagbak	*Kolowratia elegans*	Zingiberaceae	-	RP9 and bet RP9 and 11

4.1.7.1.2.5 Conservation Status

The conservation status of species is based on DAO No. 2017-11 better known as ‘*The National List of Threatened Philippine Plants and their Categories’*. From the ninety- one (91) identified species in the six (6) sampling quadrats, only seven (7) species are included in the National List of Threatened Flora species or in DAO No. 2017-11 (**Table 18**). Photos are found in **Annex G**. Some of the identified threatened tree species found in the retarding ponds are wild (those found in the secondary forest area) and some are planted by the land owners (those found in cultivated area). Those threatened tree species sited along the CoW were planted by residents.

Table 18. List of identified threatened plants found in the project area, DFCDMP, 2021

No	Common Name	Scientific Name	Family Name	Conservation Status (DAO No. 2017-11)	Location
1	Tree Fern/ Anotong	*Cyathea contaminans (Hook.)*	Cyatheaceae	Category B-Endangered	RP 8, RP 9
2	Molave	*Vitex parviflora*	Verbenaceae	Category B-Endangered	RP 8
3	Dao	*Dracontomelon dao*	Anacardiaceae	Category C-Vulnerable	RP 8
4	Mangapaho	*Mangifera monandra*	Anacardiaceae	Category C-Vulnerable	RP 8
5	Manila Palm	*Adonidia merrillii*	Arecaceae	Category C-Vulnerable	Bet RP 9 and 11, RP 11
6	Narra	*Pterocarpus indicus*	Fabaceae	Category C-Vulnerable	All stations,6
7	Anahaw	*Saribus rotundifolius*	Arecaceae	Category D-Other Threatened Species	RP8, bet RP 9 and 11

4.1.7.1.2.6 Economic and Ecological Significance of Flora Resources

The floral resources identified during the conduct of transect walk and assessment within the study area have significant values to the community. Their uses can be classified into two: 1.) Economic and 2.) Ecological. Basically, all these resources have ecological roles not only in the specific habitat where they abound but also in nature. Any of these resources which help alleviate the economic conditions have economic use. Economically important species are those used for timber, construction, cottage industry, food, medicine, fiber, feed (forage/pasture), and fuel. Ecologically important species are those ornamentals, landscape plants, hedges, and other plant resources used for soil erosion and weed control. Flora resources that include all plant types such as trees, palms, ferns, shrubs, grasses, vines, herbs etc. is very vital to mitigate the worldwide problem on climate change.

4.1.7.1.2.7 Ecological Implications of the Observed Flora in relation to the construction of flood control and dredging of Davao River project

The environmental consequences of the construction development are very minimal and related only to encroachments upon nature due to earthworks; damming or lowering of the water level and changed water flows of drainage and/ or creeks, and building of structures (complex and facilities), roads, and other appurtenant structures during construction. Like any other disturbances, the general effect of this disturbance on succession is to push it back to an early stage. As expected, the affected vegetation is either destroyed or reduced to early stage of serial

successions thus it will also affect the existing condition of the ecosystem. As observed during the study, the floral species within the area and immediate vicinities, a high number of representative species of moraceae, dipterocarps, euphorbias, legumes, rubias, and some mallows suggests a stand undergoing succession. This may reflect the increasing anthropogenic pressures in the area. The domination of aggressive ferns like pakong alakdan, kilob and agsam on the ground or floor of the open-canopy forest areas reflects the increasing exposed soils. Kilob tends to occupy newly open areas. Agsam, on the other hand, thrives in a frequently burned areas, hence its domination reflects slash-and-burn areas and frequent forest fires. Other fern species in the forest floor suggests high humus and soil moisture. As an ecological function of the flora resources with the presence of figs, moraceae species in the area, it serves as habitats for the fruitivores like many species of birds and mammals (bats, monkeys, rats etc.) Other sources of fruits include species from Meliaceae, Myrtaceae, Malvaceae, Sapindaceae, Rubiaceae, Musaceae, Anacardiaceae, and Clusiaceae which is common in the area. Agricultural crops such as corn, banana, cassava, nangka, marang, guava and other fruits planted by the nearby settlement areas also create patches of agri-ecosystem within the vicinity of the proposed project area. This landscape and vegetation formation complement the healthy cycle of food-chain since edible floras are the primary food among the primary fauna consumers thriving in the area. The high number of leguminous species in a forest area is a significant factor for its continued survival, according to a recent study. This may be attributed to the type of adaptation of legumes to poor, acerbic soil, i.e., nitrogen fixation. This is a symbiotic association of roots of plants with nitrogen-fixing-bacteria like *Rhizobium sp.* This ecological relationship contributes to the fertility of the forest soil which in turn assures survival of other associated species. In fact, this adaptation may play a significant role in the rehabilitation regimen of the area and the preservation of the possible buffer zones to be identified by the proponent. Most likely, the areas near or along the rivers, creeks, and riparian zones within or at the immediate vicinity of project area will be the potential buffer zones since based on the observations those sites are densely vegetated and biodiversity is high because obviously those areas have good ecological condition.

4.1.7.1.2.8 Impacts on Terrestrial Flora

Clearing of vegetation will result to the removal of ecologically and economically important species. The destruction of wildlife habitat will result to displacement of wildlife. Stripping of topsoil will consequently disturb the seed bank in the area through seed displacement affecting the ecological recovery of vegetation in the project site. Accelerated soil erosion as a result of clearing and earthworks will contribute to soil nutrient loss necessary for plant growth. The removal of photosynthesizing plants will affect CO_2 sequestration causing some degree of effect on the microclimate. Removal of vegetation, top soil, leaf litter, rock crevices, decaying logs, tree stumps, etc. will lead to the complete transformation of the habitat causing displacement and even direct killing of wildlife most especially those that are less mobile (i.e., amphibians, reptiles, small non-volant mammals, nestlings and other young individuals).

4.1.7.1.2.9 Mitigating Measures

Since the conservation of all species may not be possible, priority shall be given to ecologically and economically important species identified in the area. A nursery shall be established to propagate the seeds/propagules of these species, which will provide seedlings for future rehabilitation requirements. The development of the tree plantation shall use indigenous species and apply assisted natural regeneration (ANR) techniques. To minimize the impacts associated to clearing of vegetation, unnecessary clearing of vegetation shall be avoided. In addition, clearing and site preparation shall be done in stages. Poaching of wildlife shall be strictly prohibited to mitigate population reduction and allow their safe movement.

Before cutting a tree, tree cutting permit should be secured from the DENR. Every tree that will be cut should be replaced in accordance with the DENR Memorandum Circular No. 2012 – 02. Planted trees in private and forest lands, the tree replacement ratio is 1:50 while naturally growing trees in the same areas, including those affected by development projects shall have 1:100 ratio. This is in support of the National Greening Program and climate change initiatives.

Excavated topsoil shall be used to rehabilitate disturbed/worked areas or shall be temporarily stockpiled in the designated topsoil areas. The topsoil shall be seeded to promote vegetative growth and to maintain or improve the soil quality. Cut trees shall be chipped and spread out evenly which can also serve as growing medium for rehabilitation. Whenever possible, tree-balling and immediate transfer of trees to open areas in the barangay will be done. A tree cutting permit shall be secured prior to any cutting and clearing.

To mitigate the impacts to wildlife, schedule of activities should be carefully considered and implemented. Personnel, heavy equipment, other vehicles, etc. shall be confined only to pre-determined designated areas and shall not occupy other areas to avoid further disturbancesto wildlife. Regular replacement and/or maintenance of equipment particularly mufflers of vehicles shall be done to minimize noise and avoid disturbance of wildlife in the surrounding areas. Access to RPs will use the existing road networks. These road networks will be rehabilitated, paved and upgraded. These will be included in the F/S and DED. Riparian zones will be given high priority for regeneration activities to connect separated habitat areas.

Existing wildlife in the area shall be protected through an active and continuous wildlife protection and conservation campaign with the participation of all key stakeholders (e.g., communities, DENR, LGUs, etc.) within and around the project site. Progressive rehabilitation of disturbed areas shall be carried out. Summary of key impacts and mitigating measures are presented in **Table 19.**

Table 19. Key Impacts and Mitigating Measures

Impact	Mitigating Measure
1. Various earthmoving activities (e.g. road construction, embankment construction, etc.), if not done	➢ Geological investigation (e.g., landslide mapping); ➢ Geotechnical investigation;

Impact	Mitigating Measure
properly could result in slope stability problems, as well as alteration of the topography, erosion and siltation.	➢ Hydrological investigation; ➢ Slope stability analysis of critical slopes; ➢ Reshaping of the slopes; ➢ Installation of retaining structures; ➢ Surface & subsurface drainage (e.g., diversion of clear water, subsurface drains beneath stockpiles on slopes if seepages are present); ➢ Construction of silt traps.
2. Removal of ecologically and economically important species.	➢ Priority for conservation shall be given to ecologically and economically important species identified in the area. ➢ Establish a nursery to propagate the seeds/propagules of these species, which will provide seedlings for future rehabilitation requirements ➢ Tree plantation development using the indigenous species and assisted natural regeneration (ANR) techniques. ➢ Enhance Agro-forestry technologies that suitable for the area.
3. Removal of wildlife habitat and displacement of wildlife.	➢ Avoid unnecessary clearing of vegetation; strictly prohibit poaching of wildlife to mitigate population reduction and allow their safe movement. ➢ Strictly prohibit poaching of wildlife to mitigate population reduction and allow their safe movement.
4. Enhanced soil erosion which will contribute to soil nutrient loss necessary for plant growth.	➢ Excavated topsoil shall be spread out in the surrounding areas; install erosion control facilities.
5. Removal of photosynthesizing plants will affect CO2 sequestration causing some degree of effect on the microclimate	➢ Whenever possible, tree-balling and immediate transfer of trees to open areas in the barangay will be done (Applicable only to the critically endangered tree species) ➢ A tree cutting permit shall be secured prior to any clearing.
6. Removal of vegetation, top soil, leaf litter, rock crevices, decaying logs, tree stumps, etc. will lead to the complete transformation of the habitat causing displacement and even direct killing of wildlife most especially those that are less mobile (i.e., amphibians, reptiles, small non-volant mammals, nestlings and other young individuals).	➢ Schedule of activities should be carefully considered and implemented. ➢ Personnel, heavy equipment, other vehicles, etc. shall be confined only to pre-determined designated areas and shall not occupy other areas so as to avoid further disturbances ➢ Disposal area of top soil and excavated materials is under study.

Impact	Mitigating Measure
7. Formation of internal habitat fragmentation due to the creation and construction of entirely new access roads leading to isolation and decreased dispersal capabilities of different wildlife.	➢ For accessibility, existing roads will be utilized and improved.
8. The area will be more accessible attracting more illegal hunters and poachers of animals for food, trading or pets.	➢ Poaching of wildlife and hunting will be strictly prohibited. ➢ An active and continuous wildlife protection and conservation campaign will be pursued with the participation of all key stakeholders (e.g., communities, LGUs, etc.) within and around the project site. ➢ Regular replacement and/or maintenance of equipment particularly mufflers of vehicles to minimize noise.

4.1.7.2 Terrestrial Fauna

4.1.7.2.1 Description of Methods

The assessment was done through an opportunistic survey to determine the ecological measurements of the fauna assemblages for the biodiversity baseline of the proposed Davao City Flood Control and Dredging project which assesses the conservation status of fauna documented based on national legislation and DAO-2019-09 criteria and determine the changes of fauna assemblages through assessment results. Also, to determine whether the surrounding area of the project supports valuable terrestrial vertebrate fauna communities that will potentially be impacted by the project.

The exploration focused on forest animal group namely: (i) birds; (ii) frogs and reptiles; (iii) bats (or flying mammals); and, (iv) non-volant mammals which belong to a group called “vertebrates” or animal with backbones. Interviews were also performed but were limited only to conspicuous and easily identifiable species (e.g., birds, monitor lizard, snake, insects, etc.). Using the most common metrics such a species’ richness, Shannon diversity, dominance, evenness, and relative abundance were described. Global conservation status of the species was also presented.

4.1.7.2.1.1 Field survey

A specific team is responsible for each animal group. Each team is comprised of a Biologist who acted as a field researcher and one (1) local researcher. The local researcher /laborers were first oriented to the rationale of the activity and the specific objectives of the field expedition and the

modified method for each of the four animal groups was discussed. The co-researchers were then assigned to assist in the field monitoring for each fauna group. Species identification was aided using specific fauna keys such as Strange, 2000 for birds; Ingle, N.R. and L.R. Heaney (1992) for bats; Heaney *et. al*., 1999 for non-flying mammals; Diesmos *et.al.,* 2015 for amphibians; and, Brown *et.al.,* 2000 and Mc Leod *et. al.,* 2011 for reptiles. Journals and materials in the worldwide web also aided in the identification of species.

Birds Survey

All of the birds that were perceived visually or detected through calls within 30 m of the observer were counted. The researchers walked at a slow and constant speed to ensure proper, non-biased observations, DSLR cameras and photographic field guides were used to confirm the observations. All observations were recorded on the field. Nocturnal birds or those active at night were also noted when encountered or heard during the transect walk for nocturnal mammals. The observed birds were identified based on their morphology, behavior and calls according to Kennedy (2000) and Fisher and Hicks (2006), and the ecological status, i.e., endemism, of the identified birds was determined using the same field guides. Conservation status was determined using the data provided by DAO-2019-09 criteria and the published literature and field guides were used to determine the feeding guilds of the identified species. Birds were listed following the four techniques discussed below:

Survey using mist nets. This technique employs specialized nets called "mist nets" to catch flying bird. Each net was set along suspected or ideal flyways (across and along waterways, forest edges and clearings, feeding trees and near forest canopy) to catch birds that happen to pass in the area. Checking was done regularly every 30 minutes especially late afternoon and the birds trapped are immediately removed from the nets to prevent them from getting stressed and eventually die. Birds captured are kept in clean cloth bags and kept in a cool, ventilated place if not processed immediately. For each bird capture, morphometric of birds were measured by a caliper. After taking photos of a few individuals for each captured species, birds were marked with red nail polish to avoid recounting if captured after released.

Line transect survey. Transect walk follows the established foot trail along riparian zone, open and cultivated area, forest edges and interior. The transect walks were conducted in the morning at 5:00 am and in the afternoon at 4:00 pm when bird activities are assumed to be highest and extended up to 7:00 pm to consider nocturnal species. A hand-held Global Positioning System (GPS) was used to record the coordinates of each sampling point. All birds seen and heard from both sides of the transect line were recorded. Information such as the mode of observation, weather, habitat type, species, number of individuals, and the stratum where the bird was seen were recorded. Key informant interviews of the residents were also made to enhance the data gathering.

Opportunistic listing. This technique simply means listing all birds that were seen casually around the forests. Such random instances may be during hikes from and back to camp, when transects

were being established, during vegetation sampling, and during raptor observations, among others.

"Sit and Wait". This technique is effective in observing and identifying displaying raptors or birds-of-prey such as eagles, harriers, hawks, and kites. This is also utilized in taking photographs of shy birds' species where the researchers sit and wait while partially hidden in a bush waiting for a good view of to be photo-captured birds. This technique is aided with a pair of binoculars and a telephoto camera.

Volant Mammals (Flying Mammals)

The technique utilized a specialized net called "mist nets" set along suspected or ideal flyways (across and along waterways, forest edges and clearings, feeding trees and near forest canopy) to catch bats. The mono filament net will appear invisible from afar. Each net measured 6 m x 12m and will be installed either individually or in series in areas that are accessible for checking. Nets were left open during the night and field researchers keep watch of the nets during the first two hours of the evening to retrieve "microbat" or insect-feeding bats netted. These groups of bats have sharp teeth so that if left entangled will chew the way out of the nets. Other groups of bats like the "megabats" have blunt teeth and are active the whole night feeding on fruits. These groups including a few larger microbats were retrieved early the following day and hanged on suitable, shaded areas in the forest after measurements and identification. Bat identification was made possible through the bat field identification guide (Ingle et al, 1992). Measurements such as (i) forearm length; (ii) ear length; (iii) hind foot length; (iv) tail length; and, (v) total length were measured using a caliper. Weight was also measured using a Pesola spring balance. Digital photos were taken and compiled for each captured individual indicating the picture and species ID number in the data sheet. Prior to the release of all captured bats, sugar solutions were given through a dropper to replenish the energy lost during the periods of handling. Red nail polish was used to mark the nails of the captured animals to avoid double counting.

Photo 16. Picture before retrieving flying mammals in "MIST NETS"

Non - volant mammals (non-flying mammals)

This includes all other land mammals divided into (i) nocturnal, arboreal mammals, (ii) rodents and shrews, and (iii) other large mammals. The survey methods employed for each of these sub-groups includes:

a. **Nocturnal, arboreal mammals (Flying Lemur, Civets, and Flying squirrels).** Same transect line was used for birds. A team of at least three personnel walked the 2km transect and searched for arboreal mammals across all levels of the forests. Researchers also noted (i) the time an animal was detected; (ii) its position in the forest; (iii) its approximate distance from the observers; and, the (iv) point at along the transect to which it was closest. Maturity of this kind of mammals was also recognized. Transect walk was done during the first three hours of the evening when animal activity is at its peak.

b. **Rats, squirrels, and shrews.** Live traps were used to survey forest rats, shrews and squirrels. Traps were placed in suspected runways, along bushes, rotting logs, root tangles and burrows baited with pieces of half roasted coconuts laced with peanut butter. Traps were visited twice a day, once in the early morning and once in the late afternoon to check for captured animals. Captured animals were immediately retrieved for measurements of external metrics including (i) total length (TL); (ii) body length (BL); (iii) tail length (Tail); (iv) ear length (Ear); and, (v) hind foot length. Weights were also noted using a Pesola spring. Identification of the captured animals was aided with field identification key (Ingle and Heaney, 1992).

c. **Small land mammals.** Opportunistic listing for documenting other large mammals was carried out relying on indirect evidences of its presence such as fecal droppings in palm civets, forest tracks of wild pig and deer and even pieces of mammal bones and skulls.

d. **Amphibians and Reptiles.** An opportunistic method was done in collecting samples. The techniques involved establishing a 200 m transect in the forest and finding as many samples as possible on both sides of the line. This line was searched during the day, one in the morning from 9:00 am - 11:00 am and one in the afternoon from 1:00 pm to 3:00 pm when reptilians are active during these hours. At night time, frogs were surveyed during the first four (4) hours of the evening. Any animal that was encountered along the way including snakes were captured and documented. With the aid of caliper and measuring tape, morphometric of amphibians and reptiles were measured and recorded.

Photo 17. Preparation of “snap traps”

4.1.7.2.1.2 Analysis

The species assemblage for each animal group was described using the most common metrics: (i) species richness; (ii) species evenness; (iii) Shannon-Weaver index of diversity; and, (iv) relative abundance. This report also describes few species that were identified by DAO-2019-09 criteria and the World Conservation Union or IUCN as globally “threatened” species.

Species richness – refers to the cumulative number of recorded species and provides information on the commonness and rarity of species.

Shannon-Weaver Index of Diversity – this diversity index is a mathematical measure that combines species richness and evenness as a measure of diversity. Species diversity was calculated using the Shannon information statistics referred to as the Shannon-Weaver Index of Diversity (H'):

$$H' = \sum_{i=1}^{S}(pilnpi)$$

Where S is the total number of observed species, *i* is the species number and *pi* are the proportion of individuals of the total sample belonging to the *ith* species. The value of Shannon-Weaver Index of Diversity is constrained between 0 and 5. Lower diversity value normally indicates more uniform species relative to the population.

Species evenness – it is the measure of biodiversity which quantifies how equal the community is numerically. It is a measure of the homogeneity of abundances in a sample or a community. The evenness of the avifauna community was calculated using the Pielou's evenness index (E):

$$E = \frac{H'}{H'_{max'}}$$

where H' is the value derived from Shannon diversity index and H'max is the maximum value of H' calculated as H'max = In S. The value of Pielou's evenness index ranges between 0 and 1. The higher values of E mean a less variation in communities between species.

Similarities between the vertebrate taxa across sampling points were calculated using the Bray-Curtis Similarity Index and cluster analysis was performed to group samples with the most similarity. Similarity index and cluster analysis were calculated using the software PAST version 2.17. All indices were computed for rarefied samples or individuals to reduce the bias of comparisons. Relative abundance for the observed fauna groups were calculated following Ibañez (2010). For birds, this was expressed as the number of birds per 100 birds and calculated by getting the ratio of the total individuals for each species and the total individuals for all the species (N), and then multiplied by 100 birds or:

$$\text{RA} = \frac{\text{Total no. of individuals seen or heard}}{\text{Total no. of birds seen (or netted)}} \times 100 \text{ birds}$$

Relative abundance per species was measured separately for mist net and transect line data. Not all species were encountered by both techniques so that some species only had one abundance value.

For bats, relative abundance estimates for each species was expressed as the number of bats per 100 net nights, calculated by getting the ratio of the total number of individuals caught per species and the cumulative number of net nights (total number of nets used x the no. of nights nets was opened). The ratio was then multiplied by 100 or:

$$\text{RA} = \frac{\text{Total no. of individuals per species}}{\text{Total no. of net nights}} \times 100 \text{ net nights}$$

The relative abundance for rodents and shrews was expressed as the number of rodents and shrews caught per 100 trap nights. This was calculated by getting the ratio of the number of individuals trapped per species and the cumulative number of trap nights (total no. of traps used x the number of nights they were used). The ratio was then multiplied by 100 or:

$$RA = \frac{\text{Total no. of individuals per species}}{\text{Total no. of trap nights}} \times 100 \text{ trap nights}$$

Relative abundance of nocturnal arboreal mammals was expressed as the number of animals detected per 100 hours of transect. This was calculated by getting the ratio of the number of individuals detected for each species and the total number of hours spent for the transect survey. The ratio was then multiplied by 100, or:

$$RA = \frac{\text{Total no. of individuals detected per species}}{\text{Total transect hours}} \times 100 \text{ transect hours}$$

Description of species with conservation priorities identified by DAO-2019-09 criteria is provided. Percentage of Philippine endemic species was also calculated. Percent endemicity provides a broad evaluation of the importance of the area being a habitat for unique species (Ibañez, 2010).

4.1.7.2.2 Results and Discussions

4.1.7.2.2.1 Description of each Sampling Station

Collection of samples was undertaken from three sampling stations on flood control and drainage in Davao City. Different types of vegetation were observed in every station which correlates to the current situation of the faunal assessment on its ecosystem. Presence of trees such Coconut trees, Anabiong, Gmelina, Falcata, Kamansi (Breadnut fruit) and different types of fruit trees that may be a prospect roosting sites of some forms of animals in the area. However, existence of these plants may not also assure that the area is still abundance in terms of terrestrial ecology. Global Positioning System (GPS) was used to locate the areas and for mapping purposes (**Figure 22 and Table 20**).

Figure 22. Sampling map for fauna, DFCDMP, 2021

Table 20. Location and description of three sampling stations, DCFCDMP

Site Code	Site Location	Elevation (masl)	Geo Coordinates	Descriptions
			Latitude/Longitude	
S1	Brgy. Callawa, Davao City, Philippines	29 m	7°10'27.896"N 125°33'39.508"E	Area is covered with different types of trees such as coconut tree and almost covered with banana tree. Other species of trees may also observe in the area. Area was noted as early secondary forest.
S2	Brgy. Mandug, Davao City, Philippines	24 m	7°11'49.905"N 125°33'42.677"E	Different types of common trees, shrubs and herbs is abundant in the area which serves as food of some animals. Big trees were also observed in the area which serves as the roosting sites of some terrestrial fauna in the area.
S3	Barangay 19-B, Davao City, Philippines	10 m	7°5'34.090"N 125°35'39.415"E	Patches of different trees were observed in the area which may attract flying mammals such as bats and other forms of terrestrial species in the area.

Photo 18. Terrestrial fauna sampling station 1 at Brgy. Callawa, Davao City

Photo 19. Terrestrial sampling station 2 was established at Brgy. Mandug, Davao City.

Photo 20 Station 3 established at Barangay 19-B, Davao City

4.1.7.2.2.2 Volant and Non-volant mammals

4.1.7.2.2.2.1 Species composition, Species richness and Relative abundance of Bats

Mammals exhibit different adaptations to the environment which allow them to occupy different ecological niches (from terrestrial to arboreal), and these adaptations play an important role in the patterns of biodiversity and in the ecosystem's processes. Disturbances in natural ecosystems due to human activities have increased alarmingly, jeopardizing the preservation of many species, particularly in tropical forests where the land-use change from forest to disturbed areas and the increase of human settlements are alarming. Habitat fragmentation affects different biological groups and is one of the main causes of increased species extinction rates in recent decades.

Species composition of volant mammals (bats) was composed of four different species while 1 species of non-volant mammals (non- flying mammals) was also listed during the sampling. *Cynopterus brachyotis* has the highest total number of individuals gathered 33 individual bat species which is highly dominated in sampling station 2. Second is the endemic *Ptenochirus jagori* with relative abundance of eleven (11) individual species. Station 2 was dominated with captured species of bats due to its habitat which capable of supplying the food habit of volant species such as bats in the area. For Non-Volant Mammals, eight individual species of *Rattus tanezumi* from family Muridae were captured using mouse trapping (**Table 21**).

Table 21. Overall diversity volant and non- volant mammals, DFCDMP, 2021

Family	Scientific name	Endemicity	IUCN	RP 8 s1	RP11 s2	COW s3	s-ra	ra
Volant mammals								
Pteropodidae	*cynopterus brachyotis*	R	LC	4	24	5	33	46.47887
Pteropodidae	*Eonycteris robusta*	E	NT	0	6	3	9	12.67606
Pteropodidae	*Ptenochirus jagori*	E	LC	1	7	3	11	15.49296
Pteropodidae	*Ptenochirus minor*	E	LC	2	5	3	10	14.08451
Non-volant mammals								
Muridae	*Rattus tanezumi*	R	LC	5	2	1	8	11.26761
Total Individuals				12	44	15	71	100

Legend: R- resident, E – endemic, LC – least concern, NT – near threatened

Diversity indices in **Table 22** shows values of Shannon_H greater than 1. This means that the proposed sites for retarding ponds and cut-of works have low diversity. The normalized Shannon _H values are between 0 and 1. An index value equals to 1 means that all mammals captured have the same frequency. Among the three (3) sampling stations, COW has the lowest diversity of 1.512 which can be attributed to settlement development along this area which can cause disturbance to volant and non-volant mammals. RP 8 and RP 11 have more or less similar diversities. Good diversity in these areas of volant and non-volant mammals is due to the presence of source of food and the disturbance is less.

Table 22. Species richness and Diversity of volant and non-volant mammals, DFCDMP,

	RP 8 S1	RP 11 S2	COW S3
Taxa_S	4	5	5
Individuals	12	44	15
Dominance_D	0.3194	0.3564	0.2356
Simpson_1-D	0.6806	0.6436	0.7644
Shannon_H	1.237	1.282	1.512
Evenness_e^H/S	0.861	0.7211	0.9075

Station two has the highest individual count of captured volant and non-volant species with a total number of forty-four (44) individuals which was dominated by *Cynupterus brachyotis,* a fruit eating bats gathered 33 individual bat species in overall count. Second species dominate in Station two is *Ptenochirus jagori* a fruit eating bats with 11 individual species while *Rattus tanezumi* a common house rat got 8 individual species captured which can only be found in all stations but dominated in Station 1. In terms of Multivariate analysis, Station 3 and 1 clustered with 0.60% percent while Station 2 clustered only 0.40% from the two stations of the total percent composition which means that Station 2 with a highest number of individual species does not share common species from Stations 1 and 3. If the similarity will reach 1% of the composition, there is a higher chance of sharing same species in each station. Therefore, the result of

multivariate analysis implies that each station is not closely sharing same species at a time (**Figure 23**).

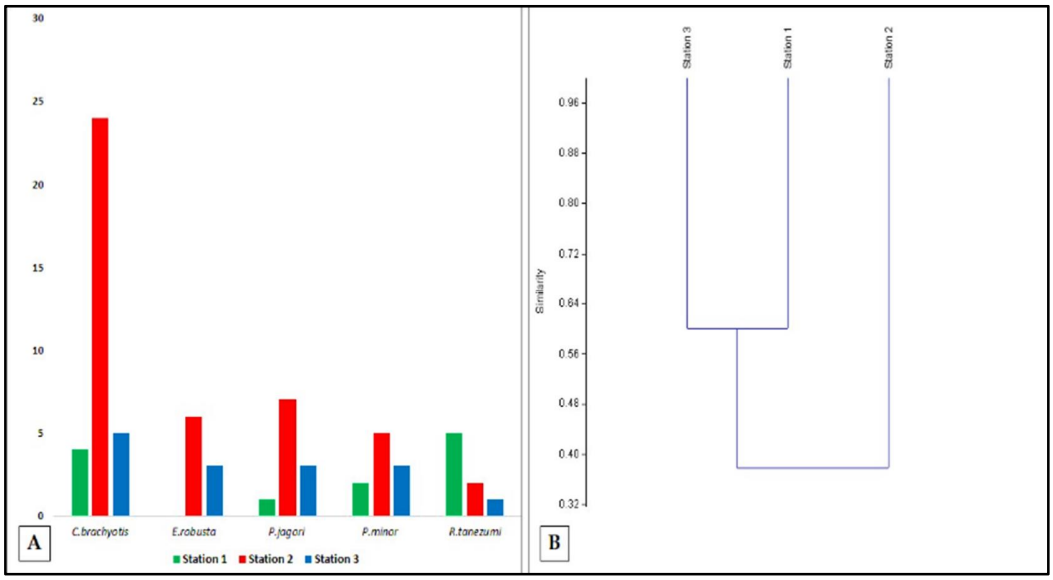


Figure 23**.** (A)Individual counts of bat species (B) Multivariate analysis clustered

4.1.7.2.2.2.2 Endemicity and Conservation Status of Volant and Non-Volant Mammals

Three (3) out of five (5) captured species of volant and non-volant mammals are endemic, posting 60% composition (including *Eonycteris robusta, Ptenochirus jagori* and *Ptenochirus minor*) while the remaining species of volant mammals and non-volant mammals comprised 40% listed as resident such as *Cynopterus brachyotis* and *Rattus tanezumi* which are highly distributed across the Asia. Only one species of bats was classified as near threatened (*Eonycteris robusta*) while other captured species were categorized as least concern. Non-volant mammals such as *Rattus tanezumi, however,* were classified as resident and considered as least concern (**Figure 24**). Data gathered were classified through DAO 2019-09 and the rest were categorized as least concern. Photos of endemic and conservation status are found in **Annex G.**

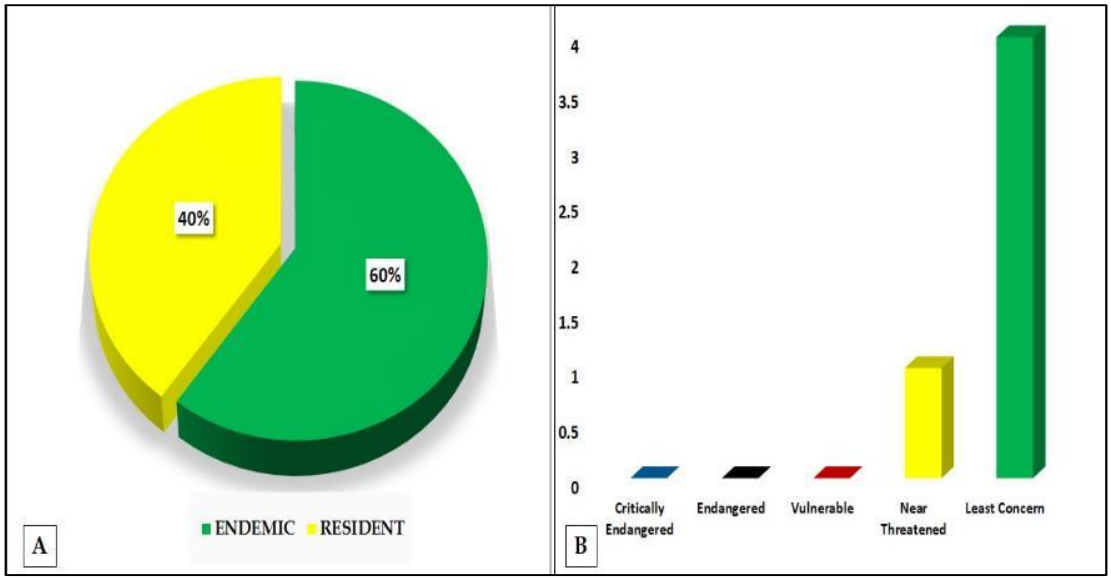


Figure 24. (A) Endemicity and (B) Conservation status of volant mammals and non-volant mammals

4.1.7.2.2.3 Avifauna

4.1.7.2.2.3.1 Species composition, Species richness and Relative abundance of Birds

Avifauna assemblages have contributed significantly to the advancement of science in the field of community ecology. Comparative avifaunal diversity is an excellent indicator of ecosystem stability because bird respond quickly to changes in their environments (G.T. Miller and S.E. Spoolman 2014). Among all other species, birds play a major role in attracting human attention. Birds are of significance as pollinators and help in seed dispersal. Furthermore, birds are relatively easy to observe and monitor for environmental assessment. The effects of environmental changes on bird population are more often influenced by several intermediate factors, or the population changes are caused by numerous interacting effects. Therefore, along with some parameters, abundance and diversity of avifaunal species serve as ecological health indicators. A total of eighteen (18) species of birds in 13 different family with two hundred thirty-five (235) individuals were recorded during the sampling. The area was dominated with invasive White breasted wood swallow (*Artamus leucorynchus*) which gathered 49 individuals dominated in sampling station 2 and station 3. Endemic species such as Philippine Bulbul (*Hypsipetes philippinus*), White-eared Brown Dove (*Phapitreron leucotis*) and Philippine magpie-robin (*Copsychus mindanensis*) was perceived in the area and heard during the opportunistic survey. DSLR camera was used for capturing distant species of birds in the area (**Table 23**).

Table 23. Overall Avifauna diversity distribution DFCDMP, 2021

Family Name	Common Name	Scientific Name	Range	IUCN	RP8 S1	RP11 S2	CoW S3	S-RA	RA
Accipitridae	Brahminy Kite	*Haliastur indus*	R	LC	0	1	1	2	0.85
Alcedinidae	White collared kingfisher	*Todiramphus chloris*	R	LC	3	5	4	12	5.11
Artamidae	White-breasted woodswallow	*Artamus leucorynchus*	R	LC	11	20	18	49	20.85
Columbidae	Asian Emerald Dove	*Chalcophaps indica*	R	LC	0	2	0	2	0.85
	White-eared Brown Dove	*Phapitreron leucotis*	E	LC	2	7	5	14	5.96
	Zebra dove	*Geopelia striata*	R	LC	1	5	2	8	3.40
	Spotted dove	*Spilopelia chinensis*	R	LC	0	4	3	7	2.98
Corvidae	Large-billed Crow	*Corvus macrorhynchos*	R	LC	1	3	2	6	2.55
	Slender-billed Crow	*Corvus enca*	R	LC	0	2	1	3	1.28
Hirundinidae	Barn swallow	*Hirundo rustica*	R	LC	0	17	5	22	9.36
Laniidae	Brown Shrike	*Lanius cristatus*	R	LC	3	7	5	15	6.38
Muscicapidae	Philippine magpie-robin	*Copsychus mindanensis*	E	LC	3	6	4	13	5.53
Nectariniidae	Olived backed sunbird	*Cinnyris jugularis*	R	LC	4	7	6	17	7.23
Oriolidae	Black naped oriole	*Oriolus chinensis*	R	LC	1	4	2	7	2.98
Pycnonotidae	Yellow-vented Bulbul	*Pycnonotus goiavier*	R	LC	2	5	3	10	4.26
	Philippine Bulbul	*Hypsipetes philippinus*	E	LC	1	1	1	3	1.28
Rhipiduridae	Philippine Pied-Fantail	*Rhipidura nigritorquis*	R	LC	3	7	5	15	6.38
Sturnidae	Asian Glossy Starling	*Aplonis panayensis*	R	LC	6	15	9	30	12.77
Total Individuals					41	118	76	235	100

Diversity and distribution of species was analyzed through Paleontological Statistic software (PAST). As can be seen in **Table 24**, station 2 was diverse in avifaunal species while sampling station 1 was slightly low in terms of biodiversity. Station 2 was filled with different types of fruiting trees which is highly capable to sustain food diet of some avifaunal species. Although, station 1 is semi forested lightly covered area with different trees and grass, the number of captured species using camera in the area was lower than the other sampling station. Food availability of the area may not favor the diet of some avifaunal species.

Table 24. Species richness and Diversity of avifaunal species, DFCDMP

	RP 8 S1	**RP 11 S2**	**COW S3**
Taxa_S	13	18	17
Individuals	41	118	76
Dominance_D	0.1315	0.09135	0.1049
Simpson_1-D	0.8685	0.9086	0.8951
Shannon_H	2.284	2.608	2.534
Evenness_e^H/S	0.7548	0.7537	0.7411

Figure 25 shows that Station 2 has the highest total number of individual count with 118 during the sampling. Second to the highest is Station 3 with 76 individual avifaunal species. These two sampling stations imply that the area is still diverse in terms of food availability in the area. Existence of fruiting bearing tress and different types of organisms within the sampling Station 2 influence avifaunal species to visit or occupy the area. Fruit trees, insects and small organisms in each station maybe one of the big factors for the diverse distribution of bird species in the area. In cluster analysis, Stations 2 and 3 posted the highest percent composition clustered with 0.80% than Station 1 clustered only 0.60% which means that Station 1 does not share almost same species of avifaunal in Stations 2 and 3. The result of mulltivariate analysis, however, does not

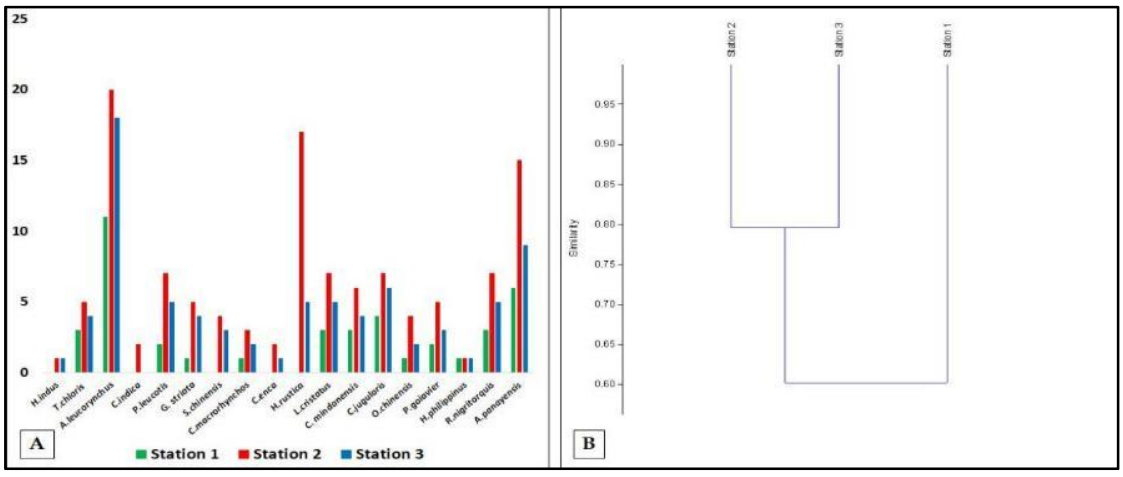


Figure 25. (A)Individual counts of avifaunal species (B) Multivariate analysis clustered.

satisfy the 1% normal standard in clustering. Therefore, the distribution of avifaunal species in three sampling stations are not equally distributed.

4.1.7.2.2.3.2 Endemicity and Conservation Status of Avifaunal Species

Eighty-three percent (83%) of the total percent composition was categorized as resident (bird species which can be found everywhere in the world) while the remaining 17% were listed as endemic. Endemic species includes Philippine Bulbul (*Hypsipetes philippinus*), White-eared Brown Dove (*Phapitreron leucotis*) and Philippine magpie-robin (*Copsychus mindanensis*) (**Figure 26**). In terms of conservation status, all species were categorized as least concern according to DAO-2019-09.

The need for a meaningful conservation in protecting the ability of avifaunal species to survive in the wildlife is a basic way to protect one's life in a lower form. People should be made to realize the negative impacts of forest deterioration and destructions that cause declining numbers of species especially in avifauna species. This may be a tall order considering that many people largely depend on forest and forest products for their source of livelihood; but this can be done. Educational curricula at all levels of education should incorporate courses on wildlife conservation and protection of their habitat.

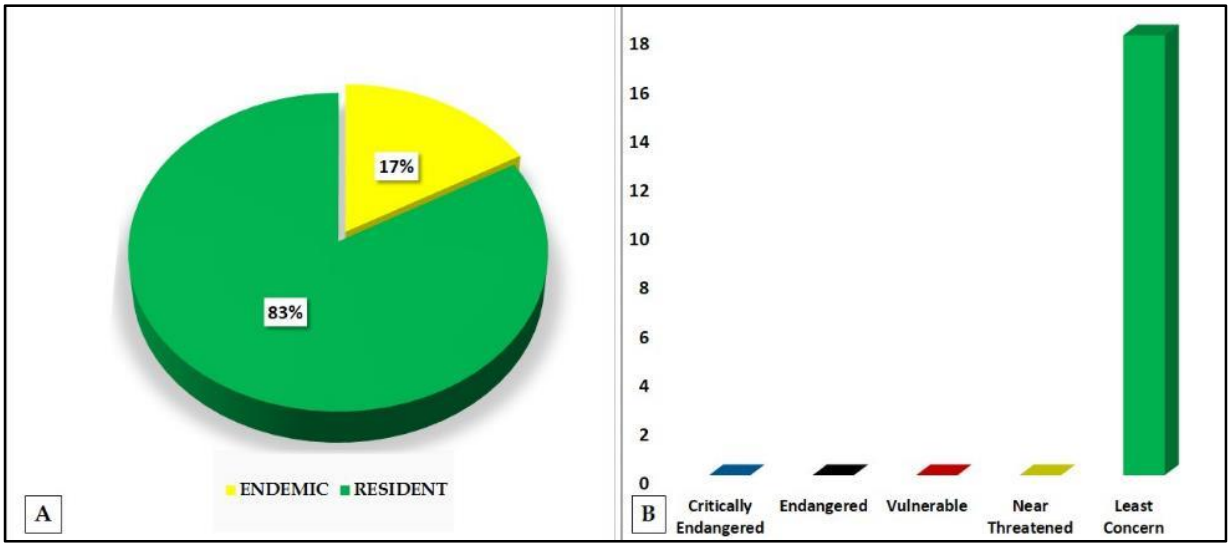


Figure 26. (A) Endemicity and (B) Conservation status of avifaunal species

4.1.7.2.2.4 Amphibians Fauna

4.1.7.2.2.4.1 Species composition, Species richness and Diversity

Herpetofauna assessment was done through opportunistic survey. For amphibians, it was collected early in the morning and in the evening when this organism is more active while reptile assessment was done through observation in each station night and day. Herpetofauna research conducted within the appropriate socio-political and economic framework, in order to effectively implement conservation area networks. It is important to re-evaluate the role of protected area systems in ensuring the persistence of communities and populations, and to identify strategies and future conservation priorities, based on climate-change scenarios and further development of the area.

Assessment of amphibians has recorded three (3) species from three different family namely Dicroglossidae (Limnonectes magnus), Bufonidae (Rhinella marina), and Rhacophoridae (Polypedates leucomystax). Forty (40) individual species of amphibians were captured and listed during the sampling. The area was dominated with Rhinella marina an invasive species of amphibians gathered 18 individual species Limnonectes magnus was classified as endemic species and listed as other threatened species in DAO-2019-09.

Table 25. Overall diversity distribution of amphibian species. DFCDMP

Family	Common Name	Scientific Name	Endemicity	IUCN	RP 8 S1	RP 11 S2	COW S3	S-RA	RA
Bufonidae	Cane Toad	*Rhinella marina*	R	LC	5	6	7	18	45
Dicroglossidae	Giant Philippine frog	*Limnonectes magnus*	E	NT	2	5	8	15	37.5
Rhacophoridae	Common tree frog	*Polypedates leucomystax*	R	LC	1	2	4	7	17.5
Total Individuals					8	13	19	40	100

Shannon_H and Evenness_e^H/S in three sampling stations were in very low value of species richness and diversity index which means high diversity. Station in RP 8 revealed the highest diversity among the three stations. Despite of the low distribution of species, presence of tadpoles was encountered and observe during the expedition where still be counted to conclude that the area will soon be diverse in amphibians if and only if the tadpoles will survive. In terms in similarity and distribution of species Station 1 and station 3 shared 0.83% of common species while station 2 shared 0.70% common species with Station 1 and station 3 (**Table 26).** Results of multivariate analysis is presented in **Figure 27**.

Table 26. Species richness and Diversity of Herpetofauna species, DFCDMP

	S1	S2	S3
Taxa_S	3	3	3
Individuals	8	13	19
Dominance_D	0.4688	0.3846	0.3573
Simpson_1-D	0.5313	0.6154	0.6427
Shannon_H	0.9003	1.012	1.06
Evenness_e^H/S	0.8201	0.9173	0.9622

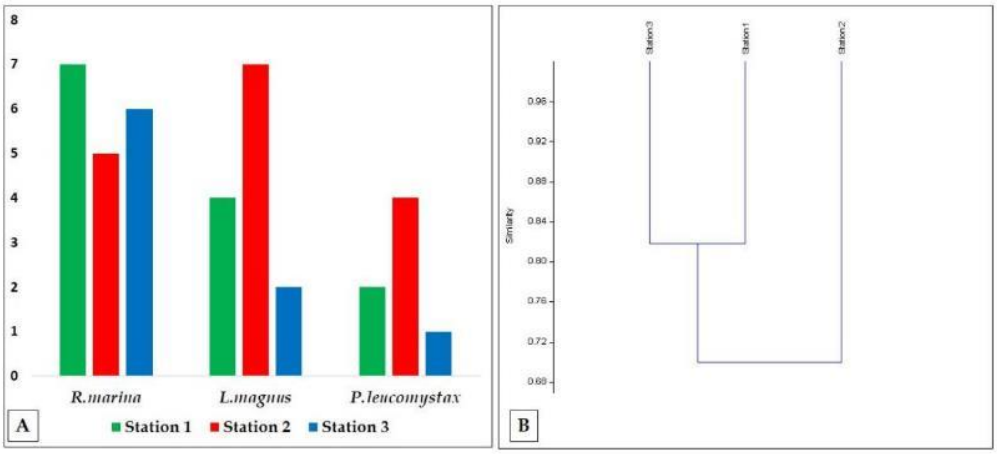


Figure 27. Endemicity and Conservation Status of Amphibians. DFCDMP

The species *L. magnus* an endemic species falls under the "Other Threatened Species" classification of DAO 2019-09. The occurrence of this species within the proposed site was highly pressured not only by the limited microhabitat but also by hunting for food. Intensive information and education campaign was continuously recommended to aid the protection of few threatened species such as *L. magnus*. *Polypedates leucomystax and Rhinella marina* are classified as least concern and resident in the area (**Figure 28**).

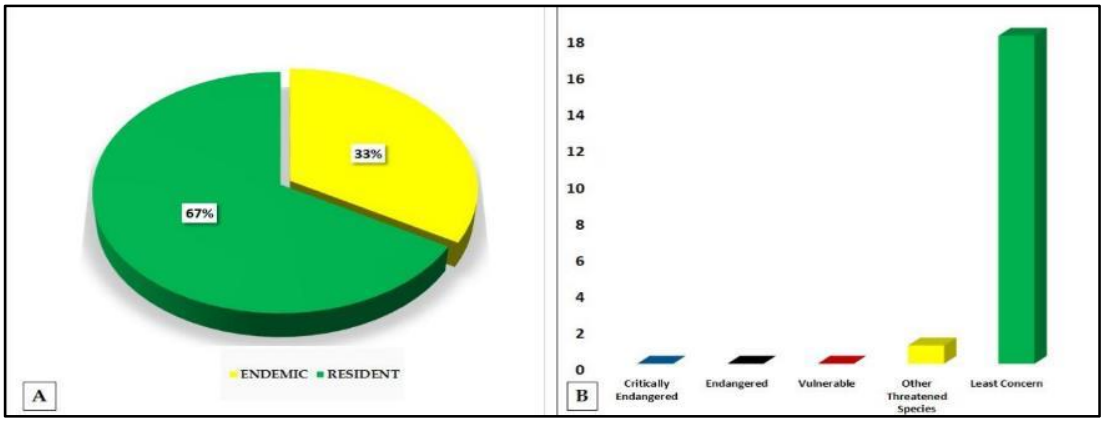


Figure 28. (A) Endemicity and (B) Conservation status of amphibian species DFCDMP,

4.1.7.2.3 Impacts to Terrestrial Fauna

The proposed priority flood control project for Davao River would cause the decline in the population of terrestrial fauna found in the site because of destruction of habitat. Further, removal of fruit trees which are the source of food of bats will lead to migration of these fauna to other places where food source is abundant. There are faunal species found which are in the category of nearly threatened according to the IUCN category, the proposed project would degrade the category to threatened and eventually extinction.

4.1.7.2.4 Mitigating Measure

Habitat destruction is unavoidable in flood control projects and there is no way to avoid for its loss. Re-colonization, however, should be encouraged in areas not within the retarding ponds construction sites and adjacent to cut-of works. Once the construction of the retarding ponds and cut-of works is completed, re-vegetation around the ponds and buffer zone of the straightened river should be established in order to create a new habitat for the terrestrial fauna. In addition, construction/ activity shall be scheduled to avoid breeding season.

The followings could be the advanced mitigation measures in particular designated fauna under the IUCN, e.g.:

- Construct artificial habita;
- Catch the fauna and release at the other area;
- Artificially breed juvenile

It is recommended to take detailed survey of fauna and examine the above mitigations in terms of those affordability, necessity, etc.

4.2 The Water

4.2.1 Hydrology and Hydrogeology

4.2.1.1 Drainage System and Watershed Delineation

Davao River is the main drainage of Davao River Basin. It is one of the largest rivers in Mindanao and the basin is included in the 18 major priorities for master planning. The headwater of the river basin is in Bukidnon province while the outfall is in Davao Gulf. As can be seen in **Figure 29**, the proposed flood control project is located downstream of the basin.

4.2.2 Water Quality

4.2.2.1 Methodology

Water samples were collected from Davao River in order to determine the water quality condition before the implementation of the flood control projects. The sampling locations were positioned using the global positioning system (GPS) (**Figure 30)**. The samples were collected

manually facing upstream and upwind to minimize introduction of contaminants. The bottles were first rinsed with river water thrice before filling them up. The samples are then shipped to the University of Immaculate Conception Science Resource Center for analysis. The methods of analysis are in accordance with the Standard Methods for the Examination of Water and Wastewater, 23rd edition. The parameters measured are biochemical oxygen demand, chloride, dissolved oxygen, fecal coliform, phosphate, total suspended solids, arsenic, cadmium, chromium hexavalent, lead, mercury, oil and grease, turbidity and nitrite. Temperature was measured at the time of sampling.

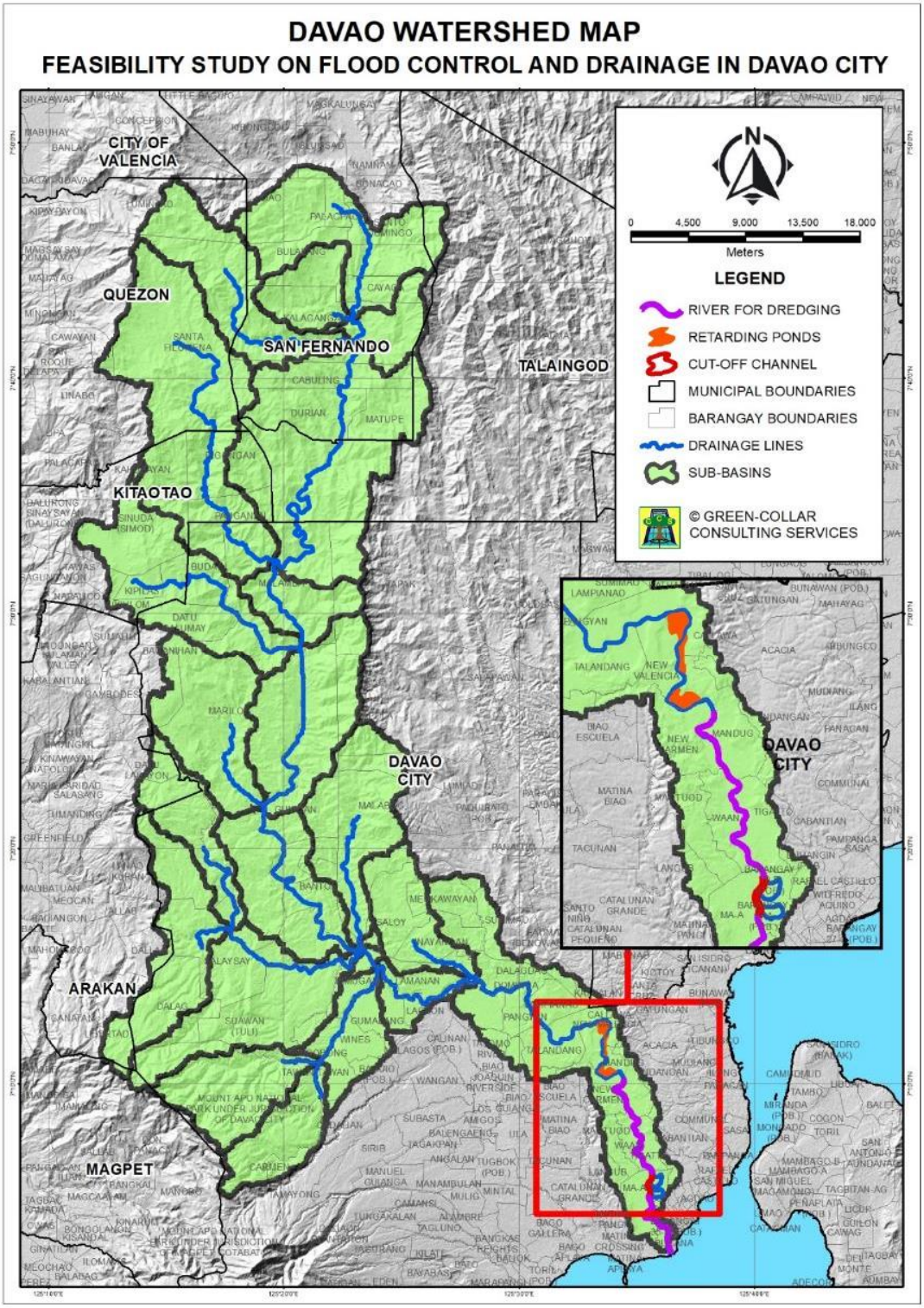


Figure 29. Davao River Watershed, DFCDMP, 2021

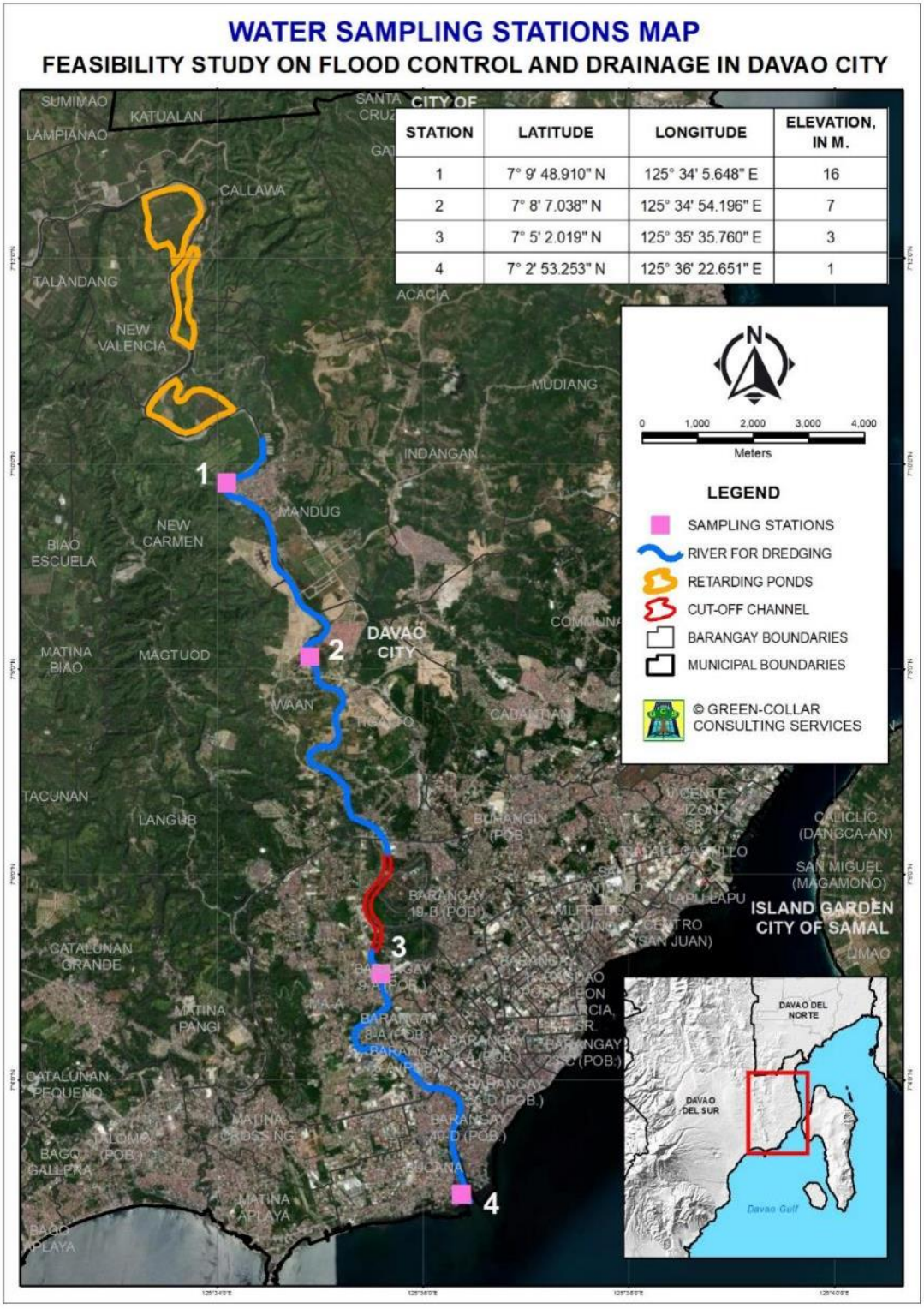


Figure 30. Water Quality sampling location, DFCDMP, 2021

4.2.2.2 Results and Discussions

Davao River is characterized by sandy clay bed. During the time of sampling, the weather was sunny with occasional rain and the water was turbid. Based on the EMB – DENR river classification, Davao River falls into two (2) classifications - Class A along barangay Mandug and Class B along barangays Waan, Ma-a and Bucana. The quality parameters are grouped into primary, secondary and others. Primary parameters are the required minimum water quality parameters to be monitored for each water body classification, while secondary parameters are other parameters to be used as baseline assessment as part of the Environmental Impact Assessment and other quality monitoring purposes. Parameters grouped as others are those included in the analysis but do not have guideline values or limits. The water quality of Davao River evaluated for primary parameters are summarized in **Tables 27.**

Table 27. Water Quality Primary Parameters, DFCDMP, 2021

Parameter	unit	Water body classification						Reference
		Class B				Class A		Japan Standard[2)]
		Bucana	Ma-a	Waan	Limit[1)]	Mandug	Limit[1)]	
Biochemical oxygen demand	mg/L	2	1	<1	5	<1	3	Class A:2
		2.9	1.5	1.5		1.5		Class B:3
Chloride	mg/L	535	7.49	6.61	250	6.28	250	-
		1,047	8.0	7.8		7.4		-
Dissolved oxygen	mg/L	7.4	8.1	8.5	NLT 5	8.1	NLT 5	Class A, B:
		6.2	7.3	7.6		7.7		< 5
Fecal coliform	MPN/100 mL	23	<1.8	<1.8	100	49	50	-
		426,853	28,793	16,340		15,635		-
pH		7.2	7.6	7.6	6.5-8.5	7.8	6.5-8.5	Class A, B: 6.5-8.5
		8.0	8.3	8.3		8.4		
Phosphate	mg/L	0.64	0.92	0.74	0.025	0.86	0.025	-
		0.80	1.68	1.29		1.33		-
Temperature	°C	27.3	26.9	28.4	26-30	27.5	26-30	-
		28.4	27.9	28.1		28		-
Total suspended solids	mg/L	70	221	84	65	211	50	Class A, B:
		386	533	530		485		50

1) Per DAO 2016-008, except for phosphate and fecal coliform; per DAO 2021-19, for phosphate and fecal coliform
2) Notification of the MoE, No. 59, 1971.
NLT - Not less than
Values in red exceed the specified water quality guideline. - WQMA Data (2012-2019), Source: EMB-DENR

Biological Oxygen Demand. Biological oxygen demand (BOD) represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic condition at a specified temperature. BOD is an indicator of pollution because it affects the dissolved oxygen (DO) level in water bodies. If the BOD of water is high, bacteria will consume dissolved oxygen in the water faster which will affect aquatic biota, e.g., fish kill – due to lack of

oxygen[7]. Under DAO 2016 – 08, BOD is a primary parameter that has to be monitored. The BOD of Davao River in all four sampling stations is below the limit for both Class A and B water. The results are not different from the WQMA water quality data.

***Chloride*.** Chloride is a major component of dissolved solids in water. The sources of chloride in surface water are either natural or man-made. The natural sources of chloride are rocks and soil while the man-made sources are agriculture, industries, and other human activities. Elevated concentration of chloride in stream can be toxic to aquatic life[8]. In addition, the presence of chloride increases the potential corrosivity of water. The chloride concentration of the Davao River along sampling Stations 1 to 3 were below the limit set in DAO 2016 -08. The chloride in Station 4, however, exceeded the limit by more than 100 per cent. The exceedance can be explained by the fact that Station 4 is in Bucana which is near the Davao Gulf. The chloride concentrations obtained in the sampling stations are similar with the WQMA data. The WQMA data of chlorides in Bucana is very high because the sampling location is different.

Dissolved Oxygen. Dissolved oxygen (DO) is the most important water quality parameter. It is a measure of the amount of oxygen dissolved in water needed by aquatic animals. Dissolved oxygen below 3 ppm will stress fish and concentrations below 2 ppm will kill some fish species. The Philippine standard for Classes A and B water set not less than 5.0 mg/L which is the minimum concentration needed to sustain aquatic organisms. The DO of Davao River measured from the four (4) stations ranged between 7.1 and 8.5 mg/L, meaning the water quality is good and can sustain life. The WQMA data on dissolved oxygen are lower than the results obtained by this project but are still within the standard value.

Fecal Coliform. Fecal coliform bacteria are the most common pollutant in rivers and streams. It can enter rivers or stream through direct discharge of waste from mammals and birds, from agricultural and storm run-off, and from untreated human sewage. Fecal coliform is not pathogenic; however, it is an indicator organism, which means that fecal coliform indicates the presence of other pathogenic bacteria that are impractical to monitor in small amounts. The fecal coliform in all four (4) stations along Davao River is below the limit of 100 MPN/100mL for Class B water and 50 MPN/100 mL for Class A. The fecal coliform of WQMA is very high compared to the results obtained by this project. The improvement of the fecal coliform in Davao River can be attributed to the intervention implemented by WQMA such as provision of sanitary facilities to the community along Davao River, putting up sewerage treatment facilities and strict implementation of the provisions of Clean Water Act. The Davao River was declared by the EMB – DENR as Water Quality Management Area (WGMA). The objective of WQMA is to improve the water quality of the identified river system.

[7] Hach, Clifford, Robert L. Klein, Jr., and Charles R. Gibbs. Introduction to Biochemical Oxygen Demand. Technical Information Series – Booklet No. 7. http://bixbydental.com/resources/intro-to-bod.pdf. Date retrieved December 2, 2021.
[8] USGS (2019). Chloride, Salinity and Dissolved Solids. Water Resources.https://www.usgs.gov/mission-areas/water-resources/science/chloride-salinity-and-dissolved-solids. Date accessed December 18, 2021

pH. The pH of the water is very important because aquatic organisms are extremely sensitive to pH and function best when the pH is almost neutral. Very high or very low pH levels caused fish kills by stressing their system and causing physical damage, which will render fishes vulnerable to diseases. The pH scale is 0 – 14 with 7 neutral. Levels below 7 denote acidic environment while pH above 7 is alkaline condition. The recommended pH level for optimum growth and reproduction of aquatic animals is between 6.5 and 8.5. Results of the analysis revealed that the pH levels of the four sampling locations in Davao River are 7.2 and 7.8 which are within the guideline values. This indicates that the water river is neither acidic nor basic hence ideal for aquatic organisms. The pH of the water is very important because it affects biological activities. Compared with WQMA data, the pH obtained in this project is slightly lower but still within the recommended standard of DAO 2016 – 08.

Phosphate. Phosphates are chemicals containing the element of phosphorous which cause excessive growth of algae in water bodies. Algae growth would become out of control creating imbalances leading to the destruction of aquatic life form. Anthropogenic sources of phosphates are agricultural farms, home gardens using fertilizers, human and pet waste, chemical manufacturing and industries.[9]. The limit for phosphate in DAO 2021-19 is 0.025 mg/L. The phosphate concentrations of the four sampling stations in Davao River exceeded the standard and not very different from the WQMA data. The exceedance can be attributed to the banana plantation in the area and the informal settlers along Davao River discharging their sewage directly to the river.

Temperature. Water temperature is very important because it affects aquatic life. Temperature also determines the ability of the water body to hold essential dissolved gasses like oxygen. As the temperature of the water increases, the amount of oxygen dissolved in water decreases. The temperature of a natural water body varies with location and elevation. The average temperature of Davao River during the period of sampling was between 26 and 28 degrees Celsius which can be described as moderate. The DAO 2016 – 08 guidelines recommended a temperature limit of fresh water between 26 ^{0}C and 30 ^{0}C.

Total Suspended Solids. Total suspended solids (TSS) are a priority water pollutant associated with the clarity of the water and electrical conductance. High concentration of TSS can cause many problems for stream health and aquatic life. Laboratory results showed TSS of Davao River exceeded the limit except in sampling Station 4, the Bucana area. The TSS in Ma-a (Station 3), and Waan (Station 2) are 221 mg/L and 84 mg/L, respectively, which are higher than the limit of 65 mg/L for Class B. The TSS in Mandug Station (1) also exceeded the limit of 50 mg/L. The exceedance of the value of TSS can be attributed to the silt laden run-off and other debris coming upstream. The possibility of these matters to settle down towards the mouth of the river explains the low concentration of TSS in Bucana. The TSS analysis for this project is done in single sampling and in fair weather, hence it could be expected the values obtained is slightly lower than the 8-year average WQMA data. As can be seen from the annexed WQMA data, there are cases where

[9] Green, Jenny (2018). How do phosphates affect water quality. https://sciencing.com/phosphates-affect-water-quality-4565075.html. Date retrieved: December 2, 2021.

TSS values are very high and sometimes very low. This can be attributed to the weather condition at the time of sampling. This could mean that WQMA interventions are effective in improving the water quality of Davao River.

Results of the laboratory analysis for secondary water quality parameters are presented in **Table 28.** The guideline used in evaluating the results is the same with that of the primary water quality parameters. For secondary water quality parameters, WQMA only monitored cadmium, lead and mercury.

Arsenic. Arsenic is a natural component of the earth's crust and is widely distributes throughout the environment in the air, water and land. It is highly toxic in its inorganic form. Exposure of elevated levels of arsenic is through drinking contaminated water, using contaminated water in food preparation and irrigation of food crops, industrial processes, eating contaminated food and smoking tobacco.[10] Due to its toxicity, the limit set in DAO 2016 – 08 is 0.01 mg/L for both Class A and Class B water. The arsenic concentrations in the Davao River measured at the four (4) sampling stations are below the limit, ranging from 0.005 mg/L to 0.007 mg/L. This indicates that there are no sources of arsenic metal along Davao River and the silts and sediments are not laden with arsenic.

Cadmium. The cadmium concentration in the four (4) sampling locations located along the Davao River is below the Philippine guideline value set in DAO 2016 - 08. The guideline value is 0.003 mg/L while the cadmium concentration in in all sampling stations is <0.003 mg/L. Cadmium and its compounds are highly toxic and exposure to this metal is known to cause cancer and targets the body's cardiovascular, renal, gastrointestinal, neurological, reproductive and respiratory systems. It is a naturally occurring metal which is normally present in zinc, lead and copper ores, coal and other fossil fuels. It is transported to rivers and streams when the ore deposits containing cadmium will come in contact with low total dissolved solids, soft and acidic waters. WQMA data of cadmium in three (Bucana, Waan and Ma-a) stations revealed an elevated concentration as compared to the results of this project which <0.003 mg/L.

Chromium Hexavalent. Results of the analysis showed slightly elevated concentration of hexavalent chromium in Davao River at water sampling stations located in Waan and Mandug compared to the Philippine standard set for Class A and Class B waters found in DAO 2016 – 08 (0.01 mg/L). The concentrations of hexavalent chromium in both Bucana and Ma-a are below the limit. Hexavalent chromium is the most toxic form of chromium found in the environment.[11] Although it is widely distributed in soil, hexavalent chromium is not common in natural waters. Its presence occurs in rivers and streams as a result of improper wastewater disposal from industries. WQMA does not include chromium in the monitoring parameters because there are

[10] World Health Organization (WHO). (2018). Arsenic. https://www.who.int/news-room/fact-sheets/detail/arsenic. Date accessed: December 19, 2021.
[11] Venkatramreddy, Velma, S.S. Vutukuru and Paul B. Tchounwou (2009). Ecolotixicology of hexavalent chromium in freshwater fish. A critical review. https://pubmed.ncbi.nlm.nih.gov/19658319/. Date accessed: December 19, 2021.

no potential sources of chromium along Davao River. The exceedance of chromium in Waan and Mandug stations is an isolated case.

Table 28. Water Quality Secondary Parameters, DFCDMP, 2021

Parameter	unit	Water body classification						Reference
		Class B				Class A		Japan Standard[2)]
		Bucana	Ma-a	Waan	Limit[1)]	Mandug	Limit[1)]	
Arsenic	mg/L	0.006	0.005	0.005	**0.01**	0.007	**0.01**	**0.01**
		No data				No data		
Cadmium	mg/L	<0.003	<0.003	<0.003	**0.003**	<0.003	**0.003**	**0.003**
		0.006	0.004	0.004		0.003		
Chromium, hexavalent	mg/L	<0.010	<0.010	0.018	**0.01**	0.019	**0.01**	-
		No data				No data		
Lead	mg/L	<0.01	<0.01	<0.01	**0.01**	<0.01	**0.01**	**0.02**
		<0.01	<0.01	<0.01		<0.01		
Mercury	mg/L	<0.002	<0.002	<0.002	**0.001**	<0.002	**0.001**	**0.0005**
		0.0011	0.0016	0.0016		0.0021		
Oil and grease	mg/L	<1	<1	<1	**1**	2	**1**	-
		No data				No data		

1) Per DAO 2016-008
2) Notification of the MoE, No. 59, 1971.
Values in red exceed the specified water quality guideline.
WQMA data (2012 – 2019), source: EMB-DENR

Lead. Lead is a naturally occurring element which is found in small amount in the earth's crust. It is highly toxic heavy metal which does not degrade in the environment. The Philippine standard of lead for Class A and Class B waters is 0.01 mg/L. Results of the water analysis revealed that the lead content in all sampling locations in Davao River is below the limit. Sources of lead in surface water are lead-containing dust from the atmosphere, wastewater from industries, and urban runoff. Both test results showed Lead less than the standards.

Mercury. Mercury is a natural occurring element which is highly toxic. Mercury when turned into organic form is a poison that causes many health issues and it is difficult for the body to eliminate. Mercury pollution in rivers is due to the disposal of wastes from industries especially mining. Since mercury is highly toxic and bio-accumulative, the Philippines set a safe limit in water of 0.001 mg/L. Mercury concentration of Davao River was found to be below the limit. This implies no sources of mercury pollutants especially mining along the river. The mercury concentrations obtained by WQMA and this study revealed values lower than the standard except in station in Mandug where WQMA data showed a slight exceedance.

Oil and Grease. Oil and grease are an effluent parameter that should be monitored. Oil and grease include fats, oils, waxes, and other related compounds found in water generally wastewater. The sources of these compounds are household, industries, and workshops. The solubility of these compounds is very low hereby slowing down the rate of microbial degradation.

If these compounds are not removed from the wastewater, it will interfere with biological life in surface water and create unsightly films.[12] The limit for this parameter stipulated in DAO 2016 – 08 for both classes of water are 1 mg/L. Bucana, Ma-a and Waan portion of Davao River have low levels of oil and grease while the Mandug area which fall under Class A has an elevated oil and grease. Like chromium, oil and grease is not included in the WQMA monitoring parameters.

In addition to primary and secondary water quality parameters, other parameters such as nitrite and turbidity of water were measured. These two (2) parameters are not included in the listing in DAO 2016 – 08 that needed to be monitored., hence no limits were specified. **Table 29** summarizes the results.

Table 29 Water quality parameters with no available DENR limits, DFCDMP

Parameter	unit	Water body classification					
		Class B				Class A	
		Bucana	Ma-a	Waan	Limit	Mandug	Limit
turbidity	NTU	70	237	146	N/A	206	N/A
nitrite	mg/L	<0.007	<0.007	<0.007	N/A	0.015	N/A

Turbidity. Turbidity is the measure of relative clarity of water. It is an optical characteristic of water and is a measure of the amount of light that penetrates the water. Clay, silts, tiny organic matter, algae, dissolved organic compounds and microscopic organisms cause the water to become turbid. Turbidity can affect ecological productivity, recreational values, and habitat quality.[13] It is difficult to ascertain if the turbidity of the water in Davao River is acceptable or not because there is no standard value to compare with.

Nitrite. Nitrite is not of concern in water quality monitoring because it is an intermediate product of the oxidation of ammonia to nitrate. Very little nitrite is present in aquatic systems. Nitrite, however, will occasionally accumulate in aquaculture system due to an imbalance in the nitrification process. Nitrite may accumulate in the blood causing the oxidation of iron in hemoglobin producing methemoglobin which is not capable of transporting oxygen.[14] The nitrite concentration in Bucana, Ma-a and Waan sampling stations showed low nitrite concentration at <0.007 mg/L. While Mandug sampling stations showed higher concentrations compared with the levels of the other three stations. This can be explained the presence of agricultural activities in Mandug which can contribute nitrite in Davao River from the leaching of agricultural fertilizers.

[12] Caltest Analystical Laboratory, Oil & Grease Analysis. https://caltestlabs.com/analytical-services/oilgreaseanalyses/. Date retrieved: December 2, 2021.
[13] USGS. Turbidity and Water. Water Science School. https://www.usgs.gov/special-topics/water-science-school/science/turbidity-and-water. Date accessed: December 20, 2021.
[14] Tomasso, Joseph R.(1997). Striped Bass and Other Morone Culture. Development in Aquaculture and Fisheries Science. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/nitrite. Date accessed: December 20, 2021.

4.2.2.3 Sediment Forecast

A. Process

The general process adopted in forecasting the sediment concentration is presented **Figure 31.** The forecast used secondary data. The datasets used are as follows:

1. Interferometric Synthetic Aperture Radar (IfSAR) – Digital Terrain Model (DTM) – a digital elevation model from the National Mapping and Resource Information Authority (NAMRIA) with 5-meter spatial resolution.

2. **River Discharge/Flow Data**. The data is the base inflow data at the upstream portion of the river.

3. **Bed Gradation Information**. The forecasting used the findings on the conducted riverbed material survey was utilized

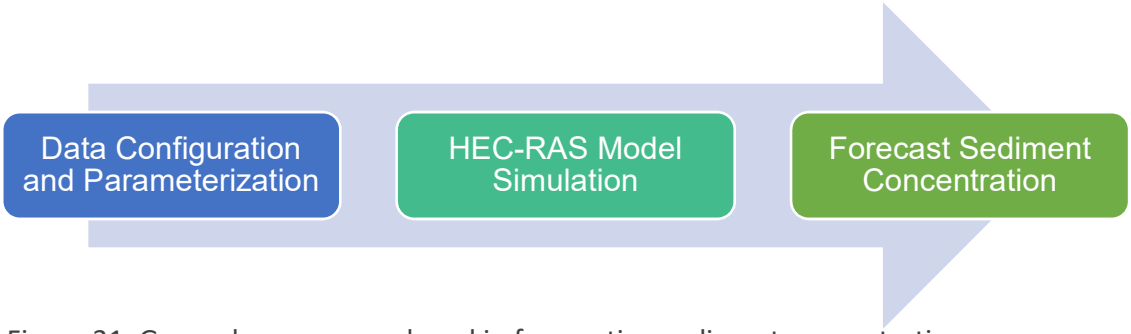


Figure 31. General process employed in forecasting sediment concentration

B. Data Configuration and Parameterization

The IfSAR DTM was configured by integrating dredging on the river as well as the proposed cut-off channel. Roughness coefficient (Manning's n value) was set to be 0.06 based on the river characteristics as discuss on the flood analysis portion in the Interim Report.

For the sedimentation simulation, bed gradation for the river stretch (from upstream to the river mouth) was set using the information described on the results of the riverbed material survey. As recorded, it was found out that the river bed majorly consisted of clay, silt, and sand from the river mouth up to the proposed location of the retarding ponds (**Figure 32**).

C. HEC-RAS Model Simulation

In the hydraulic model, the configured IfSAR DTM was the main source of elevation data. A 2D model was developed having its flow area covering the entire river stretch starting from the

upstream most portion where the retarding ponds will be located extending to the sea area near mouth of Davao River. Computational mesh grid was calculated with sizes of 10-m by 10-m are enforced with break-lines along the river banks, retarding ponds boundaries and at the starting and end lines of the dredging area. Unsteady flow data used are with base flow information of the river and with tidal variation at the downstream. The model was simulated with constant inflow data for 30 hypothetical days.

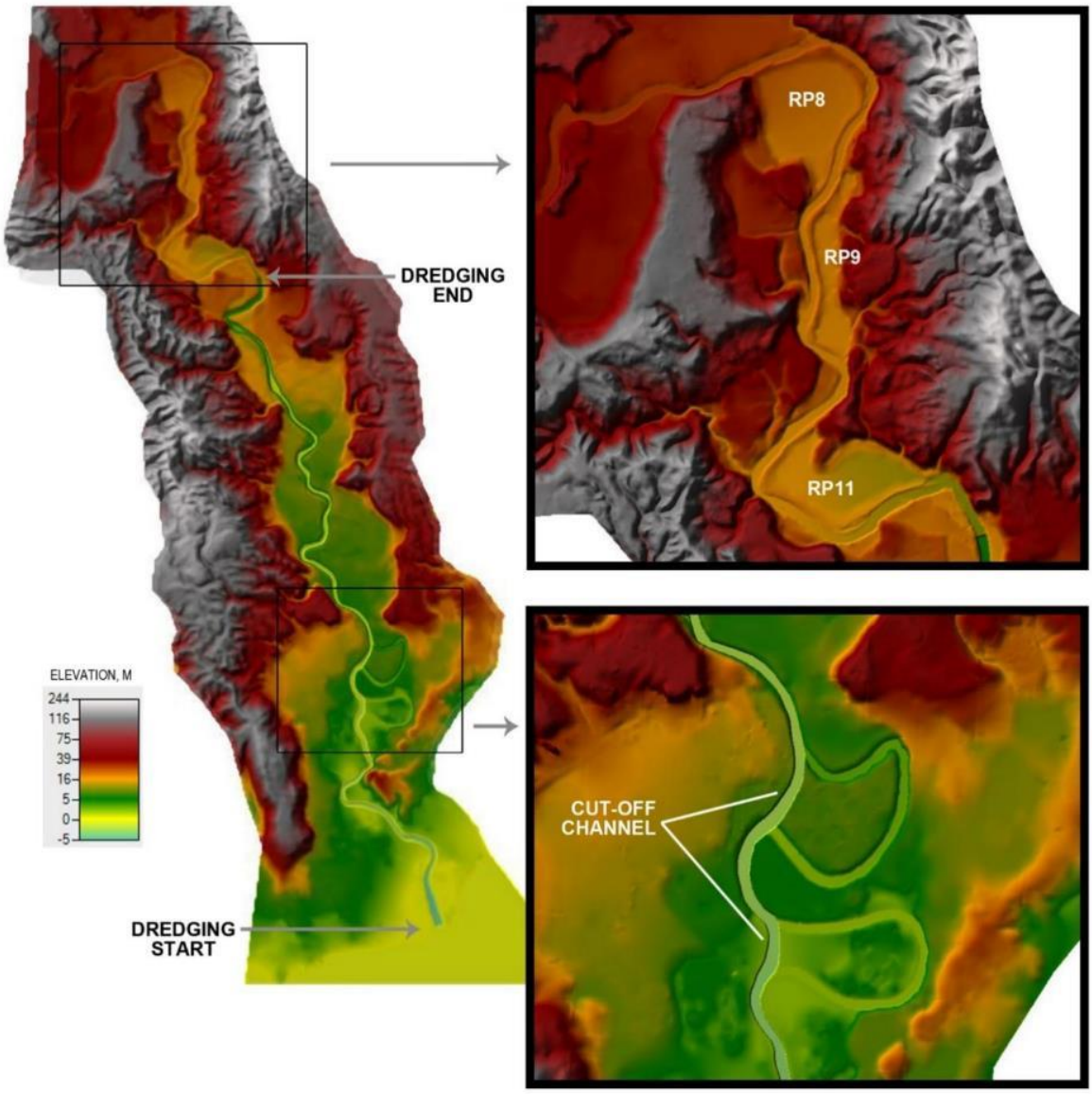


Figure 32. Configured IfSAR DTM for Davao River.

D. Forecast Sediment Concentration

The hypothetical scenario set-up in the 2D HEC-RAS model assumes that the retarding ponds, dredging activity and creation of cut-off channel along Davao River is complete and aimed to predict the possible sediment concentration at the entire stretch of the river given the applied changes. Result of the simulation is shown in **Figure 33**.

For the entire simulation period, maximum sediment concentrations were calculated at defined observation points stationed from the downstream to the upstream stretch of the river. Observation points, which represent the beginning and end stations for the retarding ponds, cut-off channel, and dredging, were selected to know the approximate sediment concentration at these locations. Sediment concentration values from these points are shown in **Table 30** and **Figure 34.**

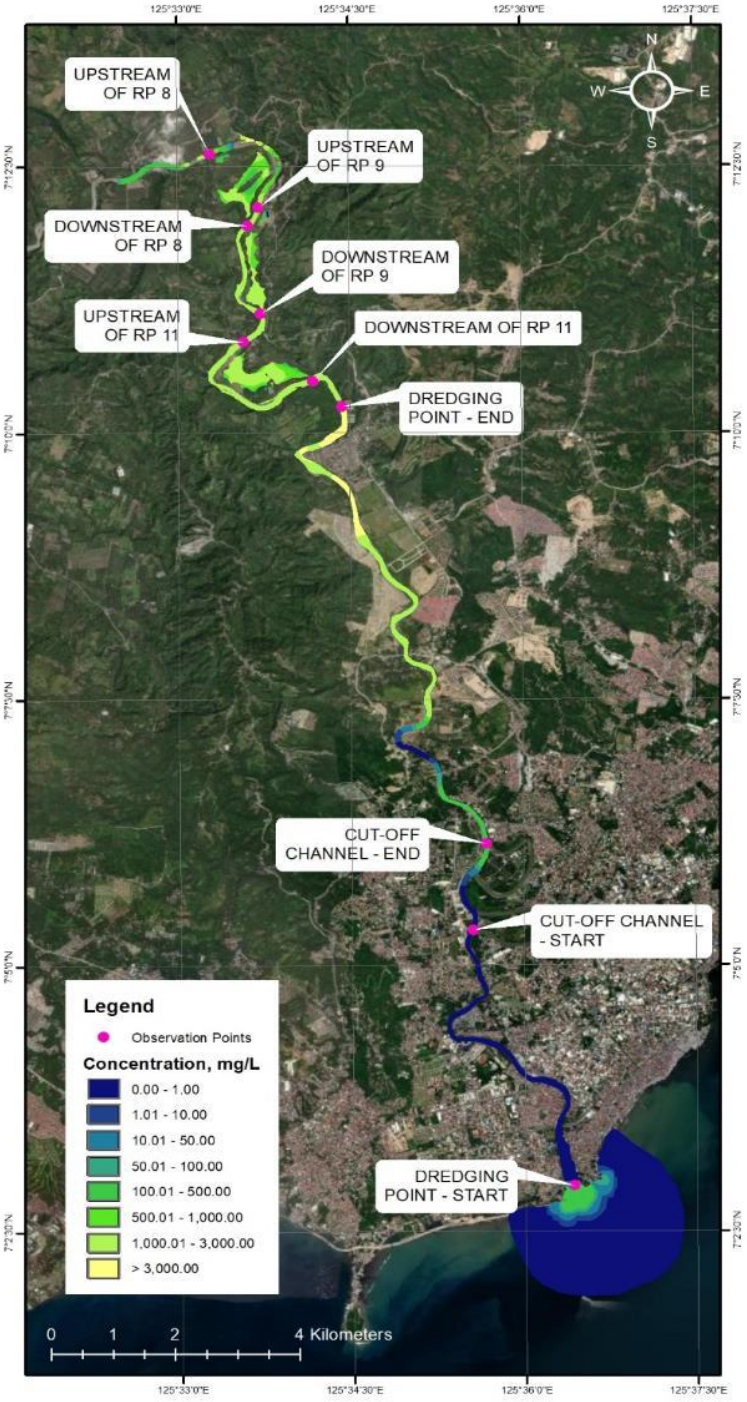


Figure 33 Sediment concentration simulation result of the HEC-RAS model.

Table 30. Sediment concentration values at observation points

Sta.	Location	Sediment Concentration, mg/L
01+000	Dredging Point - Start	48.51
07+100	Cut-Off Works - Start	0.01
08+800	Cut-Off Works - End	284.86
19+120	Dredging Point - End	5,227.11
19+900	Downstream of RP 11	1,469.97
22+720	Upstream of RP 11	1,633.43
23+360	Downstream of RP 9	1,461.85
25+180	Downstream of RP 8	1,297.92
25+540	Upstream of RP 9	1,251.96
27+740	Upstream of RP 8	1,330.58

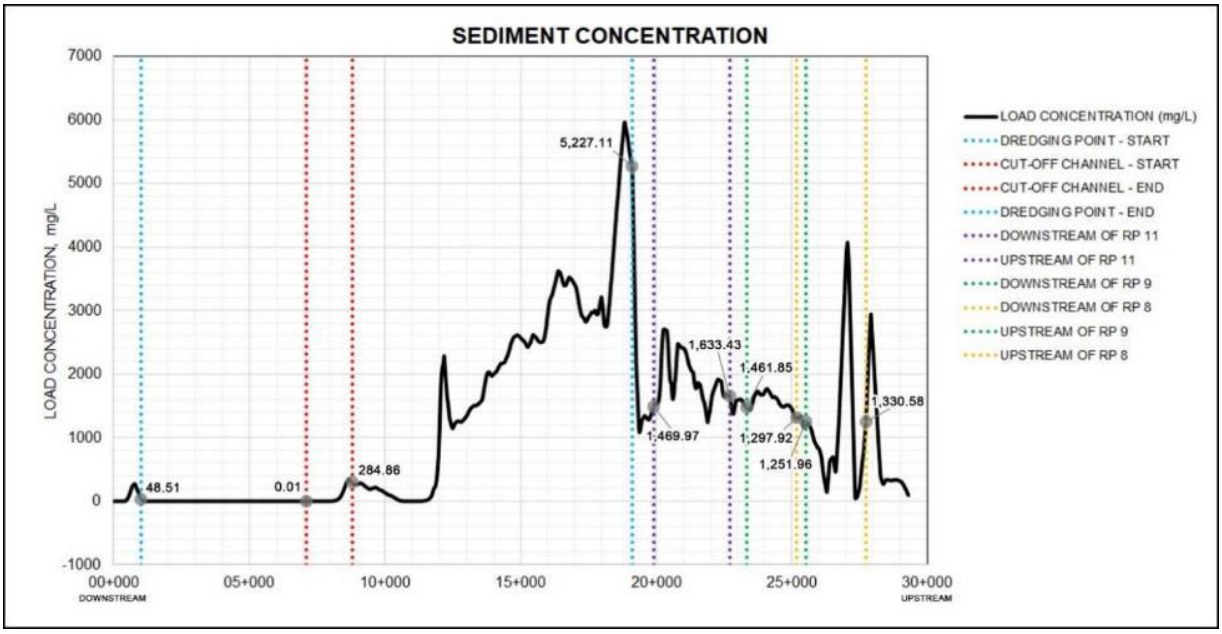


Figure 34. Sediment concentration at the downstream of Davao River.

4.2.2.4 Impacts on Water Quality

The activities of the proposed flood control projects will result to increase of TSS of the water quality of Davao River. Based on the sediment forecast, there will be an increase in concentration of sediment that will be transported downstream. Earthmoving activities and the removal of vegetation will loosen the soil and result to soil erosion. Eroded soils if not properly managed will reach to Davao River and Davao Gulf which will render the water turbid. Siltation of the river and

the sea can affect their beneficial use such as bathing and recreation. In addition, oil and grease of Davao River will also increase from the leaks of equipment and maintenance.

4.2.2.5 Mitigating Measures

Silt curtains are recommended to be placed downstream of dredging activity to minimize transport of sediment to Davao Gulf. Provision of temporary sedimentation ponds near the retarding ponds and cut-off works sites to catch silt-laden surface run-off. In order to prevent any oil leaks, contractors should ensure the equipment are properly maintained. Also, workshops for equipment maintenance should not be located near the work sites. Additional water quality monitoring station will be established in Davao Gulf near the mouth of Davao River.

4.2.3 Sediment Quality

4.2.3.1 Methodology

The sampling stations for sediment/soil are the same with the water quality. The sediment sample about one (1) kilogram was collected at the river side from a depth of approximately 12 inches from the surface using shovels and scoops. and were mixed with surface soil (as per TOR). The sample was stored in zip lock then shipped to the University of Immaculate Conception Science Resource Center for analysis. The parameters analyzed were arsenic, cadmium, chromium, lead, mercury, and sulfur. The methods of analysis used are in accordance with the Manual on Standards Analytical Procedures of the Mines & Geo-Sciences Bureau Laboratories. The samples were dried at 60^0C for 3.5 days.

4.2.3.2 Result and Discussions

There no secondary data for the quality of river sediment/soil because it is not regularly monitored unlike water quality. The result of sediment analysis is summarized in **Table 31.** The Philippines do not have guideline for sediment quality. The guidelines used in evaluating the results are the Canadian Sediment Quality Guidelines for the Protection of Aquatic Life[15] and the Sediment Quality Guidelines developed of NOAA[16]. Both references do not have guideline for sulfur.

Arsenic. Arsenic concentration in the sediment of the four samples is below the guidelines of both references. This means that there is no source of arsenic along Davao River. Arsenic is an element that is found in the atmosphere, soils, natural waters, and organisms. Of the four

[15]Canadian Environmental Quality Guidelines (2001). Canadian Sediment Quality Guidelines for the Protection of Aquatic life. Canadian Council of Ministers of the Environment. https://elaw.org/system/files/sediment_summary_table.pdf. Date accessed: December 20, 2021.

[16] NOAA Sediment Quality Guidelines developed for National Status and Trends Program. https://r.search.yahoo.com/_ylt=Awrx0MrEXcBhc14AWQWzRwx.;_ylu=Y29sbwNzZzMEcG9zAzIEdnRpZAMEc2VjA3Ny/RV=2/RE=1640025669/RO=10/RU=https%3a%2f%2fwww.coastalscience.noaa.gov%2fpublications%2fhandler.aspx%3fkey%3d1527/RK=2/RS=PzglM0HlhSmls602m4TXVuhoI3w- Date accessed: December 20, 2021.

stations, Bucana posted the highest concentration of 0.285 mg/g which can be attributed to its location being in the lowest portion of the river. Arsenic, being a heavy metal, does not degrade but accumulate.

Table 31. Summary of Sediment Quality, DFCDMP, 2021

Parameter	Mandug	Waan	Ma-a	Bucana	Canadian*	NOAA**
Arsenic (leachable) μ/g	0.122	0.143	0.238	0.285	5.9	8.2
Cadmium, μ/g	0.79	0.78	0.81	0.87	0.6	1.2
Chromium, μ/g	78.69	90.32	83.10	98.81	37.3	81
Lead, μ/g	9.94	8.47	9.68	10.56	35.0	8.0
Mercury, μ/g	0.02	0.02	<0.02	0.02	0.17	0.15
Sulfur, μ/g	41.51	29.23	74.80	376	-	-

*ISQG, in mg/kg; **ERL – Effects low range, in ppm dry basis
Note: μg/g =mg/kg=ppm

Cadmium. Cadmium level in Davao River across the four stations exceeded the Canadian guideline but below the NOAA guidelines. Sources of cadmium are not known. Cadmium is a highly toxic heavy metal. It is easily absorbed and accumulates in tissues. Cadmium is not degradable. Its concentration in sediment is an indicator of water and sediment pollution.[17]

Chromium. Chromium is a naturally occurring element that exist in trivalent state in nature. Hexavalent are found in small quantities. Chromite ore is the only natural source of chromium.[18] Other sources of chromium are anthropogenic like industries, manufacturing and mining. As can be seen from **Table 30**, concentration of chromium across the four sampling stations exceeded both guidelines with Bucana area the highest. The source of chromium is not known considering that there is no mining and industries along Davao River.

Lead. Lead is one of the most toxic heavy metals in aquatic environment. Sources of lead include non-ferrous mining, smelting, used batteries, spent ammunition and lost fishing tackle. Results of the sediment analysis across stations from Mandug down to Bucana showed exceedance of NOAA guidelines however, it is below the Interim Canadian guideline. Possible sources of lead in Davao River are the activity of informal waste pickers operating near the sanitary landfills where the waste water from the washing of the salvaged materials finds its way to Davao River thru surface run-off. In addition, more possible sources of lead are run-off from different sub-watersheds of Davao River Basin which can be naturally occurring or from human activity.

[17] Rzetala, Martyna A. (2016). Cadmium contamination of sediments in the water reservoirs in Silesian Upland (southern Poland). Journal of Soil and Sediment.
[18] WHO Regional Office for Europe, Copenhagen, Denmark, 2000. Chromium. https://www.euro.who.int/__data/assets/pdf_file/0017/123074/AQG2ndEd_6_4Chromium.PDF. Date accessed: December 21, 2021.

Mercury. Like lead, mercury is toxic heavy metal. The sources of mercury to the environment are mainly anthropogenic such as fossil fuel combustion, metal and cement production,[19] and mining. The concentration of mercury in the sediment of Davao River is below the two guideline values. This implies that Davao River is not contaminated with mercury.

Sulfur. Sulfur is a pollutant that creates nasty odors. Exposure to low levels (0-10 ppm) of hydrogen sulfide (H_2S) causes irritation of eyes, nose and throat; higher levels can cause headaches, dizziness, nausea & vomiting, coughing and breathing difficulty[20]. H_2S is generated as a result of organic material decomposition. Both the Canadian and NOAA guidelines do not provide standards for sulfur. Bucana has the highest sulfur concentration because it is the lowest among the four stations. All organic matter and other pollutants are settled and accumulated in this portion of the river.

4.2.3.3 Impacts to river sediment quality

Dredging activities would disturb the bottom sediment thus releasing heavy metals and foul odor in the process. This would increase the concentration of heavy metals in the dredged materials. Results of the analysis showed traces of heavy metals with chromium exceeding the standards. Thus, the dredged materials will be containing heavy metals which are harmful to human health.

4.2.3.4 Mitigating measures

Based on the sediment quality analysis, sediments in Davao River contain traces of heavy metals. It is recommended to conduct sediment quality analysis and dispose it in accordance to the dredging master plan. The Philippines does not have sediment quality standards, it is suggested to use other criteria such as NOAA or Canadian to refer to in making decisions of proper disposal. It is also recommended that monitoring of sediment quality be done in downstream of retarding ponds (after RP 11), CoW and before dredging sites.

4.2.4 Freshwater biota

The importance of rivers as ecological systems is impeccable as they house a multitude of species. These organisms reflect the quality of water as they are sensitive to the water changes within the system (Benetti & Garrido, 2010; Utah State University, 2017). Thus, they are integral to many programs that assess the water's quality of many freshwater ecosystems (Agouridis et al., 2015; Byrne et al., 2012).

[19] Marine Scotland (2020). Concentration of mercury (Hg), cadmium (Cd) and lead (Pb) in biota and sediment. https://marine.gov.scot/sma/assessment/concentration-mercury-hg-cadmium-cd-and-lead-pb-biota-and-sediment. Date accessed: December 22, 2021.

[20] Analyzing sulfur in soil and sediment with handheld XRF. https://www.environmental-expert.com/articles/analyzing-sulfur-in-soil-and-sediment-with-handheld-xrf-186680. Date accessed: December 22, 2021.

In terms of ecosystem services, rivers are significant in flood planning, as their overflow during the rainy season usually results in the consistent flooding of an area. Rivers also support water provisioning in many communities, nutrient cycling, and its importance in the cultural aspect of many societies that have flourished near these systems (Yeakley et al., 2016). By researching these systems, one can check their status and improve local decision-making and management projects.

This paper reports the results of the September 2021 rapid assessment conducted for the baseline survey of flood control and river improvement of the Davao River (**Figure 35**). It assessed four pre-identified water sampling stations along the river's length to determine the existing condition of aquatic fauna and riparian ecosystems.

4.2.4.1 Materials and methods

Sampling activity was done last September in the four established stations along Davao River. Station 1 was in Barangay Mandug which had a riprap on one side and an eroded riparian zone on the other side. Station 2 was in Barangay Waan with a wide stretch but mostly silted riparian zone and riverbanks on both sides of the river. Station 3 was in Barangay Maa and had similar riverbank with S2. Lastly, Station 4 was in Barangay Bucana which is by the mouth of the river (**Photo 21**). The description of each site is summarized in **Table 32**.

Table 32. Description of each water sampling stations along Davao River.

Station	Coordinates	Barangay Location	Description
1	7.16358, 125.56823	Mandug	The river had a wide stretch. Riverbank was heavily silted with the riparian zone, almost absent of hydrophilic flora, and dominated by sedges and grasses.
2	7.13528, 125.58172	Waan	Similar to S1, S2 had a wide stretch of a river. Riverbank was silted on the left side (facing downstream) and eroded on the right side. The riparian zone on the left side was almost non-existent. Both riparian zones were almost devoid of hydrophilic flora.
3	7.08389, 125.59326	Maa	There are erected ripraps on both sides of the river. Eroded soil deposits with heavy siltation, which sediment along the channels, served as riverbanks. No observed clear riparian zone in the area.
4	7.04812, 125.60629	Bucana	There is no riparian zone by the river mouth, but a mangrove area is naturally established and observed as important nesting and foraging site for bird species. The immediate surrounding polluted with plastics and other anthropogenic debris.

4.2.4.1.1 Collection of Macroinvertebrates

The collection of macroinvertebrate samples adopted the method used by Ode et al. (2007) with modifications. A modified sampling kick net with a <1mm mesh was used to collect sample replicates from the sub-points. The kick net was placed perpendicular to the flow of the water. Gathering samples included at least ten jabs or kicks in the water over the length of every replicate. Additionally, benthic macroinvertebrates were collected using an improvised corer with a 10 cm in diameter. Three composite samples (substrates) from each side of the river were taken and were stored in a resealable bag. The substrates were then washed and sieved using a cloth with fine mesh to detect benthic macroinvertebrates, which were collected manually. Samples obtained from the kick net and fine mesh cloth were placed in a pre-labeled container and preserved with a 10% formalin solution.

Photo 21. Sampling stations: a. Station 1 in Barangay Mandug. b. Station 2 in Barangay Waan. c. Station 3 in Barangay Maa. d. Station 4 in Barangay Bucana.

Figure 35. Sampling station for freshwater assessment, DFCDMP

4.2.4.1.2 Plankton Assemblage Assessment

The data was gathered during the day using a conical plankton net towed on varying lengths from the riverbank, depending on the water's depth. Samples collected were transferred to a pre-labeled sample bottle. The samples were fixed on-site using acidic Lugol's solution. After putting 3-5 drops of fixative, the bottles are wrapped in newspaper to avoid exposing them to sunlight, ready for transport to the laboratory for further processing. The samples were allowed to settle for 24 hours in the laboratory. After 24 hours, the sample solution was decanted until 20 mL for each sample left. Three drops per sample were examined and identified under the microscope to its lowest taxonomic rank possible. Each sample was separately dropped on a Sedgwick rafter and viewed through the microscope to count each species' abundance. The abundance of each plankton group was expressed in cells/ml and individuals/ml, respectively.

$$\text{Cells/mL} = \frac{N \times 1000 mm^3}{(G \times CF)}$$

Where: N = average number of cells/individuals
G = number of grid squares counted
CF = concentration factor

4.2.4.1.3 Analysis of Data

For the biotic assemblages, a separate biodiversity determination in terms of abundance, richness, and diversity index (Simpson, Shannon-Weiner) for macroinvertebrates and planktons were done.

4.2.4.2 Results and Discussions

4.2.4.2.1 Macroinvertebrate Assemblages

Only five species of macroinvertebrates were collected from the water sampling stations. Among these, three (3) were insects, while the two (2) were crustaceans (hermit crabs). The insect species included an unidentified adult species of mayfly (Ephemeroptera), accidentally caught within the net, *Tenagogonus* sp., and *Rhagovelia philippina* (**Table 33**). It was noted that only sampling station 1 had insect species, while the rest did not have any collection. Additionally, the two hermit crabs were species from *Calcinus* and *Clibanarius*. These hermit crabs are marine species, not freshwater (**Figure 36**). During the sampling period, no nekton and fishes were caught as heavy rain was experienced the night before the scheduled collection. Thus, the water level was high with an intense current of water. Casual talks with the few locals, however, revealed that they have dentified certain species of fish that they could catch. These include, but are not limited to, freshwater eels (*Anguilla sp*.), carps (*Cyprinus sp*.), tilapia (*Oreochromis sp*.), and freshwater prawns *(Macrobrachium sp*.), which can be caught in some areas of the river.

Table 33. Species of macroinvertebrates, DFCDMP

Family	Species	IUCN	Counts			
			Water Sampling Station 1	Water Sampling Station 2	Water Sampling Station 3	Water Sampling Station 4
Diogenidae	*Calcinus* sp.	--	0	0	0	4
Diogenidae	*Clibanarius* sp.	--	0	0	0	5
Ephemeridae	Unidentified mayfly species	--	1	0	0	0
Gerridae	*Limnogonus* sp.	--	4	0	0	0
Veliidae	*Rhagovelia philippina*	No Data	5	0	0	0

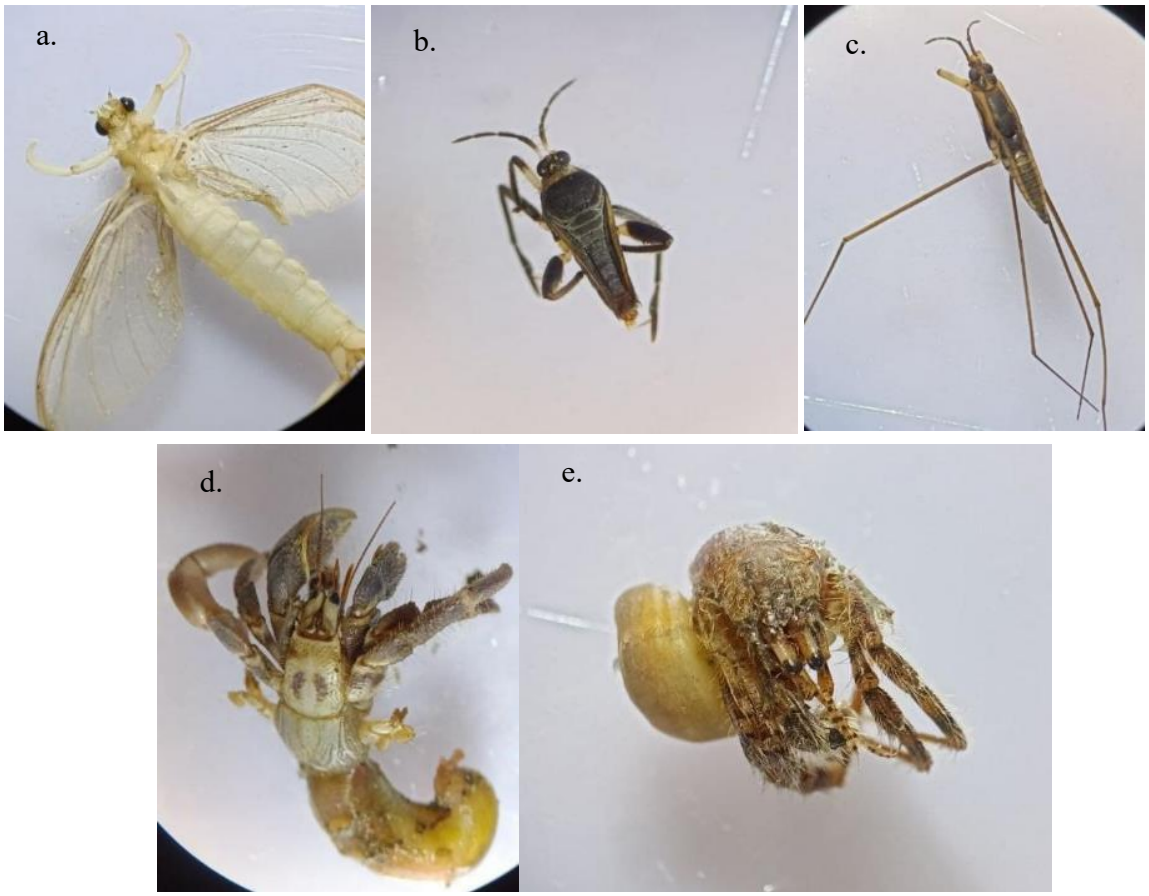


Figure 36. Macroinvertebrate: a. Unidentified mayfly species b. Rhagovelia philippina c. Limnogonus sp. d. Clinabarius sp. e. Calcinus sp.

Diversity indices showed very low values which indicate that the biodiversity in terms of macroinvertebrates was very low (**Table 34**). Based on the results, water sampling station 1 (WWS1) had 1.011, WSS2 had 0, WSS3 had 0 and WWS4 had 0.6365. However, the individuals were evenly distributed from the two sampling stations with specimens (J'= >0.9)

Table 34. Diversity indices of macroinvertebrates, DFCDMP

Indices	WSS1	WSS2	WSS3	WSS4	Total
Total number of Taxa	3	0	0	2	5
Individuals	10	0	0	9	19
Shannon_H	1.011	0	0	0.6365	1.061
Evenness_e^H/S	0.9165	0	0	0.9449	0.9629

4.2.4.2.2 Plankton Assemblage

Thirteen (13) species of phytoplankton under two (2) major groups were identified. The first groupwas *Cyclotella* sp., *Diasdesmis* sp., *Diatoma* sp1. *Diatoma* sp2, *Diatomvulgaris*, *Melaseria* sp., *M. virans*, *Navicula* sp., *Pinnularia normanii*, *Pleurosigma normanii,* and *Synura* sp., all under taxon Bacillariophyta. The second group was Cynanophyta and included *Microcystis aeruginosa*, *M. flos-aquae*, and *M. wesenbergii* were identified. No zooplankton was observed in the collection. *M. flos-aquae* had the highest density recorded in the area, which had 928 cells/mL, followed by *M. aeruginosa* at 881 cells/mL and *M. wesenbergii* with 644 cells/mL. The lowest recorded density for Bacillariophytas was *P. normanii* sp. at 18 cells/mL (**Table 35**).

Table 35. Identified phytoplankton species in all the sampling stations.

Phylum	Species	Water Sampling Station 1	Water Sampling Station 2	Water Sampling Station 3	Water Sampling Station 4	Total
		Number of Individuals (cells/mL)				
Bacillariophyta	*Cyclotella* sp.	10	5	5	0	20
	Diasdesmis sp.	0	0	42	0	42
	Diatoma sp1.	24	43	0	0	67
	Diatoma sp2.	122	0	0	0	122
	Diatoma vulgaris	23	15	0	0	38
	Meloseria sp.	76	0	0	0	76
	Meloseria virans	15		0	0	15
	Navicula sp.	12	3	10	42	67
	Pinnularia normanii	0	16	2	0	18
	Synura sp.	5	0	23	0	28
Cyanophyta						
	Microcystis aeruginosa	16	166	244	455	881
	Microcystis flos-aqaue	6	77	422	423	928
	Microcystis wesenbergii	2	89	131	422	644
	TOTAL	311	414	879	1342	2946

In terms of diversity, all stations had a relatively low diversity value (**Table 36**). Based on the Shannon-Wiener values, water sampling Station 1 (WWS1) had 1.812, WSS2 had 1.58, WSS3 had 1.327, and WWS4 had 1.203. The distribution of the population of each species in each station, however, was different. Evenness values ranged between 0 and 1, with 1 as evenly distributed. WSS4 was more evenly distributed (J'=0.83) compared to all other stations. Plankton assemblages are shown in **Figures 37** and **38**.

Table 36. Diversity of phytoplanktons collected in all the sampling sites.

Diversity index	WSS1	WSS2	WSS3	WSS4	Total
Total Number of Species	11	8	8	4	13
Individuals	311	414	879	1342	2946
Shannon_H	1.812	1.58	1.327	1.203	1.708
Evenness_e^H/S	0.5565	0.6068	0.471	0.8324	0.4247

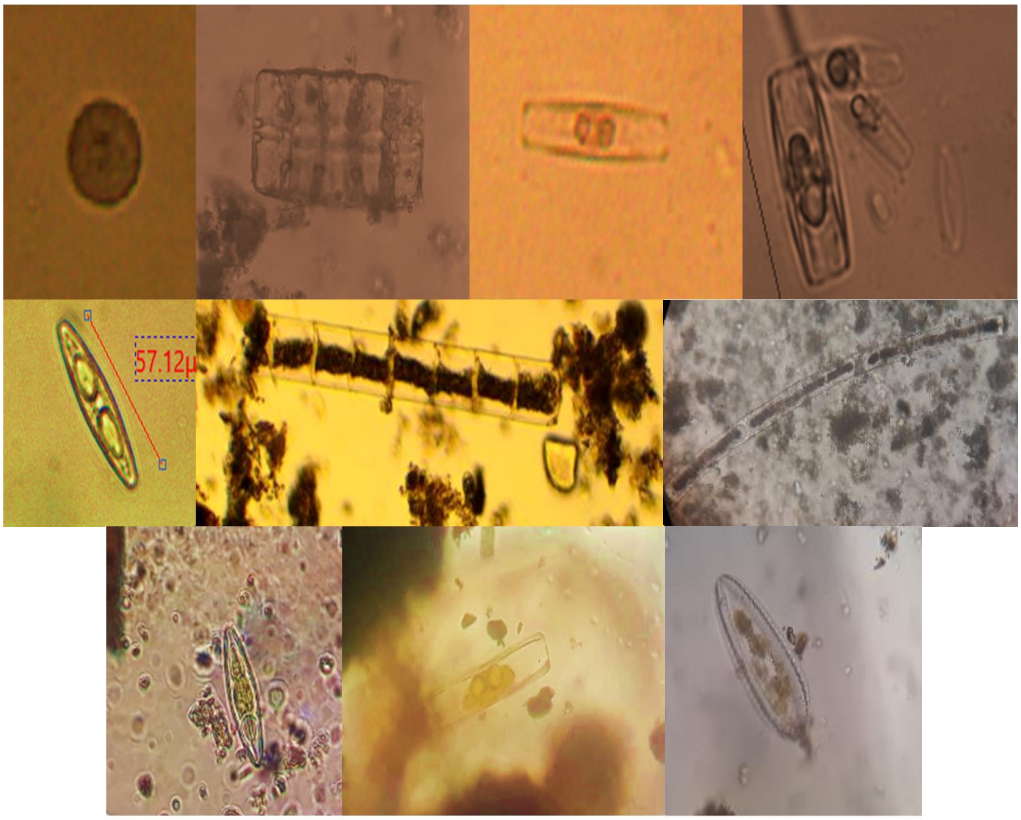


Figure 37. Recorded Bacillariophyta species (1) From right to left (top): Cyclotella sp., Diasdesmis sp., Diatoma sp1., Diatoma sp2. (2) From right to left (top): D. vulgaris., Meloseria sp., M. virans., (3) From right to left (bottom): Navicula sp., Pinnularia normanii., Synura sp.

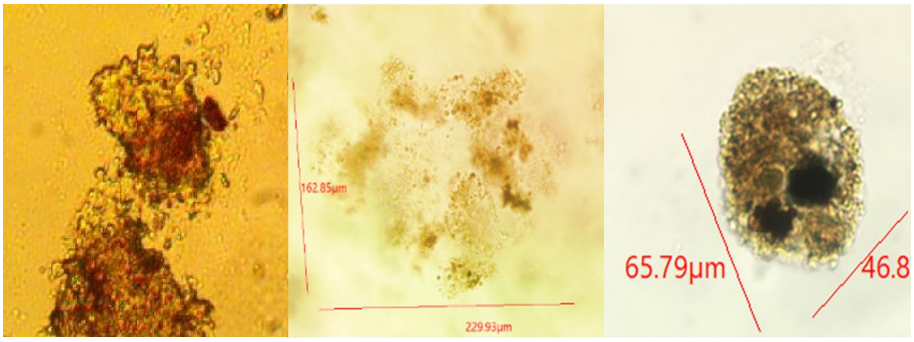


Figure 38. Recorded Cyanophyta species from the four sampling stations along Davao River
From right to left: Microcystis aeruginosa., M. wesenbergii, M. flos-aquae

There were only hermit crabs as macroinvertebrate collection for the Downstream station (WSS4) because it was a wetland, mainly a mangrove forest where no pronounced riverbank was available for sampling. The station was an estuary, where the freshwater and seawater were mixed. Hence, the ecosystem's characteristic was not precisely considered a typical freshwater riverine system where sampling areas such as riffles and riverbanks were present. These characteristics were present in the upstream stations only, and their absence in the downstream station made it incomparable to the other two stations. As noted, however, as noted that the shallow parts during low tide were teeming with brackish to marine macroinvertebrates. The low number of specimens collected from the stations can be due to the apparent damage to the river system caused by anthropogenic activities. Upstream erosion was pronounced (as evidenced by very turbid water and high sedimentation along the water stations). In contrast, the presence of ripraps reduced the amount of eroded soil that enters the river. It did not also allow the formation of riffles and shallow ephemeral pools, which would have served as the brooding place for macroinvertebrate nymphs and zooplanktons, and as hunting grounds for other adult insect species. Additionally, the heavy siltation from the upstream operations further disrupted the channels, making the water highly turbid, which did not allow light to penetrate deep into the water. The turbidity of water can limit the photosynthetic activity of phytoplanktons to the river's surface, accounting for the low values of the plankton species. Since producers were limited, the higher trophic levels were also affected due to the cascading effect on the food chain of the Davao River.

4.2.4.3 Impacts to freshwater biota

The dredging and cut-off works may lead to the loss of freshwater habitat. Siltation, which is a primary impact of the proposed flood control project during the construction phase, may lead to the decline of and death of some aquatic organisms.

4.2.4.4 Mitigating measures

The impacts to freshwater biota are unavoidable during the construction phase. In order to combat the rapidly declining river ecosystem of Davao River, the team generally recommends

reinforcing the riparian zone for flood mitigation. The absence of deep-rooted vegetation along the riverbanks was a main concern since the riparian corridor functions as runoff control and cushion for water movement. According to Tabacchi et al. (2000), trees and other low vegetations that grow along riverbanks control the sediment entering the channel. By regulating this debris and stabilizing the bank to prevent soil erosion, the amount of sediment that settles on the riverbed can be minimized. The bank prevents the "shallowing" of the river. Also, stabilized riparian zones are dissipative structures; that is, they lessen the water flow force. This dampening effect dissipates the kinetic energy of flood, directing the flow of water appropriately along the channel and reducing water velocity, which could be disastrous if flood flows faster. Given that, the following interventions are being recommended:

1. Improvement of the riparian zone by implementing the correct reforestation practices. By reforesting the area, it will allow the stability of the soil, reduce erosion and substrate deposition in the river bed, and improve water quality. It is advisable to plant appropriate tree and shrub species along the riparian zone at the riverbank following the prescribed distances. For example, the observable erosion along the midstream station's riverbank is stabilized by trees such as *Ficus* sp. Following a successful ecological succession, an increase in the ecosystem's biodiversity and stability will yield better ecological services.

2. Reduction of disturbances along the riparian zone of the Davao River. The clearing of active anthropogenic activities in these areas promotes a proper succession process. It is important to note that the riparian zone is a buffer zone for terrestrial and aquatic systems reducing the disturbances. A riparian zone can positively affect both the land and the river by reducing causes of constant erosion (mere walking along the bank destabilizes the exposed land and hence causes unwanted erosion) and, therefore, reduces the riverbed's constant sedimentation.

4.3 The Air

4.3.1 Climatology

Based on the Modified Coronas Classification, Davao City belongs to Type IV climate category (**Figure 39).** Type IV climate is characterized by rainfall which is more or less evenly distributed throughout the year. This type resembles type II climate since it has no distinct dry season. Davao City lies outside the typhoon belt.

4.3.1.1 Rainfall

Figure 40 shows that the wettest period is October with an average rainfall of about 253.47 mm while the driest month is March (99.25 mm). The annual average rainfall in Davao City is 1977.19 mm. The month of June has the most numbers of rainy days with 17 days, while the months of March and April have the least number of rainy days (11 days) (**Figure41**).

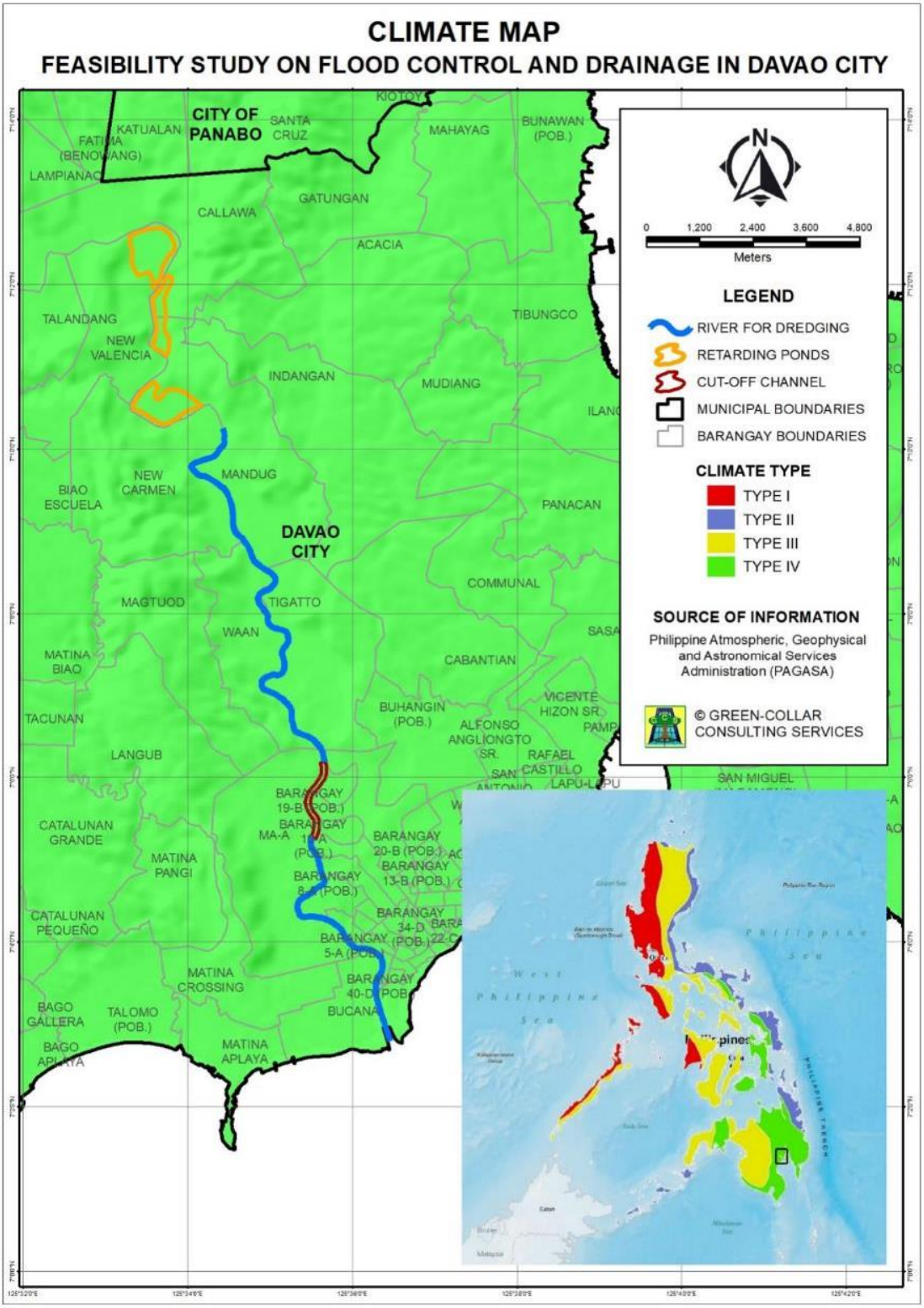
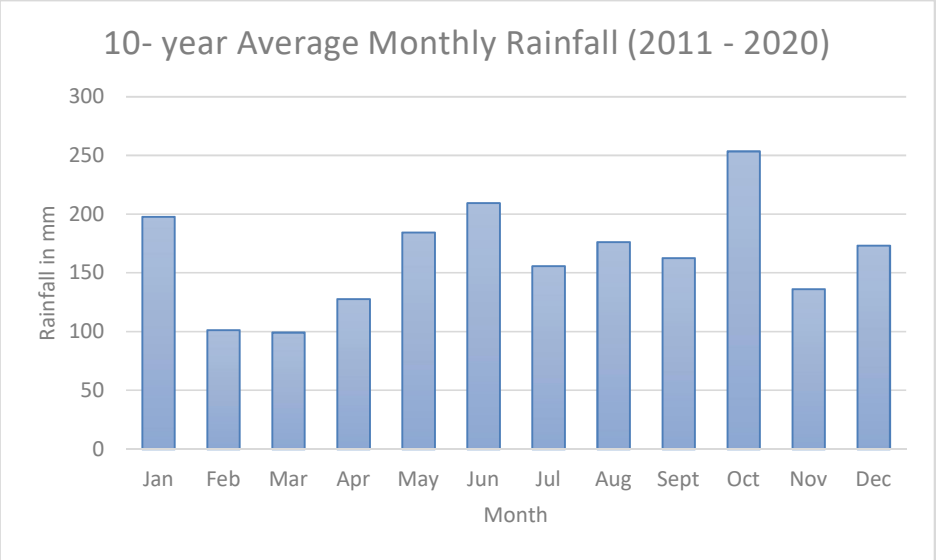
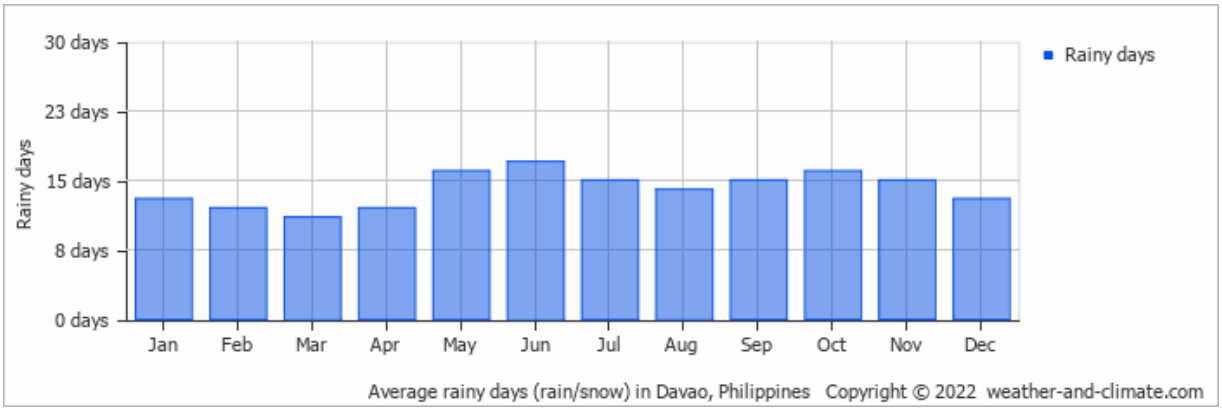


Figure 39. Climate Map of the Philippines



Source: DOST-PAGASA

Figure 40. Average Monthly Rainfall, Davao City (2011 – 2020)

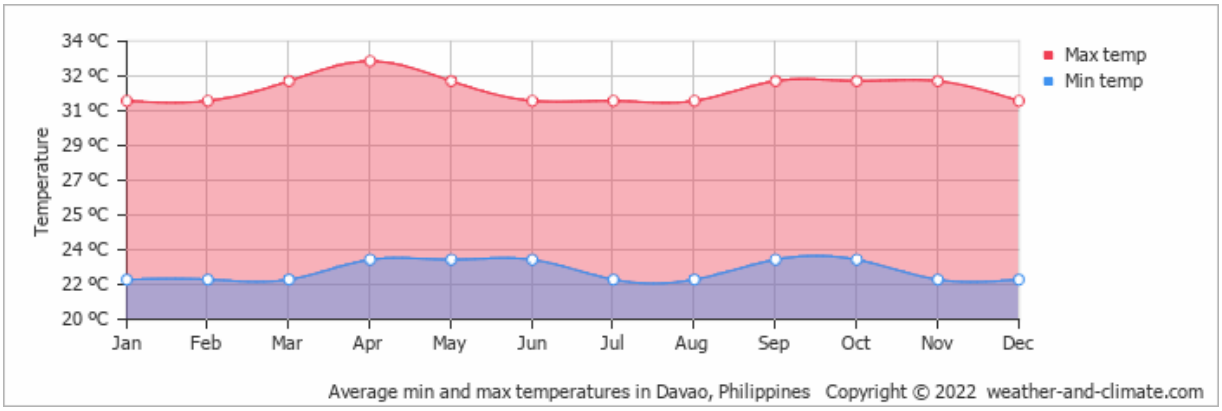


Source: weather-and-climate.com

Figure 41. Monthly Number of Rainy Days, Davao City

4.3.1.2 Temperature

On the average, daytime temperatures are always high – between 31^{0}C and 34^{0}C. The warmest month is April with an average day temperature of 33^{0}C, while the coolest month is July with average monthly temperature of 31^{0}C. The average annual monthly day time temperature is 32^{0}C. Night time temperatures are rather high with an average of 22^{0}C (**Figure 42**).



Source: weather-and-climate.com

Figure 42. Average Monthly Temperature, Davao City

4.3.1.3 Climate Extremes

Data on the normal climate and extremes were based on the data from PAGASA recorded from the Davao station from 1971 to 2000. This baseline data was used in the projection of climate change. The projection covered two time-periods – the mid21st century (2036 – 2065) and the late 21st century (2070 – 2099). The Representative Concentration Pathways (RCPs) were used and two scenarios were modeled depending on the greenhouse gas emissions – RCP 4.5 represents the moderate level while RCP 8.5 represents the high level of GHG emission. The projections were done using the Climate Information Risk Analysis Matrix (CLIRAM) tool. Climate information is presented in terms of lower bound, median bound, and upper bound. The median bound represents the most likely change in the future, the lower bound is the lowest possible change while the upper bound is the highest possible change.

As can be seen in **Table 37** that the seasonal average temperature is expected to increase in the mid-21st and late-21st century. In mid-21st, maximum mean projected temperature will be around 28.38^{0}C using RCP 4.5 while maximum mean projected temperature could reach 28.73^{0}C in late-21st century. Likewise, seasonal average temperature using the RCP 8.5 also shows an expected increase.

Table 38 presents the changes in seasonal precipitation for the mid and late 21st century. Based on RCP 4.5, the annual rainfall projection will decrease by 5.99% in the mid-21st century and will

continue to decrease in the late-21st century, relative to the baseline value of 1,571 mm. Using the same RCP, rainfall projection in March –May season will increase by 2.8 per cent in the late-21st century. On the other hand, using the RCP 8.5, annual rainfall is expected to decrease in mid and late-21st centuries by as much as 1.13% and 4.37%, respectively. Annual rainfall using RCP 4.5 in the mid-21stcentury will account to about 1,474.1 mm and 1,489.2 mm in the late-21stcentury.

4.3.2 Air Quality

4.3.2.1 Methodology

The methods of sampling and analysis of PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO for the ambient air quality were based on the DENR standard. The methodologies are summarized in **Table 39**. The air quality measurement was done in 24 – hour period.

Sampling of particulate matter was carried out using a high volume PM_{10}/$PM_{2.5}$ sampler. Ambient air was drawn at a controlled flow rate into a specially-shaped cyclone inlet where the larger particulates are inertially separated from PM_{10}/$PM_{2.5}$ size range. Each size fraction in the PM_{10}/$PM_{2.5}$ size range is then collected on the pre-weighed glass microfiber filter over the specified sampling period. The filter paper with retained particles was recovered and desiccated for 24 hours then weighed. The concentration of PM_{10}/PM2.5 in ambient air was determined from the ratio of total mass of PM_{10} and the total volume of air sampled.

Sulfur dioxide in the ambient air was collected into a solution of sodium tetrachloromercurate (TCM) by aspirating air through an impinger and treated in the laboratory with formaldehyde and especially purified acid-bleached pararosaniline containing phosphoric acid to control pH. Sulfur dioxide concentration was determined by the difference between the absorbance of the sample and the blank multiplied by the calibration factor divided by the total volume of air sampled corrected to normal temperature and pressure.

Nitrogen dioxide in ambient air was analyzed using the Griess-Saltzman Reaction method. It is absorbed in an azo dye forming reagent that produces a stable red-violet color and read by a spectrophotometer at 550 nm. The difference between the absorbance of the sample and blank multiplied by the calibration factor, divided by the total volume of air sampled equals the concentration of NO_2 in ambient air.

Table 37. Projected Changes in Seasonal Temperatures for Davao del Sur relative to 1971-2000

* upper 90th percentile; median: 50th percentile; lower: 10th percentile

Season	Scenario	Range*	Mid-21st Century (2036 – 2065)		Late-21st Century (2070 – 2099)	
			Projected Change		Projected Change	
			Change in ^{0} C	Projected seasonal mean Temperature (^{0} C)	Change in ^{0} C	Projected seasonal mean Temperature (^{0} C)
December-January-February (DJF) Observed **baseline = 26.9^0 C**	Moderate emission (RCPA 4.5)	Lower bound	1.0	27.9	1.3	28.2
		Median	1.2	28.1	1.6	28.5
		Upper bound	1.7	28.6	2.5	29.4
	High emission (RCP 8.5)	Lower bound	1.3	28.2	2.5	29.4
		Median	1.6	28.5	3.1	30.0
		Upper bound	2.2	29.1	4.1	31.0
March-April-May (MAM) Observed baseline = **27.8^0 C**	Moderate emission (RCPA 4.5)	Lower bound	1.0	28.8	1.4	29.2
		Median	1.2	29.0	1.6	29.4
		Upper bound	1.7	29.5	2.5	30.3
	High emission (RCP 8.5)	Lower bound	1.4	29.2	2.6	30.4
		Median	1.7	29.5	3.2	31.0
		Upper bound	2.3	30.1	4.0	31.8
June-July-August (JJA) Observed **baseline = 26.9^0 C**	Moderate emission (RCPA 4.5)	Lower bound	1.0	27.9	1.3	28.2
		Median	1.2	28.1	1.5	28.4
		Upper bound	1.8	28.7	2.4	29.3
	High emission (RCP 8.5)	Lower bound	1.3	28.2	2.6	29.5
		Median	1.6	28.5	3.2	30.1
		Upper bound	2.3	29.2	4.2	31.1
September – October – November (SON) Observed **baseline = 27.1^0 C**	Moderate emission (RCPA 4.5)	Lower bound	1.0	28.1	1.3	28.4
		Median	1.2	28.3	1.5	28.6
		Upper bound	1.8	28.9	2.5	29.6
	High emission (RCP 8.5)	Lower bound	1.3	28.4	2.5	29.6
		Median	1.6	28.7	3.2	30.3
		Upper bound	2.2	29.3	4.1	31.2

Source: DOST - PAGASA

Table 38. Projected Changes in Seasonal Rainfall for Davao del Sur relative to 1971-2000

Season	Scenario	Range*	Mid-21st Century (2036 – 2065)			Late 21st Century (2070 – 2099)		
			Projected Change		Projected seasonal rainfall amount (mm)	Projected Change		Projected seasonal rainfall amount (mm
			Percent (%)	Rainfall amount (mm)		Percent (%)	Rainfall amount (mm)	
December-January-February (DJF) Observed **baseline = 288 mm**	Moderate emission (RCPA 4.5)	Lower bound	-14.2	-40.8	247.3	-18.5	-53.4	234.7
		Median	-3.6	-10.2	277.9	-4.5	-13.0	275.1
		Upper bound	16.0	46.2	334.3	9.0	25.9	314.0
	High emission (RCP 8.5)	Lower bound	-8.4	-24.2	263.9	-23.7	-68.2	219.9
		Median	-0.9	-2.5	285.6	-10.5	-30.4	257.7
		Upper bound	16.0	46.1	334.2	35.6	102.5	390.6
March-April-May (MAM) Observed **baseline = 347 mm**	Moderate emission (RCPA 4.5)	Lower bound	-8.8	-30.4	316.7	-9.5	-33.0	314.1
		Median	-4.1	-14.2	332.9	2.8	9.7	356.8
		Upper bound	15.4	53.4	400.5	21.5	74.6	421.7
	High emission (RCP 8.5)	Lower bound	-6.4	-22.1	325.0	-6.4	-22.1	325.0
		Median	2.1	7.1	354.2	11.5	39.8	386.9
		Upper bound	15.4	53.3	400.4	19.2	66.8	413.9
June-July-August (JJA) Observed **baseline = 494 mm**	Moderate emission (RCPA 4.5)	Lower bound	-14.0	-69.3	424.8	-8.2	-40.7	453.4
		Median	-1.8	-8.8	485.3	-3.3	-16.5	477.6
		Upper bound	8.4	41.3	535.4	22.4	110.5	604.6
	High emission (RCP 8.5)	Lower bound	-7.1	-34.9	459.2	-8.8	-43.6	450.5
		Median	4.4	21.5	515.6	2.6	12.7	506.8
		Upper bound	18.3	90.3	584.4	33.2	164.0	658.1
September – October – November (SON) Observed **baseline = 442 mm**	Moderate emission (RCPA 4.5)	Lower bound	-24.1	-106.4	335.9	-25.3	-112.1	330.2
		Median	-14.5	-64.2	378.1	-14.2	-62.6	379.7
		Upper bound	-3.7	-16.5	425.8	-1.9	-8.3	434.0
	High emission (RCP 8.5)	Lower bound	-14.4	-63.8	378.5	-20.6	-91.2	351.1
		Median	-10.1	-44.5	397.8	-12.2	-54.0	388.3
		Upper bound	8.2	36.1	478.4	5.0	22.2	464.5

* upper 90th percentile; median: 50th percentile; lower: 10th percentile Source: DOST - PAGASA

Table 39. Methods of Ambient Air Sampling and Analysis

Parameter	Sampling Methodology/Analysis
Particulate Matter less than 10 microns (PM_{10})	High Volume Sampler – Gravimetric Method
Particulate Matter less than 2.5 microns ($PM_{2.5}$)	High Volume Sampler – Gravimetric Method
Sulfur Dioxide (SO_2)	Bubbler – Pararosaniline Method
Nitrogen Dioxide (NO_2)	Bubbler – Griess Saltzman Reaction
Carbon Monoxide (CO)	Direct reading

Reference: USEPA 40 CFR, Parts 50 and 53

Carbon monoxide concentrations were measured using a MultiRAE (PGM-54) direct reading gas analyzer equipped with special sensor for CO. The sampling was divided into three (3) 8-hour, wherein for each 8 – hour monitoring period, an hourly concentration was obtained and the average was reported. The minimum detection limit of the equipment is 1.0 ppm.

4.3.2.2 Results and Discussions

Three (3) designated sampling stations were established in determining the concentrations of PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO. **Table 40** and **Figure 43** present the coordinates of each sampling station. During the time of sampling, the weather was observed to be fair with partly cloudy to mostly cloudy skies. Wind predominantly blew from northeast at light air condition. Occurrence of very light rainfall was observed between 2330H and 0130H. Air temperature ranged from 23.6^0C to 33.1^0C, and averaged 28.6^0C.

Table 40. Ambient Air Quality Sampling Station, DFCDMP, Davao City

Station	Location	GPS Coordinates	
		Latitudes	Longitudes
A -1	Near Ma-a River at Crocodile Park, Bgy Ma-a,	$7^0$6'16" N	$125^0$35'43" E
A - 2	Sitio Luman Purok 6, Bgy New Valencia	$7^0$5'10" N	$125^0$36'37" E
A - 3	Bilusa, Bucana, Bgy 76-A	$7^0$3'31" N	$125^0$36'25" E

Tables 41, 42, 43 present the summary of the 24-hour ambient air quality monitoring in the different established stations. The pollutant concentrations are below the DENR National Ambient Air Quality Standards based on the 24-hour averaging time. The concentration of the air quality parameters in ambient air in the project sites are below the DENR NAAQGV guidelines based on 8 hours averaging time.

4.3.2.3 Impact to Air Quality

During the construction of the hard flood control infrastructures such as excavation of retarding ponds, cut-off works and dredging works, the concentrations of TSP, SOx, NOx and CO in ambient air from vehicular emissions are likely to increase. Particulate matter (PM) is also expected to increase from dust that will be generated. The increase in air pollutants could be detrimental to the health of the residents.

Table 41. Ambient Air Concentration of PM_{10} and $PM_{2.5}$, DFCDMP, Davao City

Sta. No.	Location	Date and Time of Sampling	PM_{10} (µg/Ncm)	PM2.5 (µg/Ncm)

A1	Near Ma-a River at Crocodile Park, Brgy. Ma-a	September 20-21, 2021 1330H-1330H	< 0.07	< 0.07
A2	Sitio Luman Purok 6,Brgy. New Valencia	September 21-22, 2021 1435H-1435H	< 0.07	< 0.07
A3	Bilusa, Bucana Bry. 76-A	September 22-23, 2021 1555H-1555H	4.75	< 0.07
DENR NAAQGV for Criteria Pollutantsbased on 24-hour averaging time			**150**	**35**
Japan Standard, Notofication of MoE, No. 25, 1973			**-**	**35**
WHO Ambient Air Quality Guidelines			**50**	**25**

Table 42. Measured Ambient Air Concentrations of SO2, & NO2, DFCDMP, Davao City

Sta. No.	Location	Date / Time of Sampling	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)
A1	Near Ma-a River at Crocodile Park, Brgy. Ma-a	September 20-21, 2021 1330H-1330H	3.35	0.18
A2	Sitio Luman Purok 6,Brgy. New Valencia Davao	September 21-22, 2021 1435H-1435H	3.24	0.19
A3	Bilusa, Bucana Brgy.76-A	September 22-23, 2021 1555H-1555H	4.72	0.16
DENR NAAQGV for Criteria Pollutants based on 24-hour averaging time			**180**	**150**
Japan Standard, Notofication of MoE, No. 25, 1973			**172 (0.1ppm)**	**-**
WHO Ambient Air Quality Guidelines			**20**	**40 (annual value)**

Table 43. Measured 8-hour Concentrations of CO, DFCDMP, Davao City

Sta. No.	Location	Date /Time of Sampling	8-Hour Monitoring Period	CO* (ppm)
A1	Near Ma-a River at Crocodile Park, Brgy.Ma-a	September 20-21, 2021	1330H-2130H	< 1.0
			2130H-0530H	< 1.0
			0530H-1330H	< 1.0
A2	SitioLuman Purok 6, Brgy.New Valencia Davao	September 21-22, 2021	1435H-2235H	< 1.0
			2235H-0635H	< 1.0
			0635H-1435H	< 1.0
A3	Bilusa,Bucana Brgy. 76-A	September 22-23, 2021	1555H-2355H	< 1.0
			2355H-0755H	< 1.0
			0755H-1555H	< 1.0
DENR NAAQGV for Criteria Pollutants based on 8 hours averaging time				**9**
Japan Standard, Notofication of MoE, No. 25, 1973				**10**

Minimum detection limit of CO gas analyzer: 1.0 ppm, * Average of 8 hourly concentrations.

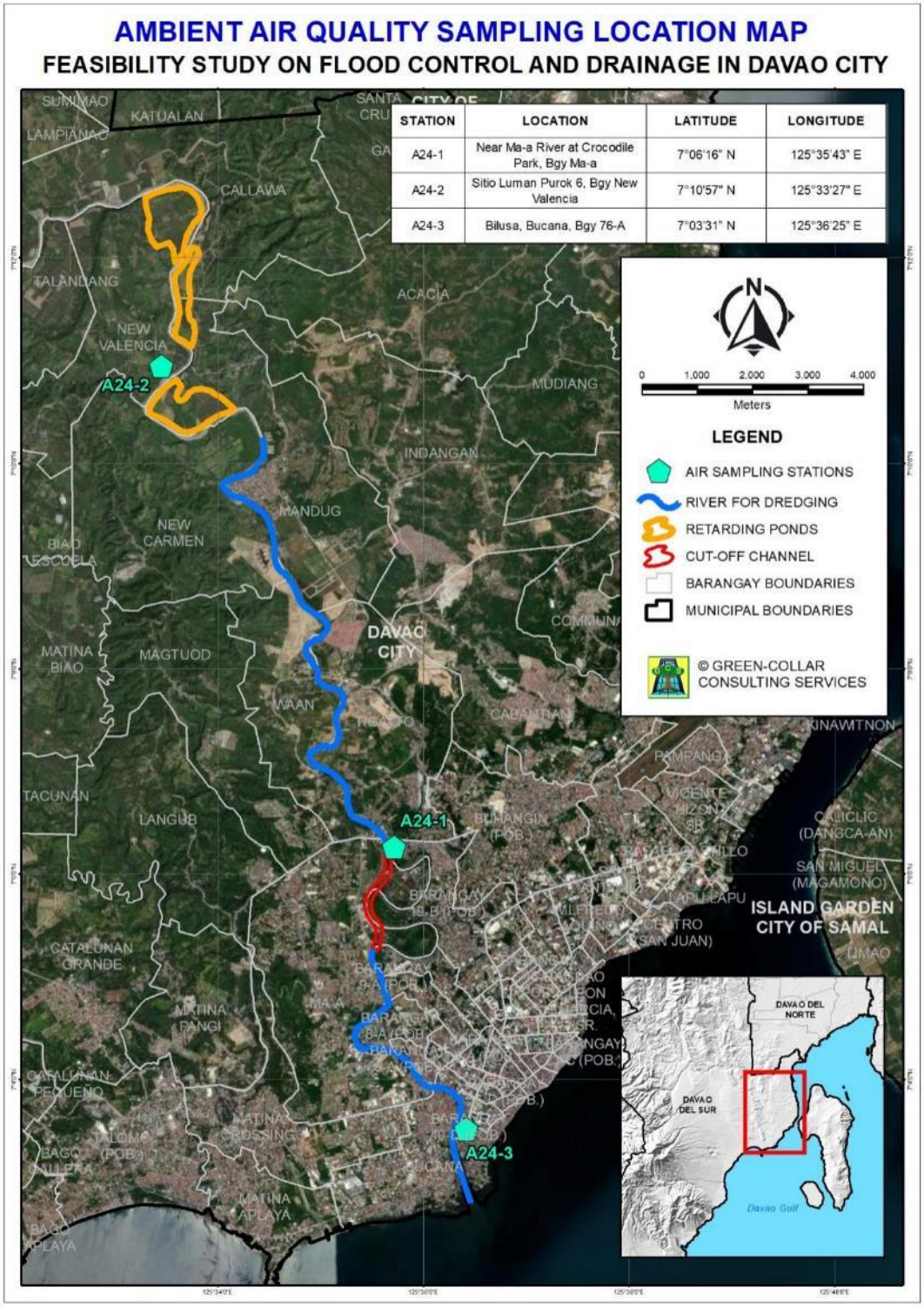


Figure 43. Air and Noise Sampling Location, DFCDMP

4.3.2.2.4 Mitigating Measures

For vehicular emissions, the use of low emission heavy equipment is recommended to minimize the increase of air pollutants. There should be regular maintenance of heavy equipment and other vehicle during the construction period. Excavated materials should be

covered while on stocked in designated area. Also, there must be continuous watering of dust generating mounds in the vicinity.

4.3.3 Ambient Noise Level

4.3.3.1 Methodology

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

The procedure used followed that of Wilson (1989)[21], in which at least a total of fifty (50) readings were recorded in order to increase the confidence limits of the data. The procedure outlined by Wilson (1989) were adopted since the 1978 NPCC did not specify the time interval, duration of sampling, size of data needed and methods of noise level analysis.

NPCC Memorandum Circular 002 series of 1980 stipulated that the arithmetic median of seven (7) maximum-recorded noise levels is regarded as the noise level comparable to the standard. Field observations during the monitoring were also noted to identify the primary sources of noise in the area. The 24-hour noise levels were taken at four (4) periods with the inclusive time as presented in **Table 44.** Monitoring stations were located the same as with air quality.

Table 44. Division of 24 – hour Noise monitoring, DFCDMP, Davao City

Period	Time
Morning	5:00 am – 9:00 am
Daytime	9:00 am – 6:00 pm
Evening	6:00 pm – 10:00 pm
Nighttime	10:00 pm – 5:00 am

4.3.3.2 Results and Discussions

The results of the 24-hour noise level monitoring in three locations (same with the station for air quality monitoring) are presented in **Table 45**. The noise levels in the three stations in all periods, except in Ma-a station for the daytime, exceeded the NPCC standards. The exceedances are attributed to animal calls (birds, frogs, insects, and roosters), and community/residential activities. In stations N1 and N2, the exceedance could be attributed to the on-going construction & heavy equipment operations (**Table 46**).

[21] Wilson, C.E. (1989). Noise Control: Measurements, Analysis, and Control of sound and Vibration. New York: Harper & Row, Publishers, Inc.

Table 45. 24 – Hour Ambient Noise Level Monitoring Results

Sta. No.	Location	Date and Time of Sampling	Period	Median Noise Level[1] (dBA)	NPCC[2] Standard(dBA)	Japan Standard[3]	WB Guideline[4]
N1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	September 21, 2021 /0740H-0750H	Morning	51	50	55	55
		September 21, 2021 /1250H-1300H	Daytime	54	55		
		September 20, 2021 /1855H-1905H	Evening	51	50	45	45
		September 20, 2021 /2210H-2220H	Nighttime	49	45		
N-2	Sitio Luman Purok 6, Brgy. New Valencia Davao	September 22, 2021 /0710H-0720H	Morning	51	50	55	55
		September 21, 2021 /1440H-1450H	Daytime	62	55		
		September 21, 2021 /1950H-2050H	Evening	53	50	45	45
		September 21, 2021 /2125H-2225H	Nighttime	48	45		
N3	Cayot Residence, Bilusa, Bucana Brgy. 76-A	September 23, 2021 /0700H-0710H	Morning	56	50	55	55
		September 23, 2021 /1045H-1055H	Daytime	62	55		
		September 22, 2021 / 2005H-2015H	Evening	58	50	45	45
		September 22, 2021 / 2230H-2240H	Nighttime	51	45		

Notes: The three stations are categorized under Class A areas (a section or contiguous area which is primarily used for residential purposes),
1) Median of seven highest recorded noise levels
2) National Pollution Control Commission (NPCC) memorandum cicular No. 002, 1980
3) Notification of MoE, No. 14,1998. Daytime: 6:00-22:00, Nighttime: 22:00-6:00
4) Environmental, Health and Safety General Guidelines, 2007. Daytime: 7:00-22:00, Nighttime: 22:00-7:00

4.3.3.3 Impact to ambient noise level

The noise generated by the heavy equipment and vehicles can cause stress and nuisance to the people living nearby. Furthermor, the noise can also disturb the wildlife in the area

affecting their life cycle. Noise and other unwanted sounds produced by the heavy equipment operation can also cause hearing impairment to workers.

4.3.3.4 Mitigating Measures

Proper work scheduling – no operation during evening and nighttime in order not to disturb the resting time of the residents. Heavy equipment should be equipped with mufflers and maintained regularly throughout the construction period in order to minimize the noise that will be generated. The workers should be provided with appropriate personal protective equipment such as earplugs.

Table 46. 24 – hour Observed Sources of Noise, DFCDMP, Davao City

Sta.No.	Location	Period	Sources of Noise
N1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	Morning	Animal calls (i.e., birds, insects and roosters)
		Daytime	On-going construction nearby, back hoe operation & chirping birds
		Evening	Animal calls (i.e., frogs and insects)
		Nighttime	Animal calls (i.e., frogs and insects)
N2	Sitio Luman Purok 6, Brgy. New Valencia Davao	Morning	Community area and animal calls (i.e., birds and roosters)
		Daytime	On-going construction nearby, heavy equipment operation and passing vehicles
		Evening	Community area and animal calls (i.e., frogs and insects)
		Nighttime	Animal calls (i.e., frogs and insects)
N3	Cayot Residence, Bilusa, Bucana Brgy. 76-A	Morning	Fishing boat, playing music from community area and crowing rooster
		Daytime	Community area, playing music and children playing
		Evening	Fishing boat and playing music from community area
		Nighttime	Animal calls (i.e., frogs and insects)

Source: BSI, 2021

4.3.4 Vibration

4.3.4.1 Methodology

Vibration acceleration was measured by the use of a direct-reading vibration meter. The vibration meter is equipped with a vibration sensor and a magnetic base and gives a display of vibration peak velocity. Vibration is expressed in terms of frequency-weighted velocity units of millimeters per second (mm/s). Twenty-four (24) hours monitoring was conducted over hourly peak vibration velocity reading recorded per minute. The average of the peak vibration velocity readings was computed. **Figure 44** shows the location of the vibration measurement station.

4.3.4.2 Results and discussions

The station was situated in unpaved rocky ground. It is about 10 – 20 meters away from a construction site. Vegetation was also observed near the station. The activities happening during the time of measurement were on-going construction, heavy equipment operation, generator set and passing vehicles (i.e., light vehicle, heavy vehicles, and motorcycles). These activities contributed to the high average hourly vibration peak velocity during daytime period. Vibration peak velocity reading during monitoring was within the criteria for residential (**Table 47**).

Table 47. Vibration Peak Velocity Monitoring, DFCDMP, 2021

Station	Location	Date/Time		Vibration Peak Velocity* (mm/s)	
				Continuous	Impulsive
Criteria for exposure to vibration[c]			Daytime	**0.56[a]** **2.2[b]**	**17.0[a]** **36.0[b]**
			Nighttime	**0.4[a]** **2.2[b]**	**5.6[a]** **36.0[b]**
V - 1	Sitio Luman, Barangay New Valencia, Davao City	October 23 – 24, 2021	Daytime (0830H - 2130H; 0730H – 0830H	7.5	
			Nighttime (2230H – 0630H)	0.4	

Notes: [a]Residence, [b]Workshop, [c]Table C1.1 Department of Environment and Conservation, Australia
*Average of hourly peak vibration velocity reading
Reference: Vibration guideline value for operation of heavy machenety, JIS (Japan International Standard) F 0906, 1999 => 2 to 2.8 mm/s (good condition) and < 7.8 (rather bad)

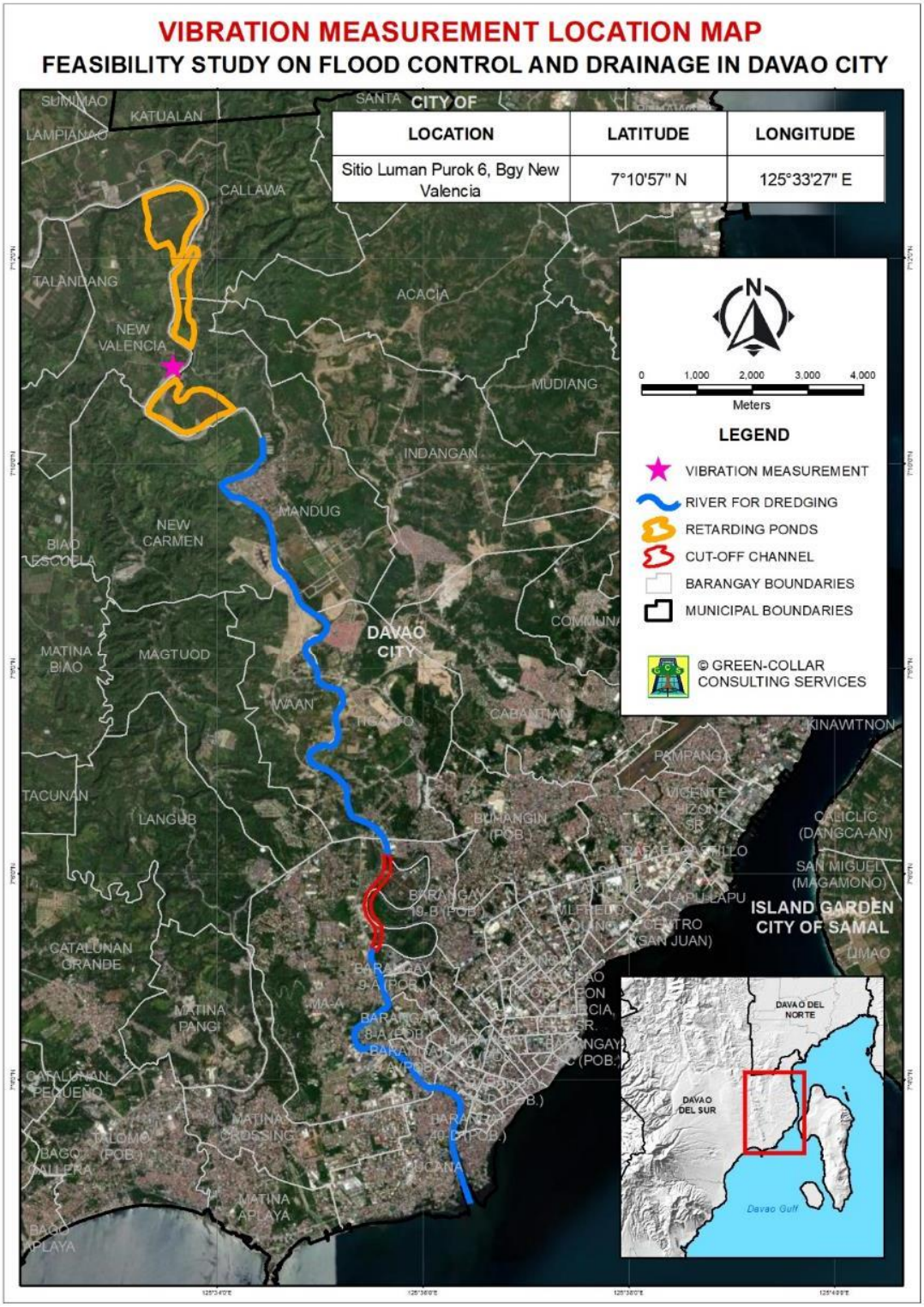


Figure 44. Vibration Measurement Location Map, DFCDMP, 2021

4.4 The People

4.4.1 Methodology

Under the DENR Administrative Order No. 2003 -30 and EMB Memorandum Circular No. 2007-002, the proponent conducted a social impact assessment as a component of this Environment Impact Statement report. With the assistance of Green-collar Consulting Services, the proponent studied the potential socio-economic effects and the community's perceptions towards the proposed flood control project in Davao River.

The EIS socio team adopted scientific procedures to produce valid and reliable results. Such methodologies included desk review; information, education, communication campaign; reconnaissance survey; and one-shot socio-economic and perception survey.

- ✓ Desk review - collection and analysis of secondary data, reports, relevant studies, and other pertinent data from reliable sources;
- ✓ Information, Education, and Communication Campaign – an IEC campaign was conducted in the thirteen (13) affected barangays in upstream, midstream, and downstream areas of Davao River in Davao City. The EIC campaign was done through field visits, community consultations, and distribution of IEC materials;
- ✓ Reconnaissance Survey - preliminary perception survey was also conducted to have initial information about views and opinions of project-affected people (PAPs) and to have an initial knowledge about the characteristics of project sites and affected communities; and
- ✓ Socio-economic and Perception Survey - A scientific investigation was conducted to characterize the socio-economic conditions of the affected households using the computer-assisted personal interview (CAPI) technique. A total of three hundred fifteen (315) respondents were interviewed using *Kobocollect* and *Kobotoolbox* applications. Of these samples, 140 are directly affected, while the rest (175) are indirectly affected. A right-coverage rule and Kish Grid were adopted to select respondents at barangay and household level to ensure randomness and avoid the chance of committing sampling error and data biases. **Table 48** presents the distribution of respondents by affected barangay
- ✓ For the dredging component, directly affected households refer to those residing within the easement zone of the Davao River. The team adopted the provisions stipulated in Article 51 of PD 1067 or the Water Code of the Philippines. The law states that "the banks of rivers and streams and the shores of the seas and lakes throughout their entire length and within a zone of three (3) meters in urban areas, twenty (20) meters in agricultural areas and forty (40) meters in forest areas, along their margins, are subject to the easement of public use in the interest of recreation, navigation, flotage, fishing, and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, flotage, fishing or salvage or to build structures of any kind". In addition, Article 55 of this PD also stipulates that "The government may construct necessary flood control structures in declared flood control areas, and for this purpose, it shall have a legal easement as wide as may be needed along and adjacent to the river bank and outside the bed or channel of the river." As to the retarding ponds and cut-off works, the team defined directly affected people as households within the 1-kilometer radius of the proposed project locations.

Table 48. Distribution of household-respondents, DCFCDMP

Affected Barangay	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
New Valencia	1	0.7	20	11.4	21	6.7
Callawa	3	2.1	20	11.4	23	7.3
Mandug	4	2.9	19	10.9	23	7.3
New Carmen	2	1.4	13	7.4	15	4.8
Tigatto	6	4.3	15	8.6	21	6.7
Waan	11	7.9	11	6.3	22	7.0
Ma-a	39	27.9	2	1.1	43	13.7
Barangay 19-B	3	2.1	14	8.0	17	5.4
Barangay 8-A	47	33.6	7	4.0	54	17.1
Barangay 5-A	6	4.3	10	5.7	16	5.1
Barangay 2-A	3	2.1	15	8.6	18	5.7
Barangay 1-A	7	5.0	14	8.0	21	6.7
Barangay 76-A	8	5.7	15	8.6	23	7.3
Total	140	100	175	100	315	100

4.4.2 Results and discussions

This section presents the results of socio-economic impact assessment conducted by the team. The report elaborates the profile of affected barangays along the Davao River, the socio-economic profile of directly and indirectly affected households, and their perceptions to the proposed project.

4.4.2.1 Profile of Davao City

The City of Davao is a coastal, highly urbanized city in the Davao Region. Although administratively independent due to its distinction as a highly urbanized city, Davao City is commonly grouped with the province of Davao del Sur. The city also serves as the regional center of the Davao Region.

The city has a land area of 2,443.61 square kilometers or 943.48 square miles. Its population, as determined by the 2020 Census, was 1,776,949. It accounted for 33.89% of the total population of the Davao Region. Based on these figures, the population density is computed at 727 inhabitants per square kilometer or 1,883 per square mile.

4.4.2.2 Profile of Project-Affected Barangays

This study examined the current conditions of the barangays affected by the proposed flood control project in Davao City. It uncovers demographics, geographics, financial services, social services, environmental management, and infrastructure and utilities of barangay New Valencia,

Callawa, Mandug, New Carmen, Tigattoo, Waan, Ma-a, 19-B, 8-A, 5-A, 2-A, 1-A, and 76-A. Below are the results of the systematic review of documents.

4.4.2.2.1 Barangay New Valencia

Demography. Barangay New Valencia is one of the barangays of Tugbok district. The population of Barangay New Valencia is not as substantial as the other barangays considered in this project. The present population, however, is almost double than its 2000 population. Its 2020 population accounts for 0.13% of the total population of Davao City (**Table 49**).

Table 49. Demographic characteristics of barangay New Valencia.

Population, PSA 2020 census	2,278
Population, PSA 2015 census	1,679
Estimated Number of Households, 2015*	420
Population, PSA 2010 Census	1,516
Population, PSA 2007 Census	1,443
Population, PSA 2000 Census	1,147

Source: PSA

In 2015, an average household has 3.72 members, down from 5.13 in 1990. According to the same census, the 5 to 29 age group accounted for over 46% of the total population, with the 5 to 9 age group accounting for 11.8% of the total population. The median age of the population was 25 years. Overall, 60 individuals aged 14 and below and 65 and over financially depend on the 100 economically active population. This is quite a heavy burden for the community. Out of this figure, 54 young individuals and 6 elderlies depend on the 100-working population.

Geography. Barangay New Valencia has an area of 954.12 hectares. The barangay is identified as a riverbank in a rural area. In terms of land use, the Agricultural Non-Tillage category occupied the highest area of about 538.93 hectares. Non tillage is an agricultural technique for growing crops or pasture without disturbing the soil through tillage such as production areas for tropical fruit tress and industrial crops. No tillage decreases the amount of soil erosion tillage causes in certain soils, especially in sandy and dry soils on sloping terrain. Also, the barangay prioritizes floodway mitigation as it allocated 176.31 hectares of mitigating flood zone (**Table 50**). Floodway mitigation involves the management and control of flood water movement, such as redirecting flood run-off using floodwalls and flood gates, rather than trying to prevent floods altogether.

Using the Land Resource Information System (LARIS), the soils in Davao City are classified into seven series and one miscellaneous land type. A soil series is a group of soils with similar profiles developed from similar parent materials under comparable climatic and vegetational conditions. The different soil series have been categorized into three groups depending on the topographic position they occupy in the landscape. These three soil groups are the following: (1) soils of the plains and valleys; (2) soils in the intermediate uplands; (3) soil of hills and mountains. The soil in the area belongs to the Tugbok series with clay as its soil type. Tugbok clay falls under intermediate upland. The parent materials from Tugbok clay is from andesites, an igneous rock. Plants with tolerance of waterlogging, compaction, or poor aeration should be favored in clayey

soils. Highland crops such as rice, Broccoli, cabbage, cauliflower, beans (bush or pole) and peas grow best in clay soils. Majority of its area has an elevation lower than 100 meters above sea level. Elevation was estimated at 140.1 meters or 459.6 feet above mean sea level. Elevation influences climate, as well as where and how people live. As elevation decreases below 300 m, the modal population density increases rapidly to >500 people/km^2 below 100 m above sea level. Generally, health conditions drive people to lower elevations where oxygen levels are higher, and living is easier. For every 100-meter rise in elevation, the temperature drops 0.6°C. The area is evenly distributed in various sloping conditions, while 248.60 hectares are recognized as Undulating to Unrolling Range (8-8%).

Table 50. Geographic characteristics of barangay New Valencia.

Land Area, (in has), OCPDC-GIS	**954.12**
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	37.15
Number of Puroks, OCPDC-RSD	7
Locational Characteristic	Riverbank
Rural/Urban Classification	Rural
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	176.31
Rural Settlement Area	74.43
Prime Agricultural	164.45
Agricultural Non-Tillage	538.93
Total	954.12
Soil Classification, CAO	Tugbok Clay
Elevation (in has.), OCPDC-GIS	
>100 m	594.62
101 - 300 m	359.50
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	229.08
Gently Sloping to Undulating Range (3-8%)	213.43
Undulating to Unrolling Range (3-8%)	248.60
Rolling to Moderately Steep Range (18-30%)	142.93
Steep Range (30-50%)	120.08

Economic Services. In terms of the barangays' economic opportunities, four commercial and industrial establishments are present, specifically micro-level (1), small (1), and large (1) establishments employing a total of 11 individuals (Table 51). Micro businesses in the Philippines can be classified according to the size of assets, size of equity capital, and number of employees. A typical micro business is a business that employs nine people or fewer, with assets of ₱3 million and below. The PSA classifies an enterprise as a micro if it has less than 10 employees, small if it has 10-99 employees, medium with 100-199 employees, and large if it has 200 or more employees. In the Philippines, about 90 percent of all businesses are categorized as micro businesses. These consist of enterprises engaged in industry, agribusiness and or services, whether single proprietorship, cooperative, partnership or corporation. Their total assets, inclusive of those arising from loans but exclusive of the land on which the particular business

entity's office, plant and equipment are situated, have value of not more than ₱3 million. The MSMEs account for most businesses in the Philippines and are important contributors to job creation and global economic development. They represent about 90% of businesses and more than 50% of employment worldwide. Formal SMEs contribute up to 40% of national income (GDP) in emerging economies.

Table 51. Economic services in barangay New Valencia.

Commercial and Industrial Establishments, Bus. Bureau, 2019	Value
Micro	
Number	1
Total Capitalization	200,000.00
Declared No. of Employees	3
Small	
Number	1
Total Capitalization	550,000.00
Declared No. of Employees	2
Medium	
Number	0
Total Capitalization	0.00
Declared No. of Employees	0
Large	
Number	1
Total Capitalization	10,800,000.00
Declared No. of Employees	6

Social Services. Table 52 presents the summary of the basic social services offered in Barangay New Valencia. There is one health center to serve the community with three health workers and two nutrition scholars. Regarding health indicators, about 68.36% of the children aged 11 months old and below were immunized, and the prevalence of severely underweight children aged 0-71 months old is unobservable. Regarding education, there are two (2) Public Elementary Schools in the barangay. In addition, there are two daycare centers established in the barangay, while a secondary public school is located in a nearby barangay.

Environmental Management. Burying is the method of garbage disposal practiced by the community. Moreover, a material recovery facility can be found in the barangay, as reported by City Environment and Natural Resources (CENRO) office.

Table 52. Social services in barangay New Valencia.

Type of Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	3
No. of Barangay Nutrition Scholars	2
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	68.36
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.00
School Facilities, Dep.Ed 2019	2
Public Schools	2 (Elementary School)
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	2

Infrastructure and Utilities. Davao Light and Power Company provides electricity to the barangay, like all other areas in Davao City. In addition, there are 67 streetlights in the barangay distributed throughout the site (**Table 53**).

The barangay's water system is Level 2. This water supply facility comprises a source, a reservoir, a piped distribution network with an adequate treatment facility, and communal faucets. Further, within the barangay, three level 2 water systems are conditioning.

Table 53. Infrastructure and utilities in barangay New Valencia.

Utility	Provider/Number
Power, DLPC 2019	DLPC
Number of Streetlights	67
Water System, DCWD, CEO, 2019	
Level II, *(no. of units)*	3

4.4.2.2.2 Barangay Callawa

Demography. The population of Barangay Callawa is erratic due to the upward and downward swings from 2000 to 2007 censuses. There was a general increase in its population, yet a decline is observed from the latter years as compared to 2010. In 2020, the PSA recorded a 2.21% population growth rate of this barangay. From 3,553, the population bloated to 3,941 in 2020 (**Table 54**). The 2020 population figure represented 0.22% of the total population of Davao City. Based on the the 2015 census on population, the estimated number of individuals in each household was 3.93, a marked improvement from the 5.65 individuals in 1990. The 10 to 14 age group posted the highest population at 418 individuals. The 80 and over age group had the lowest

population with 26 individuals. The median age in Barangay Callawa is 24. The computed Age Dependency Ratios revealed that 65 young and old members depend on 100 working age population. This is broken down as follows: 57 youths (14 years old and below) and 8 old aged individuals depend on 100 of the working age population (*https://www.philatlas.com/mindanao/r11/davao-city/callawa.html).*

Table 54. Demographic characteristics of barangay Callawa

Population 2020	3,941
Population, PSA 2015 census	3,553
Estimated Number of Households, 2015*	888
Population, PSA 2010 Census	2,848
Population, PSA 2007 Census	3,026
Population, PSA 2000 Census	2,483

Source: PSA

Geography. Barangay Callawa has a land area of 1354.75 hectares within a riverbank in a rural setting. In terms of land use, most of the site was allocated for agricultural non-tillage with a total area of 790.90 hectares, while 546,64 hectares were allocated for floodway mitigation. The soil comes from Cabantian series and clay is its soil type. The parent materials came from soft shales with mix of weathered gravels and pebbles. The site is a little bit elevated, less than 200 meters above sea level (**Table 55**). Elevation of Barangay Callawa is estimated at 41.5 meters or 136.2 feet above mean sea level.

It is important to remember that while there is no large establishment officially recorded, the Callawa Develoment Corporation (CADECO) is based in Barangay Callawa. It is part of the three (3) parcels of land in Davao which is operated by Lapanday Agricultural Development Corporation (LADC) w hich was acquired by the Lorenzos in 1982. These three (3) parcels of land comprising of 1,270 hectares are directly owned and managed (Guihing Agricultural Development, Lapanday Agricultural Corp, and Cadeco Farms) by LADC. These also formed the historical roots of the Lapanday Food Corporation (LFC). Beginning in 1997, LFC has expanded its area in the different parts of Mindanao and diversified its products. Lapanday introduced the first Philippine brands of fresh fruit to the global market: “Mabuhay,” “Estrella,” and “Aloha” were all grown and packed in farms owned and managed by Lapanday and then made available in grocery stores in China, Japan, the Middle East, Korea and other countries in Asia and the Pacific rim. The Lapanday Foods Corporation is a grower, supplier, and exporter of farm-fresh bananas, asparagus and pineapples from the Philippines to international markets and is employing 5,001-10,000 employees. The Lapanday Foods Corporation employs 5,001-10,000 employees. The Lapanday Foods Corp with Certificate of Registration of Growers/ Farmers issued by the BPI in July 2019, July 2018, October 2018 and November 2018 is based in Lanang, Davao City. The average salary for Lapanday Foods Corporation employees in Philippines is ₱628, 571 per year.

Table 55. Geographic characteristics of barangay Callawa

Geographic Characteristic	Area/Type
Land Area, (in has), OCPDC-GIS	1354.75
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	25.49
Number of Puroks, OCPDC-RSD	15
Locational Characteristics	Riverbank
Rural/Urban Classifications	Rural
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	546.64
Rural Settlement Area	17.15
Prime Agricultural	0.06
Agricultural Non-Tillage	790.90
Total	1,354.75
Soil Classification, CAO	Cabantian Clay
Elevation (in has.), OCPDC-GIS	
>200 m	1,269.19
201 - 500 m	85.56
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	791.14
Undulating to Unrolling Range (8-8%)	316.40

Social Services. The social services available to the community are shown in **Table 57**. There has 1 health center with 5 health workers and 2 nutrition scholars. In terms of its health indicators, 95.67% of the children aged 11 months old and below were immunized, and only 0.19% of its 0–71-month-old children population is severely underweight. There are three (3) Public Schools, 1 for elementary, 1 for high school, and the other for senior high school. In addition, the barangay also has 5 Day Care Centers.

Table 56. Economic services in barangay Callawa

Nature	
Commercial & Industrial Establishment, Bus. Bureau, 2019	
Micro	
Number	22
Total Capitalization	2,244,500.00
Declared No. of Employees	85
Small	
Number	1
Total Capitalization	550,000.00
Declared No. of Employees	4
Medium	
Number	0
Total Capitalization	0.00
Declared No. of Employees	0
Large	
Number	0
Total Capitalization	0.00
Declared No. of Employees	0

Table 57. Social services in barangay Callawa

Type of Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	5
No. of Barangay Nutrition Scholars	2
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	95.67
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.19
School Facilities, Dep.Ed 2019	3
Public Schools	1 (Elementary School) 1 (High School) 1 (Senior High School)
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	5

Environmental Management. The garbage disposal practice in the barangay is through the collection which is initiated by the local government. Also, the barangay has no material recovery facility, as reported by the City Government.

Infrastructure and Utilities. The Davao Light and Power Company is the primary provider of power in Barangay Callawa. One hundred twenty-six streetlights are installed and well-distributed throughout the barangay (**Table 58**).

As to the supply of water, Barangay Callawa has Levels I and II water supply systems. The former is a protected well or a developed spring with an outlet but without a distribution system, generally adaptable for rural areas where the houses are thinly scattered. At the same time, the latter is a water supply facility composed of a source, a reservoir, a piped distribution network with an adequate treatment facility, and communal faucets. In addition, there are 18 level 1 water systems within the barangay, while there are 4 level 2 water systems.

Barangay Callawa has been identified as one of the five (5) potential sites for a second international airport in Davao as endorsed by the Regional Development Council (RDC) to the Department of Transportation (DoTr) as the national government prepares to bankroll the expansion of the Davao International Airport (DIA). The other sites include Tagum City, Davao del Norte; Samal Island; and Sta. Maria, Davao del Sur. The expansion of the DIA, also known as the Francisco Bangoy International airport located in Davao City, is expected to be rolled out soon as the national government has taken it off the public-private partnership (PPP) lineup and included it in the list of projects for public funding.

Table 58. Infrastructure and utilities in barangay Callawa

Utility	Number
Power, DLPC 2019	
Number of Streetlights	126
Water System, DCWD, CEO, 2019	
Level I, *(no. of units)*	18
Level II, *(no. of units)*	4

4.4.2.2.3 Barangay Mandug

Demography. The population of Barangay Mandug is increasing at an increasing rate. From 12,362 residents in 2007, it went up to 13,594 in 2015, and 15,296 in 2020. Based on 2015 and 2020 populations, the barangay registered a 2.51% population growth rate (**Table 59**). The 2020 population represented 0.86% of the total population of Davao City.

Based on the 2015 census on population, there were 4.2 members per household. This is an improvement from the 5.43 individuals in 1990. The age group with the highest population in Mandug is 5 to years old bracket posted the highest frequency *at* 1,419 individuals while the 80 and over age bracket registered 109 individuals. The median age of the population in Mandug was 26 years indicating that half of the entire population is aged less than 26 and the other half are over the age of 26. Overall, the total depency ration was 57 dependents (young and old-age) to every 100 of the working population broken down as 47 youth dependents and 9 aged/senior citizens to every 100 of the working population.

Table 59. Demographic characteristics of barangay Mandug

Population 2020	15,296
Population, PSA 2015 census	13,594
Estimated Number of Households, 2015*	3,399
Population, PSA 2010 Census	13,234
Population, PSA 2007 Census	12,362
Population, PSA 2000 Census	12,004

Source: PSA

Geography. The barangay has a land area of 969.19 hectares. Its location is a riverbank in an urban setting. In terms of its land use, most of the area was allocated for Agricultural Non-Tillage (299.63 has), floodway mitigation (212.10 has), and Planned Unit Development (200.90 has). A large site is also devoted to prime agricultural commodities (111.76 has). The soil is derived from Faraon and Cabantian series with clay as its soil type. The area has an elevation of less than 200 meters above sea level, and most of the area is nearly flat (**Table 60**).

Economic Services. Various commercial and industrial establishments mainly perform the barangays' economic opportunities. Most of it belongs to a micro-level of about 104. Also, small (24), Medium (4), and large (2) level establishments are operating in the community. These

establishments employ 352 individuals, though not as massive as the others, but a good source of employment in the community (**Table 61**).

Like CADECO in Callawa, same could be said of LADECO because LADECO is under LFC whose official address is Lanang. The Lapanday Group of Companies continued its expansion programs in South Cotabato; Sto. Tomas, Panabo; Kapalong from Del Monte, Hagonoy, Igpit, and Malalag in Davao del Sur; and, Mabini, Compostela Valley. With the fast-growing business, Lapanday needed to strengthen its supply chain capability. It built a Cold Storage facility in the Madaum Port, Tagum in 1998 followed by a Box Manufacturing Plant in Barangay Mandug, Davao City in 2004. The latter has since supplied all of the company's box requirements and complemented the company's Plastic Manufacturing Plant located in the same area. The Lapanday Aricultural Development Corporation banana plantation was once located in Barangay Mandug providing livelihood to thousands of employees. The banana plantation was replaced by the Box Manufacturing

Table 60. Geographic characteristics of barangay Mandug

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	969.19
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	14.06
Number of Puroks, OCPDC-RSD	28
Locational Characteristics	Riverbank
Rural/Urban Classifications	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	212.10
Institution	4.81
Medium Density Residential	122.70
Low Density Residential	17.30
Prime Agricultural	111.76
Agricultural Non-Tillage	299.63
Planned Unit Development	200.90
Total	969.19
Soil Classification, CAO	Cabantian /Faraon Clay
Elevation (in has.), OCPDC-GIS	
>200 m	969.19
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	746.08
Gently Sloping to Undulating Range (3-8%)	82.39
Steep Range (30-50%)	34.21

Table 61. Economic services in barangay Mandug

Economic Service	Number
Commercial & Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	104
Total Capitalization	11,795,518.62
Declared No. of Employees	261
Small	
Number	24
Total Capitalization	20,748,861.00
Declared No. of Employees	63
Medium	
Number	4
Total Capitalization	10,700,001.00
Declared No. of Employees	22
Large	
Number	2
Total Capitalization	20,750,000.00
Declared No. of Employees	6

Social Services. Being in the urban setting, more social services of the barangay are available. They have one health center to serve the community with six health workers and three nutrition scholars. Regarding its health indicators, 92.22% of the children aged 11 months old and below were immunized, and apparently, the prevalence of severely underweight children aged 0-71 months old is only 1.02%. Regarding education provision, nine are present, six from the public and three from the private sector. Additionally, 4 Day Care Centers can be found in the barangay (**Table 62**).

Table 62. Social services in barangay Mandug

Social Services	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	6
No. of Barangay Nutrition Scholars	3
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	92.22
Prevalence Rate of Severely Underweight Children aged 0-71 months	1.02
School Facilities, DepEd 2019	9
Public Schools	4 (Elementary School) 1 (High School) 1 (Senior High School)
Private Schools	2 (Elementary School) 1 (Elementary and High School)
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	4

Environmental Management. As observed in the barangay, the local government collected the garbage by schedule. In addition, a material recovery facility is missing in the barangay.

Infrastructure and Utilities. The expanse of Davao Light and Power Company had reached Barangay Mandug installing 359 streetlights in various areas. In addition, the company also lit up 359 streetlights in the community. Level 1 and Level 2 water supply systems in the barangay serve the community. There are 11 Level 1 water systems within the barangay, while there are 4 level 2 water systems (**Table 63**).

Table 63. Infrastructure and utilities in barangay Mandug

Utility	Number
Power, DLPC 2019	
Number of Streetlights	359
Water System, DCWD, CEO, 2019	
Level I, *(no. of units)*	11
Level II, *(no. of units)*	4

4.4.2.2.4 Barangay New Carmen

Demography. Barangay New Carmen's population is not as massive as the other communities involved in this project. A 2.79% growth rate in population, however, was observed from 2015 to 2020. This data suggests that New Carmen's population is increasing at an increasing rate over time (**Table 64**).

Table 64. Demographic characteristics of barangay New Carmen

Population Projection 2020, OCPDC	2,942
Population, PSA 2015 census	2,626
Estimated Number of Households, 2015*	657
Population, PSA 2010 Census	1,961
Population, PSA 2007 Census	1,720
Population, PSA 2000 Census	1,541

Source: PSA

Using the 2015 census on population, the median age of the total population is 20 years. There are 4.5 members in a household. The total dependency ratio was 72 dependents (young and old-age) to every 100 of the working population. Of this figure, 66 youths are dependent to 100 of the working age population and 6 aged/senior citizens are dependent to every 100 of the working population.

Geography. As can be seen from **Table 65,** Barangay Carmen has a total land area of 1,107.9 hectares. The barangay is classified as rural area dominated by a river bank. More than half of the total land area is used for Agricultural Non-Tillage (688.84 hectares), while 184 hectares are utilized for Prime Agricultural production. In addition, about 100.07 hectares are reserved for

floodway mitigation purposes. The barangay has a clay soil type and is a soil series originating from Tugbok. Plants with tolerance of waterlogging, compaction, or poor aeration should be favored in clay soils. The elevation is mostly less than 100 meters above sea level, with an area of 711.81. The majority is rolling to a moderately steep range (18-30%) in sloping.

Economic Services. Regarding the barangays' economic opportunities, there are five (5) micro enterprises and one (1) small level enterprise. These recognized commercial and industrial establishments employed 40 individuals in total. No medium and large establishments are present in the community (**Table 66**).

Social Services. Social services are observable in the community. One (1) health center is operational and serves the community with three (3) health workers and two (2) nutrition scholars. About 92.54% of children aged 11 months old and below were immunized. The prevalence of severely underweight children aged 0-71 months old is about 2.04%. In terms of education, only one elementary public school in the community is present, and one (1) Day Care Center is operational and functional (**Table 67**).

Table 65. Geographic characteristics of barangay New Carmen

Geographic Characteristics	Number/Type
Land Area, (in has), OCPDC-GIS	1,107.9
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	39.69
Number of Puroks, OCPDC-RSD	7
Locational Characteristics	Riverbank
Rural/Urban Classifications	Rural
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	100.07
Rural Settlement Area	66.02
Prime Agricultural	184.00
Agricultural Non-Tillage	688.84
Waste Management Treatment Utilization Disposal	15.42
Planned Unit Development	14.12
Marginal	39.46
Total	1,107.93
Soil Classification, CAO	Tugbok Clay
Elevation (in has.), OCPDC-GIS	
>100 m	711.81
101 - 300 m	388.88
301-500m	7.24
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	172.20
Gently Sloping to Undulating Range (3-8%)	198.83
Rolling to Moderately Steep Range (18-30%)	695.40
Steep Range (30-50%)	41.49

Environmental Management. In the community, the method of garbage disposal is through burying. It can be due to the distance of the area from the nearest accessible road for most households. Also, the barangay has no material recovery facility for the proper disposal and management of household wastes.

Table 66. Economic services in barangay New Carmen

Economic Services	Number
Commercial & Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	5
Total Capitalization	725,000.00
Declared No. of Employees	8
Small	
Number	1
Total Capitalization	500,000.00
Declared No. of Employees	32
Medium	
Number	0
Total Capitalization	0.00
Declared No. of Employees	0
Large	
Number	0
Total Capitalization	0.00
Declared No. of Employees	0

Table 67. Social services in barangay New Carmen

Social Services	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	3
No. of Barangay Nutrition Scholars	2
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	92.54
Prevalence Rate of Severely Underweight Children aged 0-71 months	2.04
School Facilities, Dep.Ed 2019	1
Public Schools (Elementary)	1
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	1

Infrastructure and Utilities. Davao Light and Power Company solely provides the city with an electricity source, such as Barangay Carmen. In addition, the company had installed nine streetlights distributed throughout its vicinity (**Table 68**).

The barangay has a Level 1 water supply system. It is a protected well or a developed spring with an outlet without a distribution system, generally adaptable for rural areas where the houses are thinly scattered. Based on the record, there are four protected wells in the community.

Table 68. Infrastructure and utilities in barangay New Carmen

Utility	Number
Power, DLPC 2019	
Number of Streetlights	9
Water System, DCWD, CEO, 2019	
Level II, *(no. of units)*	4

4.4.2.2.5 Barangay Tigatto

Demography. The population of Tigatto has an observed massive increase from 2000 to 2015 with a 229% increase. This can be attributed to the area's recent development, just like subdivisions and residential areas. However, the population of this barangay declined by 7.76% in 2020, as reported by the PSA (**Table 69**). The 2020 population represents 1.40% of the total population of Davao City. The number of households in 2015 was estimated at 7.48, a marked increase from the 5.30 in 1990.

Table 69. Demographic characteristics of barangay Tigatto

Population 2020	24,795
Population, PSA 2015 census	36,387
Estimated Number of Households, 2015*	9,097
Population, PSA 2010 Census	14,533
Population, PSA 2007 Census	13,631
Population, PSA 2000 Census	11,053

Source: PSA

According to the 2015 Census, the 15 to 19 years old age group posted the highest population with 4,877 individuals. The median age was 19 years old, indicating that half of the total population of Tigatto is aged less than 19 and the other half is over the age of 19. This is a very young population. The ≥ 80-year-old age group registered the lowest population with 73 individuals. Computing the age dependency ratios, there are 67 dependents (young and old-age) to every 100 of the working population. This is broken down as follows: there are 64 youth dependents to every 100 population of the working age population and 3 aged/senior citizens to every 100 working, population.

Geography. Barangay Tigatto has an area of 761.31 hectares. The location is identified as a riverbank in an urban setting. In terms of land use, it is evident that most of the area was allocated for floodway mitigation with 294.53 hectares. However, there is also apportioned huge land for High-Density Residential (127.12 has), Low-Density Residential (114.69 has), and Planned Unit Development (90.69 has). The soil of barangay Barangay Tigatto originated from Cabantian series whose parent materials are soft shales with a mix of weathered gravel and pebbles. The soil type is clay and an elevation less than 200 meters above sea level and is nearly level in slope (**Table 70**).

Table 70. Geographic characteristics of barangay Tigatto

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	761.31
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	10.46
Number of Puroks, OCPDC-RSD	16
Locational Characteristics	Riverbank
Rural/Urban Classifications	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	294.53
Institution	1.02
Major Commercial	1.79
High Density Residential	127.12
Medium Density Residential	66.00
Low Density Residential	114.69
Infrastructure/Utilities	8.40
Agricultural Non-Tillage	56.71
Planned Unit Development	90.69
Open Space	0.37
Total	761.31
Soil Classification, CAO	Cabantian Clay
Elevation (in has.), OCPDC-GIS	
>200 m	761.31
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	525.96
Gently Sloping to Undulating Range (3-8%)	190.89
Undulating to Unrolling Range (8-8%)	44.46

Economic Services. In terms of the barangays' economic opportunities, various establishments are present. However, most of it belongs to micro-level establishments. Also, small (57), Medium (7), and large (8) scale establishments are also operating in the community, which employ 770 individuals (**Table 71**).

Social Services. The social services of the barangay are vividly available. The barangay has 1 health center serving the community with 8 health workers and 3 nutrition scholars. About 70.85% of the children aged 11 months old and below were immunized. In addition, the prevalence of severely underweight children aged 0-71 months old is less than 1% or about 0.63% only (**Table 72**).

The educational facility is present in the community as well. There are 5 schools from the public and private sectors. Specifically, the barangay has 1 elementary public school and 1 private elementary school. In addition, 1 private high school and 2 private senior high schools are situated in the area. Furthermore, there are 6 Daycare Centers in the community.

Table 71. Economic services in barangay Tigatto

Commercial and Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	205
Total Capitalization	23,065,400.00
Declared No. of Employees	348
Small	
Number	53
Total Capitalization	42,933,012.75
Declared No. of Employees	166
Medium	
Number	12
Total Capitalization	38,958,000.08
Declared No. of Employees	118
Large	
Number	10
Total Capitalization	117,572,501.00
Declared No. of Employees	138

Environmental Management. The garbage disposal practice in the barangay is through regular collection done by the local government. As recorded, the barangay has no Material recovery facility.

Table 72. Social services in barangay Tigatto

Social Service	**Number**
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	8
No. of Barangay Nutrition Scholars	5
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	70.85
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.63
School Facilities, Dep.Ed 2019	5
Public Schools (elementary)	1
Private Schools (elementary (High school) (Senior high school	1 1 2
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	6

Infrastructure and Utilities. Davao Light and Power Company solely provides electric power to Davao City's entirety. In Tigatto, 499 streetlights are installed throughout the barangay's vicinity (**Table 73**).

In terms of its water system, the water systems observed are the Level 1 or a protected well or a developed spring with an outlet but without a distribution system, generally adaptable for rural areas where the houses are thinly scattered, and Level 2 or a water supply facility composed of a source, a reservoir, a piped distribution network with an adequate treatment facility, and communal faucets.

Table 73. Infrastructure and utilities in barangay Tigatto

Utility	Number
Power, DLPC 2019	
Number of Streetlights	499
Water System, DCWD, CEO, 2019	
Level I, *(no. of units)*	4
Level II, *(no. of units)*	4

4.4.2.2.6 Barangay Waan

Demography. Barangay Waan has a population of 3,925 in the year 2015 (**Table 74**). Compared to the year 2000, the 2015 population increased about 65%. The population continues to grow in 2020 with a 2.92% growth rate (4,500 individuals). The average household size is 4.54 members per household in 2015. This is down from the 5.14 members in 1990. The median age in Barangay Waan is 23. Overall, the age dependency ratio was 57. This implies a huge burden to the working members. Of this total figure, 53 youths and 4 aged/senior citizens depend on every 100 of the working population.

Table 74 Demographic characteristics of barangay Waan

Population 2020, OCPDC	4,500
Population, PSA 2015 census	3,925
Estimated Number of Households, 2015*	981
Population, PSA 2010 Census	3,179
Population, PSA 2007 Census	2,654
Population, PSA 2000 Census	2,379

Source: PSA

Geography. Barangay Waan has an area of 436.97 hectares and is identified as a riverbank in a rural setting (**Table 75**). Regarding its land use, it is allocated for the Agricultural Non-Tillage with 183.28 hectares. However, floodway mitigation is also a large area of about 166.11 hectares. The barangay has a clay soil classification with an elevation less than 200 meters above sea level and has a slope of nearly level (0-3%). The land form and land cover in Barangay Waan is highly diverse,

ranging from lowland, agricultural, plantations, and upland agriculture. This is suitable for growing diverse agricultural crops.

Economic Services. Various commercial and industrial establishments are present in the barangay in terms of the barangays' economic opportunities. Most of it is micro-level establishments of about 25 in number. Also, small (2), Medium (3), and large (1) level establishments are observed in the community. These establishments employ a total of 100 individuals (**Table 76**). These economic players are benefiting the employees and the barangay through taxes and boosted economic activities.

Table 75. Geographic characteristics of barangay Waan

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	436.97
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	13.26
Number of Puroks, OCPDC-RSD	14
Locational Characteristics	Riverbank
Rural/Urban Classifications	Rural
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	166.11
Institution	4.93
Major Commercial	1.50
Low Density Residential	59.84
Infrastructure/Utilities	3.91
Agricultural Non-Tillage	183.28
Planned Unit Development	5.41
Open Space	0.13
Special Use	0.00
Marginal	11.87
Total	436.97
Soil Classification, CAO	Cabantian Clay
Elevation (in has.), OCPDC-GIS	
>200 m	436.97
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	436.97

Social Services. The community's social services are observed, especially about health and education. The community has 1 health center to serve the community with 9 health workers and 1 nutrition scholar in terms of health. About 4.34% of the children aged 11 months old and below were immunized. Also, 1.82% of the children aged 0-71 months old are severely underweight (**Table 77**).

In terms of education, facilities from the public schools are present with 1 elementary, 1 high school, and 1 senior high school. Also, there are 3 Day Care Centers are operating in the barangay.

Table 76. Economic services in barangay Waan

Commercial and Industrial Establishments, Bus. Bureau, 2019	Number
Micro	
Number	25
Total Capitalization	3,730,000.00
Declared No. of Employees	51
Small	
Number	2
Total Capitalization	1,305,000.00
Declared No. of Employees	4
Medium	
Number	3
Total Capitalization	8,000,000.00
Declared No. of Employees	21
Large	
Number	1
Total Capitalization	20,264,667.86
Declared No. of Employees	24

Environmental Management. The garbage in Barangay Waan is collected based on a schedule. The LGU of Davao City initiates this method. As observed, no Material recovery facility is observed in the barangay.

Table 77. Social services in barangay Waan

Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	9
No. of Barangay Nutrition Scholars	1
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	84.34
Prevalence Rate of Severely Underweight Children aged 0-71 months	1.82
School Facilities, Dep.Ed 2019	3
Public Schools - Elementary	1
- High School	1
- Senior High School	1
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	3

Infrastructure and Utilities. Davao Light and Power Company provides power to the barangay. In addition, there are 94 installed streetlights distributed throughout barangay Waan. Also, the barangay was served by Level I and II water systems. The former has 10 units, while there later has 4 operational water systems (**Table 78**).

Table 78. Infrastructure and utilities in barangay Waan

Utility	Number
Power, DLPC 2019	
Number of Streetlights	94
Water System, DCWD, CEO, 2019	
Level I, *(no. of units)*	10
Level II, *(no. of units)*	4

4.4.2.2.7 Barangay Ma-a

Demography. Barangay Maa had a population of 58,874 in 2020. This represents 3.31% of the total population of Davao City. An increasing movement of the population is observed from 2000 to 2015. The latest census figures in 2020 denote a negative growth rate of 0.33%, or a decrease of 929 people, from the previous population of 59,803 in 2015. It is expected that the population will increase in the coming years due to massive economic growth and development (**Table 79**). In 2015, there were 3.6 members in a household, a remarkable decrease from 5.35 members in a household in 1995.

Table 79. Demographic characteristics of barangay Ma-a

Population 2020	58,874
Population, PSA 2015 census	59,803
Estimated Number of Households, 2015*	14,951
Population, PSA 2010 Census	49,915
Population, PSA 2007 Census	51,299
Population, PSA 2000 Census	39,578

Source: PSA

According to the 2015 census of population, the age group with the highest population in Ma-a is *20 to 24*, with 7,474 individuals. As usual, the 80 and over age group registered the lowest population, with 291 individuals. The mean age of the total population is 24.9 years. The computed age dependency ratio is 43 to every 100 economically working population. The mean dependency ratio among youths is 38 while for the aged/senior citizens group is 5 to every 100 of the economically working population.

Geography. Barangay Maa has 999.38 hectares. It is an inland riverbank based on its area in an urban setting. In terms of its land use, the vast area is reserved for primary commercial and floodway mitigation with 234.13 hectares and 230.549 hectares, respectively. Apart from the abovementioned, another principal apportionment is for the Low-Density Residential, High-Density Residential, and Medium Density Residential. The barangay has clay-type soil, where approximately half of the area is nearly level while the other half is a P-Rolling to Moderately Steep Range (**Table 80**). Elevation is estimated at 17.9 meters or 58.7 feet above mean sea level.

Economic Services. Barangay Maa is a populated place. It is an agglomeration of buildings where people live and work. There are several hotels, inns, parks, restaurants, high end subdivisions,

town houses, condominiums and other business establishments in Barangay Maa that provide entertainment and livelihood to a lot of people. In terms of the barangays' economic opportunities, various establishments are present. Most of it belongs to a micro-level, which is 710 in number. Also, small (328), Medium (193), and large (83) level establishments are observed in the community. These establishments employ 9,703 individuals, a considerable employment generation for the community (**Table 81**).

Table 80. Geographic characteristics of barangay Ma-a

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	999.38
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	4.97
Number of Puroks, OCPDC-RSD	63
Locational Characteristic	Inland/Riverbank
Rural/Urban Classification	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	230.549
Institution	42.722
Major Commercial	234.130
High Density Residential	107.281
Medium Density Residential	99.921
Low Density Residential	140.318
Socialized Housing	20.102
Light Industrial	0.684
Infrastructure/Utilities	3.706
Planned Unit Development	0.479
Tourism Development	13.345
Urban Ecological Enhancement	65.834
Conservation	2,202
Open Space	0.205
Special Use	37.905
Total	999.383
Soil Classification, CAO	Cabantian Clay
Elevation (in has.), OCPDC-GIS	
>200 m	999.383
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	495.316
O-Undulating to Unrolling Range (8-8%)	1.292
P-Rolling to Moderately Steep Range (18-30%)	502.776

Social Services. In the urban setting, the barangay has an available social service. There is a health center to serve the community with 3 health workers and 8 nutrition scholars. However, less than half of the children aged 11 months old and below were immunized (35.50% of its population). In addition, the prevalence of severely underweight children aged 0-71 months old is observed at 1.77% (**Table 82**).

The barangay has 27 academic institutions; four (4) are public schools, 16 are private, and 7 provide vocational education. Moreover, there are 10 Day Care Centers installed in the barangay.

Also, there is the presence of Forest Lake Memorial Park in Maa, Davao City which provide all the social, environmental, economic, and health benefits parks to the city and its people. The parks are centers for activity, attract visitors, serve as community signature pieces, offer a venue for cities to hold exercise activities, gatherings, and host other events.

Table 81. Economic services in barangay Ma-a

Commercial and Industrial Establishment, Bus. Bureau, 2019	
Micro	
Number	710
Total Capitalization	92,368,229.40
Declared No. of Employees	1,534
Small	
Number	328
Total Capitalization	282,062,411.12
Declared No. of Employees	1,836
Medium	
Number	193
Total Capitalization	701,345,733.91
Declared No. of Employees	2,899
Large	
Number	83
Total Capitalization	2,709,259,934.95
Declared No. of Employees	3,434

Table 82. Social services in barangay Ma-a

Social Service	**Number**
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	3
No. of Barangay Nutrition Scholars	8
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	35.50
Prevalence Rate of Severely Underweight Children aged 0-71 months	1.77
School Facilities, Dep.Ed 2019	27
Public Schools – elementary High school Senior High School	2) 1 1
Private School – elementary Elementary & High School Senior High School Tertiary School	4 7 2 3
Vocational School	7
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	10

Environmental Management. The garbage in the barangay is collected as performed by the utility workers of the barangay. However, it is initiated by the LGU of Davao City. No Material recovery facility is observed in the barangay.

Infrastructure and Utilities. The Davao Light and Power Company installed 1408 streetlights distributed throughout barangay Ma-a. In addition, the water service facility within the barangay is provided by Davao City Water District (**Table 83)**.

Table 83. Infrastructure and utilities in barangay Ma-a

Utility	Number
Power, DLPC 2019	
Number of Streetlights	1408
Water System, DCWD, CEO, 2019	
DCWD	

4.4.2.2.8 Barangay 19-B

Demography. The population of the barangay appeared to be increasing in 2010 to 2015. From 2015 to 2020, the population decreased slightly by 0.68%, or a decrease of 1,014 people, from the previous population of 31,766 in 2015 as shown in **Table 84**. The 2020 census population represents 1.73% of the total population of Davao City. In 2015, there were 3.31 members in the household down from 5.42 in 1990.

Table 84. Demographic characteristics of barangay 19-B

Population 2020	30,752
Population, PSA 2015 census	31,766
Estimated Number of Households, 2015*	7,942
Population, PSA 2010 Census	29,247
Population, PSA 2007 Census	28,088
Population, PSA 2000 Census	19,875

Source: PSA

According to the 2015 Census, the 20-24 age group posted the highest population with 4,271 individuals while the *80 and over posted the lowest frequency* with 201 individuals. The median age of the total population was computed at 26 years. The overall age dependency ratio was 38 to every 100 of the working age population. There are 6 aged/senior citizens who are dependent and 32 young individuals who are dependent to every 100 of the total working population.

Geography. The barangay is endowed with a large land area equivalent to 362.552 hectares. The significant parcel of lands is utilized for low-density residential and major commercial concerns. Moreover, 88.06 hectares of the total land area are reserved for floodway mitigation. Also, the barangay has a clay type soil, slope of 0-3%, and 200 meters above sea level elevation (**Table 85**).

Table 85. Geographic characteristics of barangay 19-B

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	362.552
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	2.45
Number of Puroks, OCPDC-RSD	21
Locational Characteristics	Riverbank
Rural/Urban Classifications	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	88.06
Low Density Residential	105.20
Medium Density Residential	8.43
Institution	7.10
Minor Commercial	42.49
Major Commercial	105.20
Special Use	5.98
Open Space	0.10
Total	362.55
Soil Classification, CAO	Matina Clay,Cabantian Clay and Faraon Clay
Elevation (in has.), OCPDC-GIS	
>200 m	362.552
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	362.55

Economic Services. The economic services present in the community are at the micro-level or about 577. These establishments employ 2,412 individuals. Moreover, 78 large-level establishments employed 2,111 individuals equivalent to medium enterprises. The small-scale businesses employed 1904 people (**Table 86**).

Table 86. Economic services in barangay 19-B

Commercial & Industrial Establishment, Bus. Bureau, 2019	
Micro	
Number	577
Total Capitalization	74,459,336.80
Declared No. of Employees	2,412
Small	
Number	289
Total Capitalization	248,234,362.34
Declared No. of Employees	1,904
Medium	
Number	178
Total Capitalization	690,065,680.77
Declared No. of Employees	2,111
Large	
Number	78
Total Capitalization	17,221,546,891.00
Declared No. of Employees	2,111

Social Services. The barangay has a health center with 2 health workers and 7 nutrition scholars. In addition, the fully immunized children aged 11 months and below is 35.16% of its population, while the prevalence of underweight children is only 0.08%.

In terms of the school facility, there are 14 that provide education. There is 1 public elementary school, 11 private schools, and 2 vocational schools. The private schools are offering elementary education (7), elementary and high school education (1), senior school education (1), and tertiary education (2). In terms of Day Care Center, one is available in the community (**Table 87**).

Environmental Management. Like other barangays, the garbage disposal practice observed in the barangay is through the collection initiated by the LGU of Davao City. As well, the community also used pits for their disposal. Therefore, no Material recovery facility is observed in the barangay.

Table 87. Social services in barangay 19-B

Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	2
No. of Barangay Nutrition Scholars	7
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	35.16
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.08
School Facilities, Dep.Ed 2019	14
Public Schools - Elementary	1
Private School – Elementary Elementary and High School Senior High School Tertiary	7 1 1 2
Vocational School	2
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	5

Infrastructure and Utilities. The only power provider in the barangay is the Davao Light and Power Company and installed 920 streetlights in the area. On the other hand, the water service facility within the barangay is fully served by Davao City Water District (**Table 88**).

Table 88. Infrastructure and utilities in barangay 19-B

Utility	Number
Power, DLPC 2019	
Number of Streetlights	920
Water System, DCWD, CEO, 2019	
DCWD	

4.4.2.2.9 Barangay 8-A

Demography. Barangay 8-A is formerly referred to as *Poblacion*. An increasing trend is observed in the population of Barangay 8A. From the year 2000 to the year 2015, an approximately 86% increase is recorded. There were 3.52 members in a household in 2015 from 5.22 in 1990. In 2020, the population increases to 15,259 with 6.98% growth rate (**Table 89**). This population accounts for 0.86% of the total population of Davao City.

Table 89. Demographic characteristics of barangay 8-A

Population 2020	15,259
Population, PSA 2015 census	11,075
Estimated Number of Households, 2015*	2,769
Population, PSA 2010 Census	8,859
Population, PSA 2007 Census	6,902
Population, PSA 2000 Census	5,961

Source: PSA

According to the 2015 Census, the age group with the highest population in Barangay 8-A is *5 to 9*, with 1,218 individuals. The median age of the total population is 24 years. The economically active population and actual or potential members of the work force, those aged *15 to 64*, constitute a total of 65.23% (7,224). This group supports the young and the old members of the population. For every 100 of this economically working population, 53 young and old people depend on them. This is half of the population. Of this figure, 49 are lower than 14 years old and 4 are aged/senior citizens.

Geography. Barangay 8A has a total land area of 179.8 hectares. It should be noted that the barangay is in an urban setting. About its land use, most of the area is devoted to floodway mitigation (85.58 hectares). However, various land utilization is recognized as low-density residential area (16.1%), high-density residential area (3.6%), Institution (10.2%), MinorCommercial (9.8%), and for Special Use (12.34%). The barangay has a clay soil type originating from Matina, Cabantian and Faraon series. Faraon clay is black. There are numerous limestone rocks as erosion pavements on the surface as the parent materials come from soft coralline limestone. Rice, coconut, corn, bananas and gabi thrive in Faraon clay. The elevation is less than 200 meters above sea level with a 0-3% slope (**Table 90**). Elevation is estimated at 30.6 meters or 100.4 feet above mean sea level.

Table 90. Geographic characteristics of barangay 8-A

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	179.8
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	1.34
Number of Puroks, OCPDC-RSD	11
Locational Characteristic	Riverbank
Rural/Urban Classification	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	85.585
Low Density Residential	28.932
High Density Residential	6.468
Institution	18.326
Minor Commercial	17.682
Special Use	22.186
Total	179.777
Soil Classification, CAO	Matina Clay,Cabantian Clay and Faraon Clay
Elevation (in has.), OCPDC-GIS	
>200 m	179.777
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	179.777

Economic Services. The barangays' economic opportunities are also seen in the establishments present in the barangay. These include the micro-level establishment that is 67 in number. Also, small (17), Medium (9), and large (6) level business entities are observed in the community. These establishments employ 530 individuals, and 370 are employed in large-scale enterprises (**Table 91**).

Table 91. Economic services in barangay 8-A

Commercial and Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	67
Total Capitalization	7,146,000.00
Declared No. of Employees	81
Small	
Number	17
Total Capitalization	14,913,602.50
Declared No. of Employees	46
Medium	
Number	9
Total Capitalization	44,870,385.00
Declared No. of Employees	33
Large	
Number	6
Total Capitalization	158,600,000.00
Declared No. of Employees	370

Social Services. The barangay has a health center run by 6 barangay health workers and 5 nutrition scholars. Around 76.53% of the children aged 11 months old and below were fully immunized. However, the prevalence of severely underweight children aged 0-71 months old is observed, with 0.15 of the population categories. Within the barangay, no public schools are operating. However, there are 9 private schools and a vocational school in the community (**Table 92**).

Environmental Management. The garbage disposal practice observed in the barangay is through the collection initiated by the LGU of Davao City. No Material recovery facility is observed in the barangay.

Infrastructure and Utilities. Davao Light and Power Company provides the barangay the power needed, with 359 streetlights installed and distributed throughout the vicinity of the barangay. Moreover, the water service facility within the barangay is entirely provided by the Davao City Water District (**Table 93**).

Table 92 Social services in barangay 8-A

Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	6
No. of Barangay Nutrition Scholars	5
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	76.53
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.15
School Facilities, Dep.Ed 2019	10
Private Schools – Elementary School Elementary and High School Senior High School Tertiary School	1 3 2 2
Vocational School	1
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	5

Table 93. Infrastructure and utilities in barangay 8-A

Utilities	Number
Power, DLPC 2019	
Number of Streetlights	359
Water System, DCWD, CEO, 2019	
DCWD	

4.4.2.2.10 Barangay 5-A

Demography. Barangay 5A's population has been increasing from 2000 to 2015. However, in the recent report of PSA, the population of this barangay tends to decline by 0.51% (2020 PSA Census) (**Table 94**). Its 2020 population represented 0.63% of the total population of Davao City. The population has an average of 3.72 members per household down from 5.39 in 1990.

Table 94. Demographic characteristics of barangay 5-A

Population 2020	11,160
Population, PSA 2015 census	11,436
Estimated Number of Households, 2015*	2,859
Population, PSA 2010 Census	11,232
Population, PSA 2007 Census	9,946
Population, PSA 2000 Census	9,530

Source: PSA

Based on the 2015 Census of Population, the 20 to 24 age group accounted for nearly 12% of the total population while the *80 and over accounted for 0.3% of the total population.* The median age of the total population is 24 years. Overall, 49 young and old-age individuals depend for every 100 of the economically working population. There are about 46 14 years and under who depend on every 100 of the working age population and about 4 aged/senior citizens depend on every 100 of the working population.

Geography. The barangay has a total land area of 38.1 hectares within the población, apparently within the urban area with a nearby riverbank. With the identified land area, the utilization of the majority is for floodway mitigation of about 29.610 hectares. It has a clay soil type, elevation of less than 200 meters above sea level, and 0-3% slope level (**Table 95**).

Economic Services. In terms of the barangays' economic opportunities, various establishments are present. Most of it belongs to a micro-level, which is 957 in number. Also, small (57), Medium (7), and large (8) level establishments are observed in the community. This establishment employs 1,611 individuals. Specifically, 1136,170, 110, and 195 are employed in micro, small, medium, and large-scale enterprises, respectively (**Table 96**).

Table 95. Geographic characteristics of barangay 5-A

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	38.1
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	0.87
Number of Puroks, OCPDC-RSD	19
Locational Characteristic	Riverbank
Rural/Urban Classification	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	29.610
Low Density Residential	-
Medium Density Residential	-
High Density Residential	2.882
Institution	0.832
Special Institution	-
Minor Commercial	4.814
Total	38.138
Soil Classification, CAO	Matina Clay,Cabantian Clay & Faraon Clay
Elevation (in has.), OCPDC-GIS	
>200 m	38.138
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	38.138

Table 96. Economic services in barangay 5-A

Commercial and Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	957
Total Capitalization	56,804,963.63
Declared No. of Employees	1,136
Small	
Number	57
Total Capitalization	47,353,590.00
Declared No. of Employees	170
Medium	
Number	7
Total Capitalization	28,232,903.20
Declared No. of Employees	110
Large	
Number	8
Total Capitalization	112,606,632.20
Declared No. of Employees	195

Social Services. Social services are observed in Barangay 5A. There is a health center to serve the community with 6 health workers and 4 nutrition scholars. In terms of its health service indicators, an accomplishment of 86.85% of the children aged 11 months old and below received full immunization. The incidence of severely underweight children aged 0-71 months old is only 0.65, which is a good indication since it is less than 1 percent of the children's population.

Moreover, in terms of the school facility, there is an elementary public school in the barangay, 1 private tertiary school, and 2 vocational schools. Also, one (1) Day Care Center is located in the barangay (**Table 97**).

Table 97. Social services in barangay 5-A

Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	6
No. of Barangay Nutrition Scholar	4
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	86.85
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.65
School Facilities, Dep.Ed 2019	
Public Schools - Elementary	1
Private School - Tertiary	1
Vocational School	2
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	5

Environmental Management. As a common means of garbage disposal in the City, the barangay as well implements the collection garbage policy. No Material recovery facility is observed in the barangay.

Infrastructure and Utilities. The Davao Light and Power Company is also the power service provider of barangay 5-A. In addition, based on the City Planning Office report, there are about 217 streetlights erected in different areas of the barangay. Moreover, the water service facility within the barangay is f provided by Davao City Water District (**Table 98**).

Table 98. Infrastructure and utilities in barangay 5-A

Utility	Number
Power, DLPC 2019	
Number of Streetlights	217
Water System, DCWD, CEO, 2019	
DCWD	

4.4.2.2.11 Barangay 2-A

Demography. Barangay 2A has shown a declining rate of population from 2000 to 2020. A 4.15% decrease in the population growth rate was observed between 2015 and 2020 (**Table 99**).

Table 99. Demographic characteristics of barangay 2-A

Population Projection 2020, OCPDC	4,021
Population, PSA 2015 census	3,589
Estimated Number of Households, 2015*	897
Population, PSA 2010 Census	2,953
Population, PSA 2007 Census	3,108
Population, PSA 2000 Census	3,312

Source: PSA

Geography. Barangay 2A has a total land area of 16.38 hectares in the heart of the población. The barangay is found in the riverbank yet classified as an urban area based on the map. In terms of its land use, most of the areas are utilized for floodway mitigation or equivalent to 14.574 hectares. The barangay's soil classification is clay with an elevation less than 200 meters above sea level (**Table 100**).

Economic Services. The barangay has various commercial and industrial establishments with a total of 580 establishments. The majority are those categorized as micro-level establishments of about 317, followed by small-level establishments with some 131, around 85 belong to medium enterprises, and about 47 are classified as large-scale establishments. The latter has a reported combined capital in billion (**Table 101**).

Table 100. Geographic characteristics of barangay 2-A

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	16.38
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	City Hall area
Number of Puroks, OCPDC-RSD	7
Locational Characteristic	Riverbank
Rural/Urban Classification	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	14.574
Low Density Residential	-
Medium Density Residential	-
High Density Residential	-
Institution	0.667
Special Institution	-
Minor Commercial	0.114
Total	16.380
Soil Classification, CAO	Matina Clay,Cabantian Clay & Faraon Clay
Elevation (in has.), OCPDC-GIS	
>200 m	16.38
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	16.38

Table 101. Economic services in barangay 2-A

Commercial and Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	317
Total Capitalization (in million pesos)	38,176,400.00
Declared No. of Employees	1,063
Small	
Number	131
Total Capitalization (in million pesos)	106,693,506.51
Declared No. of Employees	1,259
Medium	
Number	85
Total Capitalization (in million pesos)	332,947,222.26
Declared No. of Employees	608
Large	
Number	47
Total Capitalization (in million pesos)	1,144,657,994.97
Declared No. of Employees	632

Social Services. The same with the other barangays in the población, the social service of the Barangay 2A is accessible where it has 1 health center to serve the community with 5 health workers and 1 nutrition scholar. About 71.34% of the children aged 11 months old and below were immunized. However, the prevalence of severely underweight children aged 0-71 months old is not observed (**Table 102**).

Within the vicinity of the barangay, there were no public schools, and private schools were established. However, the students still have access to various basic education facilities, both public and private schools, located in the adjacent and nearby barangays. Moreover, 3 vocational schools are in the barangay. Moreover, one (1) Day Care Center was also installed in the barangay.

Table 102. Social services in barangay 2-A

Social Service	**Number**
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	5
No. of Barangay Nutrition Scholars	1
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	71.34
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.00
School Facilities, Dep.Ed 2019	
Vocational School	3
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	1

Environmental Management. The observed garbage disposal practice in the barangay is through the collection as initiated by the LGU of Davao City. Like other barangays, there is no material recovery facility in the barangay.

Infrastructure and Utilities. The barangay sourced its power from the Davao Light and Power Company. In fact, there are 70 streetlights in the barangay distributed throughout the area. In addition, the water service facility within the barangay is fully served by the Davao City Water District (**Table 103**).

Table 103. Infrastructure and utilities in barangay 2-A

Utility	Number
Power, DLPC 2019	
Number of Streetlights	70
Water System, DCWD, CEO, 2019	
DCWD	

4.4.2.2.12 Barangay 1-A

Demography. Barangay 1A has erratic population growth due to its observed increase and decrease trends, from the year 2000 to the year 2020 census. The latest PSA Census declared a 0.10% decrease in the population growth rate of this barangay based on 2015 to 2020 records (**Table 104**).

Table 104. Demographic characteristics of barangay 1-A

Population Projection 2020, OCPDC	3,477
Population, PSA 2015 census	3,103
Estimated Number of Households, 2015*	776
Population, PSA 2010 Census	3,038
Population, PSA 2007 Census	3,201
Population, PSA 2000 Census	3,000

Source: PSA

Geography. Barangay 1A has 15.355 hectares and is a riverbank with an urbanized area classification. In terms of land use, most of the areas are allocated for floodway mitigation. The barangay has a clay soil classification with an elevation less than 200 meters above sea level (**Table 105**).

Economic Services. Barangay 1A has various commercial and industrial establishments majority of which are categorized as micro-level establishments. The various establishments employed a combined total of 304 individuals (**Table 106**).

Table 105. Geographic characteristics of barangay 1-A

Geographic Characteristi	Number/Type
Land Area, (in has), OCPDC-GIS	15.355
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	0.01
Number of Puroks, OCPDC-RSD	7
Locational Characteristic	Riverbank
Rural/Urban Classification	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	14.574
Low Density Residential	-
Medium Density Residential	-
High Density Residential	-
Institution	0.667
Special Institution	-
Minor Commercial	0.114
Total	15.355
Soil Classification, CAO	Matina Clay,Cabantian Clay & Faraon Clay
Elevation (in has.), OCPDC-GIS	
>200 m	15.355
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	15.355

Table 106. Economic services in barangay 1-A

Commercial and Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	61
Total Capitalization	7,254,750.00
Declared No. of Employees	120
Small	
Number	21
Total Capitalization	16,547,003.00
Declared No. of Employees	108
Medium	
Number	10
Total Capitalization	33,422,706.00
Declared No. of Employees	41
Large	
Number	4
Total Capitalization	51,726,921.00
Declared No. of Employees	35

Social Services. Being in the urban setting, the social service of the barangay is available where it has 1 health center to serve the community with 3 health workers and 1 nutrition scholar. In terms of its health indicators, more than half of the children aged 11 months old and below were immunized, and apparently, the prevalence of severely underweight children aged 0-71 months old is not observed. In addition, two (2) Public Elementary Schools and one (1) Day Care Center are in the barangay (**Table 107**).

Environmental Management. The garbage disposal practice observed in the barangay is through the collection initiated by the LGU of Davao City. No Material recovery facility is observed in the barangay.

Table 107. Social services in barangay 1-A

Social Service	Number
No. of Health Centers, CHO 2019	1
Barangay Health Human Resources	
No. of Barangay Health Workers	3
No. of Barangay Nutrition Scholars	1
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	68.28
Prevalence Rate of Severely Underweight Children aged 0-71 months	0.00
School Facilities, Dep.Ed 2019	2
Public Schools - Elementary	2
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	1

Infrastructure and Utilities. The Davao Light and Power Company is the main electric power provider in the barangay. In addition, based on the report of CPDO, 53 streetlights are installed throughout the vicinity. Moreover, the water service facility within the barangay is served by Davao City Water District (**Table 108**).

Table 108. Infrastructure and utilities in barangay 1-A

Utility	Number
Power, DLPC 2019	
Number of Streetlights	53
Water System, DCWD, CEO, 2019	
DCWD	

4.4.2.2.13 Barangay Bucana (76 – A)

Demography. Barangay 76 – A is the biggest barangay in Davao City. Barangay 76-A or Bucana has a population that appears to be decreasing based on the latest record of the PSA XI. From 58,082 individuals in 2000, it reached 83,964 in 2015 but declined to 80,538 in 2020 (**Table 109**).

Table 109. Demographic characteristics of barangay 76-A

Population Projection 2020, OCPDC	94,074
Population, PSA 2015 census	83,964
Estimated Number of Households, 2015*	20,991
Population, PSA 2010 Census	78,352
Population, PSA 2007 Census	74,113
Population, PSA 2000 Census	58,082

Source: PSA

Basing from the 2015 census of population, the age group with the highest population in Barangay 5-A is 20 to 24 age group accounted for 11.6% of the total population while the 80 and over age group accounted for 0.3% of the total population. The median age of the total population was 24 years. The overall age dependency ratio in the area was 49 individuals for every 100 economically working population. By type, 46 youths depend on 100 of the working age population while are 4 aged/senior citizens depend on 100 of the working population.

Geography. The land area of the barangay is equal to 410.51 hectares. It is a coastal area in an urban setting. The land use of the barangay is intended for various needs. The floodway mitigation had captured the largest allocation of about 183.241 hectares. Apart from the flood mitigation, some portions are intended for Major Commercial, High-Density Residential, Low-Density Residential, Minor Commercial, Socialized Housing, Open Space, Institution, Infrastructure/Utilities, and Tourism Development, which is arranged from highest to lowest in its allocation in the barangay. Additionally, the barangay has a clay soil type and near slope topography (**Table 110**). Elevation is estimated at 6.8 meters or 22.3 feet above mean sea level.

Economic Services. Various establishments are present in the community in terms of the number. Also, small (545), Medium (279), and large (95) level establishments are l observed in the community. These establishments employ a total of 14,832 individuals from in the community (**Table 111**). The more popular **b**usiness establishments and restaurants include: SM Mall, World Palace, E.T., Yellow Fin, After Dark Restobar, Pia's Cafe, BC Chicken House, Times Beach restaurants, Citra Mina, K1 Spa, Davao City Overland Transport Terminal, Park Square Inn, Anton Rose Inn, Casa Leticia and Emar's Beach Resort and Hotel. Most of the residents are fishermen, laborers, tricycle/trisicad drivers, businessmen and government workers. In 2009, the Internal Revenue Allotment for the barangay was PhP25 Million.

Table 110. Geographic characteristics of barangay 76-A

Geographic Characteristic	Number/Type
Land Area, (in has), OCPDC-GIS	410.51
Distance from City Hall to Brgy. Proper, (in kms.),OCPDC-GIS	2.79
Number of Puroks, OCPDC-RSD	4
Locational Characteristics	Coastal
Rural/Urban Classification	Urban
Land Use, (in has.), OCPDC-GIS	
Floodway Mitigation	183.241
Institution	8.449
Major Commercial	77.119
Minor Commercial	27.018
High Density Residential	41.429
Low Density Residential	39.610
Socialized Housing	12.665
Infrastructure/Utilities	6.711
Tourism Development	2.629
Open Space	11.641
Total	410.512
Soil Classification, CAO	San Miguel Clay Loam, Matina Clay Loam and Cabantian Clay Loam
Elevation (in has.), OCPDC-GIS	
>200 m	410.512
Slope (in has.), OCPDC-GIS	
Level to Nearly Level (0-3%)	410.512

Table 111. Economic services in barangay 76-A

Commercial and Industrial Establishments, Bus. Bureau, 2019	
Micro	
Number	1,107
Total Capitalization	140,194,380.00
Declared No. of Employees	2,818
Small	
Number	545
Total Capitalization	473,702,967.37
Declared No. of Employees	2,990
Medium	
Number	279
Total Capitalization	935,338,011.05
Declared No. of Employees	2,973
Large	
Number	95
Total Capitalization	3,060,305,114.03
Declared No. of Employees	6,051

Social Services. The social services of the community are as well available. A health center is functional with 20 barangay health workers and 15 nutrition scholars to cater to the huge barangay population. Moreover, only 13.20% are fully immunized children aged 11 months old and below in 2019. This immunization turnout is too small compared to other barangays in the city. There is also a recorded 3.85% of severely underweight children aged 0-71 months (**Table 112**).

For the education providers in the barangay, 31 institutions provide such. These come from the public, private, and institutions providing vocational education services. In addition, there are 21 daycare centers in the barangay, which appeared to be the highest in the city. **Public Schools**: S.I.R. Elementary School, Kabacan Elementary School and Villa Abrille Elementary School (formerly Bucana Elementary School). **Private Schools:** Ateneo de Davao Grade School and High School, Philippine Women's College, College of South East Asia, John Paul College, Tecarro Medical Foundation and Agro Industrial College Foundation.

Environmental Management. The garbage disposal practice observed in the barangay is through the collection initiated by the LGU of Davao City. No Material recovery facility is observed in the barangay.

Infrastructure and Utilities. The Davao Light and Power Company is the sole power source provider of the barangay, with 1,451 streetlights distributed in the vicinity. Moreover, the water service facility within the barangay is operated by Davao City Water District (**Table 113)**.

Table 112. Social services in barangay 76-A

Social Service	Number
No. of Health Centers, CHO 2019	5
Barangay Health Human Resources	
No. of Barangay Health Workers	20
No. of Barangay Nutrition Scholars	15
Health Services, CHO 2019	
% of Fully Immunized Children aged 11 months old and below	13.20
Prevalence Rate of Severely Underweight Children aged 0-71 months	3.85
School Facilities, Dep.Ed 2019	31
Public Schools – Elementary	3
High School	1
Senior High School	1
Private Schools – Elementary	6
Elementary and High School	5
Senior High School	3
Tertiary School	3
Vocational School	9
Social Welfare, CSSDO 2019	
Total Number of Day Care Centers	18

Table 113. Infrastructure and utilities in barangay 76-A

Social Service	Number
Power, DLPC 2019	DLPC
Number of Streetlights	1451
Water System, DCWD, CEO, 2019	
DCWD	DCWD

4.4.2.3 *Profile of Project-Affected Households*

The analysis process utilized a primary data source gathered from direct and indirect affected households of the proposed flood control project in Davao City. These individuals are coming from 13 barangays in the city. To provide a brief background of the respondents, the evaluation team considers their profile such as age, gender, place of birth, civil status, ethnic origin, religion, and years of residency.

Age. Table 114 shows that most of the respondents in the survey are prime to mature workers with an age of 20 to 59 years (78%). In addition, some of them (17%) are elderly with an age of 60 and above. In contrast, 3 percent of the respondents are described as early workers aged 15 to 19 years. It is worth noting that only 3 percent of the respondents in directly affected areas are elderly compared to 8 percent in indirectly affected barangays.

Table 114. Distribution of respondents according to age.

Age	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
15-19	8	5.7	3	1.7	11	3.5
20-29	21	15.0	26	14.9	47	14.9
30-39	32	22.9	38	21.7	70	22.2
40-49	40	28.6	43	24.6	83	26.3
50-59	18	12.9	31	17.7	49	15.6
60-69	17	12.1	20	11.4	37	11.7
70 & above	4	2.9	14	8.0	18	5.7
Total	140	100	175	100	315	100

Gender. Table 115 shows that, generally, there are more female respondents (66%) interviewed in the study. The same characteristics is reflected in both direct (62%) and indirect (69%) affected households in Davao City.

Table 115. Distribution of respondents according to gender.

Gender	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Male	53	37.9	55	31.4	108	34.3
Female	87	62.1	120	68.6	207	65.7
Total	140	100.0	175	100.0	315	100.0

Place of Birth. Table 116 shows that most respondents originated within the locality or barangay (47%). Worth noting, perhaps, that some of them came from other municipalities within and outside Davao del Sur.

Table 116. Distribution of Respondents According to Place of Birth.

Place of Birth	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Within the Barangay	64	45.7	85	48.6	149	47.3
Other Barangays Within Davao City	34	24.3	28	16.0	62	19.7
Other Cities/Municipalities of Davao del Sur Province	20	14.3	21	12.0	41	13.0
Outside the Province of Davao del Sur	13	9.3	17	9.7	30	9.5
Other Region	9	6.4	24	13.7	33	10.5
Total	140	100.0	175	100.0	315	100.0

Civil Status. Table 117 shows that most respondents are married (70%), and only 17 percent are single. Worth noting, perhaps, that the same characteristic is reflected in both direct and indirect affected households.

Table117. Distribution of Respondents According to Civil Status.

Civil Status	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Single	18	12.9	35	20.0	53	16.8
Married	108	77.1	113	64.6	221	70.2
Widowed	11	7.9	23	13.1	34	10.8
Separated	3	2.1	4	2.3	7	2.2
Total	140	100.0	175	100.0	315	100.0

Ethnic Origin. In terms of ethnic background, an enormous number of respondents in both direct and indirect affected areas are Davaoeños, followed by Boholano (6%), Ilonggo (4%), and other ethnic groups (22%), respectively (**Table 118)**.

Table 118. Distribution of Respondents According to Ethnic Origin.

Ethnic Origin	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
No Response	1	0.7	1	0.6	2	0.6
Davaoeño	84	60.0	118	67.4	202	64.1
Boholano	1	0.7	18	10.3	19	6.0
Ilonggo	6	4.3	6	3.4	12	3.8
Indigenous People (IP)[1)]	3	2.1	7	4.0	10	3.2
Others	45	32.1	25	14.3	70	22.2
Total	140	100.0	175	100.0	315	100.0

1) Kagan in Ma-a

Religion. In general, most of the respondents (72%) are affiliated with Roman Catholic religious organizations. On the other hand, 21 percent are members of other religious groups. Expectedly, the same picture is reflected in both direct and indirect affected areas (**Table 119**).

Table 119. Distribution of Respondents According to Religion.

Religion	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Roman Catholic	81	57.9	146	83.4	227	72.1
INC	5	3.6	3	1.7	8	2.5
Protestant	5	3.6	6	3.4	11	3.5
SDA	2	1.4	0	0.0	2	0.6
Others	47	33.6	20	11.4	67	21.3
Total	140	100.0	175	100.0	315	100.0

Years of Residency. Table 120 shows that respondents' average years of residency from indirectly affected areas is 28 years compared to those from directly affected communities of 25 years, respectively.

Table 120. Years of Residency of the Respondents.

Particular	Years of Residency	
	Directly Affected Household	Indirectly Affected Household
Average	24.95	28.32
Longest	100	73
Earliest	1	1

Household Composition. The structure of the household respondents from directly and indirectly affected communities of the flood control project is one of the indicators considered in the analysis. The composition of households is characterized based on the size of the households, the number of minors and seniors in the household, and the number of household members with disabilities (**Table 121**).

The study revealed that respondents from direct and indirectly affected areas have the same household size of 5, based on average. The result is also similar in terms of the average number of minors. The study further revealed that the average number of household members with senior citizens in both areas is 1. In contrast, the number of household members with a disability is 2, on average. Lastly, the average number of the working household of the interviewed household is 2.

Table 121. Household Structure of Directly and Indirectly Affected Household

Particular	Directly Affected Household	Indirectly Affected Household
Household Size	5	5
Number of Minors	5	5
Number of Seniors	1	1
Number of Household Members with Disability	2	2
Number of Working Household Member	2	2

Primary Source of Income. The analysis considers the household source of income associated with the flood control project. The indirectly affected households' primary source of income is a vendor or business owner (21%). However, the same result in the indirectly affected communities (29%). In addition, some of them are dependent on the income from being a private employee (11%). Worth mentioning, though, that 14 percent of them have no permanent source of income at all (Category none). This none-income group is composed mainly of retired employees or pensioners, while some are highly dependent on government support programs (ex. 4Ps), and a few are on-call employees who are getting paid when called into work in construction or other activities (**Table 122**). When the respondents are grouped by project component, it was revealed that most of the affected households in retarding pond areas are private employees, while some are government employees, vendors or business owners, drivers, and farmers. In cut-off work areas, particularly in Ma-a, most of the directly affected households are fisherfolks fishing in Davao River and/or in Davao City Gulf. The same percentage of directly affected households are vendors or business owners and private employees, while some are drivers, government employees, or other sources of income. Further, directly, and indirectly affected household respondents in the dredging areas are mostly vendors or business owners, while some are private or government employees, government employees, drivers, fisherfolks, and a few are farmers.

Table122. Distribution of Respondents According to Primary Source of Income.

Component	Category	Type				Total	
		Direct		Indirect			
		F	%	F	%	F	%
Retarding Ponds	None	1	12.5	9	15.3	10.0	14.9
	Farmer	1	12.5	1	1.7	2.0	3.0
	Vendor/Business Owner	0	0.0	6	10.2	6.0	9.0
	Driver	0	0.0	4	6.8	4.0	6.0
	Private Employee	3	37.5	7	11.9	10.0	14.9
	Government Employee	0	0.0	7	11.9	7.0	10.4
	Others	3	37.5	25	42.4	28.0	41.8
Total		8	100.0	59	100.0	67	100.0
Cut-off Works	None	8	20.5	0	0.0	8	19.5
	Fishing	6	15.4	0	0.0	6	14.6
	Vendor/Business Owner	6	15.4	0	0.0	6	14.6
	Driver	3	7.7	0	0.0	3	7.3
	Private Employee	6	15.4	1	50.0	7	17.1
	Government Employee	1	2.6	0	0.0	1	2.4
	Others	9	23.1	1	50.0	10	24.4
Total		39	100.0	2	100.0	41	100.0
Dredging	None	21	15.8	10	7.5	31.0	11.7
	Farmer	1	0.8	3	2.3	4.0	1.5
	Fisherman	6	4.5	0	0.0	6.0	2.3
	Vendor/Business Owner	29	21.8	45	33.8	74.0	27.8
	Driver	9	6.8	3	2.3	12.0	4.5
	Private Employee	21	15.8	8	6.0	29.0	10.9
	Government Employee	6	4.5	16	12.0	22.0	8.3
	Others	40	30.1	48	36.1	88.0	33.1
Total		133	100.0	133	100.0	266	100.0

Main Income Earner. In terms of being the breadwinner of the household, husband or wife considers the primary income earner (68%), followed by son (10%) and female relative (4%) (**Table 123**).

Table 123. Distribution of Respondents According to Main Income Earner.

Main Income Earner	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Husband/Wife	82	58.6	128	73.1	210	66.7
Daughter	31	22.1	27	15.4	58	18.4
Son	20	14.3	11	6.3	31	9.8
Female Relative	5	3.6	6	3.4	11	3.5
Male Relative	2	1.4	0	0.0	2	0.6
Others	0	0.0	3	1.7	3	1.0
Total	140	100	175	100	315	100

Gross monthly income. Respondents from directly affected communities have a monthly income of P5,001-P10,000 (37%). However, 17 percent of households in these areas earn less than P5,000 monthly. On the other hand, almost half of the respondents from indirectly affected communities have a monthly income of P5,001-P10,000 (48%). Notably, 21 percent of these households earned less than P5,000 a month (**Table 124**).

In Retarding Pond areas, most affected people (directly or indirectly) are earning P5,001 to P10,000 in a month. Affected people in cut-off work and dredging areas are also making the same amount (P5,001 to P10,000), which is below the poverty threshold level of Davao City. The result implies that directly and indirectly affected households live below the poverty line and are economically categorized as poor.

Farm Size. Data shows that interviewed households are predominantly (69%) non-owner of agricultural land, as stated in **Table 125**. It seems worth noting that only 23 percent of them hold farms area.

Primary Farm Produce. In terms of primary farm produce, some of the respondents in both direct and indirectly affected areas produce bananas in their farm lot, followed by coconut (11%), Ilonggo (4%), and other crops (17%) respectively (**Table 126**).

In the retarding ponds, most respondents in the directly affected sites are planting coconut, while indirectly affected people commonly produce bananas. In cut-off areas, most affected people are growing bananas, while one directly affected respondent planted mangos. Respondents typically plant bananas, directly and indirectly, at affected sites in dredging areas. Others also produce mango, coconut, and rice, while a few raises chickens.

Table 124. Distribution of Respondents According to Household Gross Monthly Income.

Component	Category	Type				Total	
		Direct		Indirect			
		F	%	F	%	F	%
Retarding Ponds	Less than 5,000	1	12.5	15	25.4	16	23.9
	P5,001 – P10,000	4	50.0	29	49.2	33	49.3
	P10,001 – 15,000	2	25.0	8	13.6	10	14.9
	P15,001 – 20,000	0	0.0	5	8.5	5	7.5
	P20,001 - 25,000	1	12.5	1	1.7	2	3.0
	P30,001 - 40,000	0	0.0	1	1.7	1	1.5
Total		8	100	59	100	67	100
Cut-off Works	No response	2	5.1	0	0.0	2	4.9
	Less than 5,000	7	17.9	0	0.0	7	17.1
	P5,001 – P10,000	14	35.9	1	50.0	15	36.6
	P10,001 – 15,000	11	28.2	1	50.0	12	29.3
	P15,001 – 20,000	3	7.7	0	0.0	3	7.3
	P20,001 - 25,000	2	5.1	0	0.0	2	4.9
Total		39	100	2	100	41	100
Dredging	No Response	6	4.4	3	2.2	9	3.3
	Less than 5,000	24	17.6	27	20.0	51	18.8
	P5,001 – P10,000	50	36.8	64	47.4	114	42.1
	P10,001 – 15,000	30	22.1	22	16.3	52	19.2
	P15,001 – 20,000	20	14.7	9	6.7	29	10.7
	P20,001 - 25,000	4	2.9	6	4.4	10	3.7
	P25,000 - 30,000	2	1.5	0	0.0	2	0.7
	P40,001 - 45,000	0	0.0	3	2.2	3	1.1
	> 45,000	0	0.0	1	0.7	1	0.4
Total		136	100	135	100	271	100

Table 125. Distribution of Respondents According to Farm Ownership.

Farm Ownership	**Directly Affected Household**		**Indirectly Affected Household**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**
Yes	29	20.7	42	24.0	71	22.5
No	101	72.1	117	66.9	218	69.2
No Response	10	7.1	16	9.1	26	8.3
Total	140	100.0	175	100.0	315	100.0

Table 126. Distribution of respondents by farm produce

Component	Category	Type					
		Direct		Indirect		Total	
		F	%	F	%	F	%
Retarding Ponds	Banana	0	0.0	8	42.1	8	34.8
	Mango	1	25.0	0	0.0	1	4.3
	Coconut	3	75.0	4	21.1	7	30.4
	Rice	0	0.0	1	5.3	1	4.3
	Pig	0	0.0	1	5.3	1	4.3
	Others	0	0.0	5	26.3	5	21.7
Total		4	100	19	100	23	100
Cut-off Works	Banana	1	100.0	0	0.0	1	100
Total		1	100	0	0	1	100
Dredging	Banana	3	42.9	4	23.5	7	29.2
	Manga	2	28.6	2	11.8	4	16.7
	Coconut	0	0.0	2	11.8	2	8.3
	Rice	0	0.0	1	5.9	1	4.2
	Chicken	1	14.3	0	0.0	1	4.2
	Others	1	14.3	8	47.1	9	37.5
Total		7	100.0	17	100.0	24	100.0

Farm Size. Data shows that household respondents are predominantly (41%) small landholders owning less than 2 hectares (**Table 127)**. It is especially true in the directly affected households. It seems worth noting that 45 percent of residents in indirectly affected areas hold farms less than 1 hectare. Also, only 5.6% of respondents declared to have more than 3 hectares of farm.

Table 127. Distribution of Respondents According to Farm Size.

Farm Size	**Directly Affected Household**		**Indirectly Affected Household**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**
Less than 1 hectare	7	24.1	19	45.2	26	36.6
1 to 1.9 hectares	19	65.5	10	23.8	29	40.8
2 to 2.9 hectares	0	0.0	1	2.4	1	1.4
3 hectares and above	1	3.4	3	7.1	4	5.6
No Response	2	6.9	9	21.4	11	15.5
Total	29	100.0	42.0	100.0	71	100.0

Type of Farm Ownership. Regarding farm ownership, 35 percent of the respondents generally owned their land but were not farmed or idle. Also, 31% of households in directly affected areas owned the land they cultivated (**Table 128**). Specifically, most of the respondents in directly affected areas of retarding ponds, cut-off works, and dredging are non-farm owners, while the rest are agricultural land holders.

Table 128. Distribution of Respondents According to Farm Ownership.

Component	Category	Type				Total	
		Direct		Indirect			
		F	%	F	%	F	%
Retarding Ponds	Yes	3	37.5	13	24.1	16	25.8
	No	5	62.5	41	75.9	46	74.2
Total		8	100	54	100	62	100
Cut-off Works	Yes	1	2.9	0	0.0	1	2.7
	No	34	97.1	2	100.0	36	97.3
Total		11	100	11	100	22	100
Dredging	Yes	8	6.4	8	6.6	16	6.5
	No	117	93.6	113	93.4	230	93.5
Total		125	100.0	121	100.0	246	100.0

Farm Income. Regarding farm income, respondents from directly affected communities have a monthly income of P5,001-P10,000 (24%). However, 14 percent of households in these areas earned less than P5,000 monthly. Notably, 38 percent of families living in indirectly affected communities earned less than P5,000 a month (**Table 129)**.

Table 129. Distribution of Respondents According to Farm Income.

Farm Income	**Directly Affected Household**		**Indirectly Affected Household**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**
Less than PhP5,000	4	13.8	16.0	38.1	20	28.2
PhP5,001 - PhP10,000	7	24.1	7.0	16.7	14	19.7
PhP10,001- PhP15,000	1	3.4	6.0	14.3	7	9.9
PhP15,001 - PhP20,000	0	0.0	1	2.4	1	1.4
More than PhP30,000	0	0.0	2	4.8	2	2.8
No Response	17	58.6	10.0	23.8	27	38.0
Total	29	100.0	42.0	100.0	71	100.0

4.4.2.4 Housing Conditions

Status of House Ownership. Presented in **Table 130** is the distribution of households directly and indirectly affected by the proposed project according to house ownership, whether they own the house. As the table show, 140 are directly affected, and 175 are indirectly affected. Among the directly affected households, a significant majority, or 84.3 percent, own the house, and only 22 or 15.7 percent do not. Similarly, among the indirectly affected, a great majority of 132 or 75.4 percent are owners, while only 43 or 24.6 percent are not owners. In sum, a great majority of 250 of 79.4 percent own their houses, and only 65 or 20.6 percent do not.

Conclusively, of the households surveyed, which will be directly and indirectly affected by the proposed flood control project of Davao City, a significant majority own the houses they live in, while the minority do not.

Table 130. Distribution of Respondents According to House Ownership.

House Ownership	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Yes	118	84.3	132	75.4	250	79.4
No	22	15.7	43	24.6	65	20.6
Total	140	100.0	175	100.0	315	100.0

Years of House Establishment in the Area. Table 131 presents the distribution of directly and indirectly affected households in terms of years of residency. Most of the 140 directly affected families, or 27.1 percent, reside in the area for 5 to ten years. Meanwhile, 22.1 percent stayed for 11 to 19 years, 20 percent lived at the site for 29 years, and 13.6 percent have been there for 40 years and above. In addition, 12.1 percent have been there for 1 to 5 years, and 7 or 5 percent have been there for 30 to 39 years. For the indirectly affected households, most of them are residing in the area for 1 to 5 years; 21.1 percent live in the area for 11 to 19 years; 20 percent have been there for the longest 40 years and above; 14.3 percent have been there for 5 to 10 years; 13.1 percent have been there for 20 to 29 years, and 9.7 percent of them have been there for 30 to 39 years. Most respondents, or 21.6 percent, stayed there for 11 to 19 years, while 7.6 percent have been there for 30 to 39 years.

In conclusion, both the household groups – directly and indirectly, affected by the proposed flood control project of Davao City have established their houses in the areas covered for a considerable period. It implies that relocating them elsewhere could tremendously affect their livelihood sources and access to essential services such as health and education. Therefore, there are important aspects in related resettlement plans.

Table 131. Distribution Of Respondents by Years of Residence

Years of Residence	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
1 to 5 years	17	12.1	38	21.7	55	17.5
5 to 10 years	38	27.1	25	14.3	63	20.0
11 to 19 years	31	22.1	37	21.1	68	21.6
20-29 years	28	20.0	23	13.1	51	16.2
30-39 years	7	5.0	17	9.7	24	7.6
40 years & above	19	13.6	35	20.0	54	17.1
Total	140	100.0	175	100.0	315	100.0

House Roofing Material. Shown in **Table 132** is the distribution of households directly and indirectly affected by the proposed flood control project of Davao City according to the materials used for the roofing of their houses. As the figures show, all 140 or 100 percent of the directly affected households have G.I. sheet roofing. On the other hand, among the 175 houses which will be indirectly affected by the project, a great majority of 171 that is 97.7 percent have G.I. sheet roofing; 2 or 1.1 percent are with nipa roofing; and also, two are made of other materials which are neither G.I. sheet nor nipa.

In summary, of the total 315 households surveyed, a great majority of 311, that is 98.7 percent have houses with G.I. sheet roofing; 2 or 0.6 percent have nipa roofing, and another 2 or 0.6 percent have roofing of other materials that are neither G.I. sheet nor nipa.

The data suggest that houses directly and indirectly affected by the proposed flood control project have categorically durable roofing that can last for a relatively long time. Hence, of considerable worth in calculating resettlement costs.

Table 132. Distribution of Respondents by House Roofing Material

Roofing Material	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
G.I. Sheet	140	100.0	171	97.7	311	98.7
Nipa	0	0.0	2	1.1	2	0.6
Others	0	0.0	2	1.1	2	0.6
Total	140	100.0	175	100.0	315	100.0

House Walling Material. Presented in **Table 133** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the materials used for the walling of their houses. As the table shows, walling of the houses includes materials such as bamboo, wood, cement, G.I. sheet, and others, a combination of materials.

Among the 140 houses which will be directly affected, a good majority of 62 or 44.3 percent are of cement walling; similarly, a good majority of 61 or 43.6 percent are of wood walling; 16 or 11.4 percent are of bamboo walling, and one or 0.7 percent is of G.I. sheet walling. On the other hand, among the 175 houses which will be indirectly affected, a simple majority of 90 or 51.4 percent are with cement walling; 49 or 28 percent are with wood walling; 31 or 17.7 percent are with bamboo walling, and 5 or 2.9 percent are with walling of a combination of any of the enumerated materials.

In sum, of the 315 houses which will be directly and indirectly affected by the flood control project of Davao City, most of these houses that are 152 or 48.3 percent are made with cement walling; 110 or 34.9 percent are made with wood walling; 47 or 14.9 percent are with bamboo walling; 5 or 1.6 percent are with walling of a combination of the materials earlier mentioned, and 1 or 0.3 percent is made with a G.I. sheet walling. Therefore, it can be concluded that the

houses which will be affected are of varying cost, and that is an important element in estimating cost of resettlement.

Table 133. Distribution of Respondents by House Walling Material

Walling Material	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Bamboo	16	11.4	31	17.7	47	14.9
Wood	61	43.6	49	28.0	110	34.9
Cement	62	44.3	90	51.4	152	48.3
G.I. Sheet	1	0.7	0	0.0	1	0.3
Others	0	0.0	5	2.9	5	1.6
Total	140	100.0	175	100.0	315	100.0

Status of Lot Ownership. Table 134 shows the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the status of lot ownership. Among the 140 households which will be directly affected, most of them, that is 56 or 40 percent are using the lot free of any rent or acquisition cost; 53 or 37.9 percent are said to be owners of the lot on which their houses are built; 29 or 20.7 percent are renting, and 2 or 1.4 percent cannot categorize the status of their lots – neither owned nor rented and they cannot also say that they are allowed by the owner to freely use the lot, they are just simply there and occupy the area (ISF).

Table 134. Distribution of Respondents by Lot Ownership

Lot Ownership	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Owner	53	37.9	74	42.3	127	40.3
renter	29	20.7	23	13.1	52	16.5
free use of land	56	40.0	70	40.0	126	40.0
Others	2	1.4	8	4.6	10	3.2
Total	140	100.0	175	100.0	315	100.0

Meanwhile, among the 175 households which will be indirectly affected by the proposed project, most of them, that is 74 or 42.3 percent are owners of the lots on which their houses are established; 70 or 40 percent are using the lots free of any rent or acquisition cost; 23 or 13.1 percent are lot renters, and 8 or 4.6 percent cannot categorically identify the status of lot ownership.

All in all, of the 315 households which will be directly and indirectly affected by the proposed project, most of them, 127 or 40.3 percent own the lots on which their houses are built; 126 or

40 percent used freely; 52 or 16.5 percent are renting; and 10 or 3.2 percent of them cannot categorically identify the status of lot ownership.

Therefore, it can be inferred that of the entire area which will be directly and indirectly affected by the proposed projects, a portion of which is titled or privately owned, owned by the state; while others are categorically classified as Informal Settler Families (ISFs), especially those occupying without the permission of the owners. Hence, lot ownership is a very important aspect to consider in establishing the project and in the resettlement of the affected households. Specific details and comprehensive discussions of land ownership can be found in the Resettlement Action Plan found in Annex I of this report.

Type of Toilet Facility. Presented in **Table 135** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the type of toilet facility they have. As shown in the figures, among the 140 households which will be directly affected, a great majority of 135 or 96.4 percent have their water-sealed toilets; 4 or 2.9 percent share water-sealed toilets with neighbors or they do not have their own; and one or 0.7 percent does the wrap and throw practice, which means they just throw their human wastes in rivers or any streams and/or in the garbage.

Table 135. Distribution of Respondents by Type of Toilet Facility.

Type of Toilet Facility	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
water sealed	135	96.4	166	94.9	301	95.6
dig in the ground	0	0.0	1	0.6	1	0.3
Share with neighbor's toilet	4	2.9	6	3.4	10	3.2
Wrap and throw (rivers, streams)	1	0.7	1	0.6	2	0.6
Others	0	0.0	1	0.6	1	0.3
Total	140	100.0	175	100.0	315	100.0

Meanwhile, among the 175 households which will be indirectly affected by the proposed project, also a great majority of them, 166 or 94.9 percent have water-sealed toilets; 6 or 3.4 percent of them share toilets with neighbors; 1 or 0.6 percent has dug in the ground as a toilet; another 1 or 0.6 percent does the wrap and throw practice, and still another 1 or 0.6 percent have other uncategorized toilet facility or practice of human waste disposal.

In sum, among the 315 households which will be directly and indirectly affected by the proposed project, a great majority of 301 or 95.6 percent have their water-sealed toilets; 10 or 3.2 percent share toilets with neighbors; 1 has dug in the ground as a toilet; 2 of 0.6 percent are doing the wrap and throw practice of waste disposal, and 1 or 0.3 percent has another uncategorized means of human waste disposal.

Conclusively, human waste disposal is not a big issue among the households as majority of them have water-sealed toilets for hygienic and sanitary disposal of their wastes. Nonetheless, it is imperative that during the implementation of the project including the related resettlement for those that will be affected, proper disposal facility of all types of waste is a must-have.

Sources of Water. Table 136 presents the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to source of water for drinking and other purposes. A can be gleaned from the table, among the 140 households which will be directly affected, a good majority of 87 or 62.1 percent have water service connections with the Davao City Water District (DCWD); 37 or 26.4 percent rely on ground water; 14 or 10% are sourcing water from various uncategorized sources; 1 or 0.7 percent is sourcing water from a spring; and another 1 or 0.7 percent is relying on rain water.

Likewise, among the 175 households which will be indirectly affected by the proposed project, a good majority of 106 or 60.6 percent have water service connection with the DCWD; 48 or 27.4 percent are getting water from different uncategorized sources; 15 or 8.6 percent are sourcing water underground; 4 or 2.3 percent are relying on a spring, and 2 or 1.1 percent are dependent upon rainwater.

In sum, of the 315 households which will be directly and indirectly affected by the proposed project, a good majority of 193 or 61.3 percent have water service connection with DCWD; 62 or 19.7 percent are getting water from various uncategorized sources; 51 or 16.2 in reliance to underground water; 5 or 1.6 percent are relying upon a spring, and 3 or 1 percent are dependent upon rainwater.

In conclusion, the households which will be affected by the project whether directly or indirectly, are situated in places where there are permanent sources of water. Therefore, in the course of implementing the project, including the related resettlement of those affected, ensuring they will have permanent sources of water is imperative.

Table 136. Distribution of Respondents by Source of Water

Sources of Water	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Spring	1	0.7	4	2.3	5	1.6
groundwater	37	26.4	15	8.6	51	16.2
rainwater	1	0.7	2	1.1	3	1.0
City Water District	87	62.1	106	60.6	193	61.3
Others	14	10.0	48	27.4	62	19.7
Total	140	100.0	175	100.0	315	100.0

Fuel for Cooking. Table 137 shows the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the fuel they used for cooking. As can be gleaned from the table, households use clean fuel, solid fuel, and

uncategorized ones referred to as others. Clean fuel includes gas and electricity, while solid fuel is exclusively wood in this study's findings.

As shown by the figures, among the 140 households which will be directly affected by the project, 70 of them that is 50 percent of half of them are using wood, for cooking; 27 or 19.3 percent of them use gas; 22 or 15.7 percent of them are using stoves which can be powered by both clean fuel electricity and gas, and 21 or 15 percent of them are using various uncategorized fuels for cooking.

Meanwhile, among the 175 households which will be indirectly affected by the project, most of them, 78 or 44.6 percent are using wood, for cooking; 42 or 24 percent of them use stoves that can be powered by both clean fuels, gas and electricity; 37 or 21.1 percent of them are using gas; 15 or 8.6 percent of them are using other uncategorized fuels for cooking; and 3 or 1.7 percent of them are using electricity for cooking.

Table 137. Distribution of Respondents by Type of Fuel for Cooking

Use for Cooking	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Wood	70	50.0	78	44.6	147	46.7
Stove (gas and electric)	22	15.7	42	24.0	64	20.3
Gas	27	19.3	37	21.1	64	20.3
Electric Powered	0	0.0	3	1.7	3	1.0
Others	21	15.0	15	8.6	36	11.4
Total	140	100.0	175	100.0	315	100.0

In totality, among the 315 households which will be affected by the proposed project, most of them, 147 of 46.7 to be exact are using wood for cooking; 64 or 20.3 percent are using stoves that can be powered by both clean fuel gas and electricity; also 64 or 20.3 percent of them are using gas; 36 or 11.4 percent of them are using various uncategorized fuels; and 3 or 1 percent of them are exclusively using electricity for cooking.

Therefore, it can be concluded that most of the households which will be affected by the proposed project either directly or indirectly are situated in areas where wood as fuel for cooking abounds.

Monthly Electricity Bill. Presented in **Table 138** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to their monthly bill for electricity consumption. As can be gleaned from the table, of the 140 households that will be directly affected, 61 or 43.6 percent, that is most of them have monthly electricity consumption worth P901.00 and above; 42 or 30 percent of them consumes P301.00 to P600.00 worth of electricity; 20 or 14.3 percent of them consumes P601.00 to P900.00, and 17 or 12.1 percent of them consumes P300.00 or less.

On the other hand, among the 175 households which will be indirectly affected by the project, 77 or 44 percent, that means most of them consumes electricity that is worth P901.00 and above in for a month; 41 or 23 percent consumes P301.00 to P600.00 worth; 29 or 16.6 percent bills P300.00 or less in a month; and 28 or 16 percent pays P601.00 to P900.00 a month.

In sum, of the 315 households which will be affected by the project, directly or indirectly, 138 or 43.8 percent, and that is most of them, bills P901.00 and above for electricity consumption in each month; 83 or 26.3 percent of them consumes P301.00 to P600.00 worth; 48 or 15.2 percent of them bills P601.00 to P900.00; and 45 or 14.3 percent of them pays P300.00 or less a month.

Conclusively, the households that will be affected by the project are obviously low-income ones given their electricity consumption of mostly less than a thousand pesos in a month. Hence, sustainable source of livelihood must be an important consideration in resettlement plans.

Table 138. Distribution of Respondents According to the Monthly Electricity Bill.

Monthly Electricity Bill	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
P300 and below	17	12.1	29	16.6	45	14.3
P301 to P600	42	30.0	41	23.4	83	26.3
P601 to P900	20	14.3	28	16.0	48	15.2
P901 and above	61	43.6	77	44.0	138	43.8
Total	140	100.0	175	100.0	315	100.0

4.4.2.5 Access to Education, Health Care Services, and Information

Educational Attainment. Table 139 presents the distribution of respondents per household that will be directly and indirectly affected by the proposed flood control project of Davao City according to their educational attainment. As the table shows, of the 140 respondents from households which will be directly affected, 75 or 53.6 percent, that is a simple majority of them are high school graduates; 30 or 21.4 percent of them are college graduates; 29 or 20.7 of them are elementary graduates; 5 or 3.6 percent of them finished vocational course; and 1 or 0.7 percent of them has no formal education.

Similarly, among the 175 respondents from households which will be indirectly affected by the project, a simple majority of them that is 100 or 57.1 percent of them are high school graduates; 36 or 20.6 percent of them are elementary graduate; 31 or 17.7 percent of them are college graduates; 5 or 2.9 percent of the got vocational education; and 4 or 2.3 percent have no formal education.

In summary, of the 315 respondents from the households which will be affected by the project either directly or indirectly, a simple majority of them that is 175 or 55.6 percent are high school graduates; 65 or 20.6 percent of them are elementary graduate; 61 or 19.4 percent of them are

college graduates; 10 or 3.2 percent of them got vocational training; and 5 or 1.6 percent of them have not gotten any formal education.

Therefore, given the figures, a great majority of the respondents are basically literates. Only very few have not gotten formal education. Less than 25 percent of them, however, are college graduate; less than 25 percent also are elementary graduate; and even less than 5 percent of them got vocational training. The provision of practical skills training for them to be sustainably and gainfully employed is ideal.

Table 139. Distribution of Respondents According to Educational Attainment.

Educational Attainment	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Elementary	29	20.7	36	20.6	65	20.6
Highschool	75	53.6	100	57.1	175	55.6
Vocational	5	3.6	5	2.9	10	3.2
College	30	21.4	31	17.7	61	19.4
No formal education	1	0.7	4	2.3	5	1.6
Total	140	100.0	175	100.0	315	100.0

Number of Schooling Household Members. Presented in **Table 140** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the number of schooling household members. As shown in the table, among the households which will be directly affected, there is a maximum of 6 preschoolers, minimum of 1 and a mean of 2; maximum of 5 elementary school children, minimum of 1, and a mean of 2; a maximum of 4 high school attendees, minimum of 1, and a mean of 2; a maximum of 8 college enrollees, minimum of 1, and a mean of 1; and 1 vocational course taker.

On the other hand, among the 175 households which will be indirectly affected by the project, there is a maximum of 4 preschoolers, minimum of 1, and a mean of 1; a maximum of 3 elementary graders, minimum of 1, and a mean of 1; a maximum of 4 high school attendees, minimum of 1, and a mean of 2; a maximum of 2 college students, minimum of 1, and a mean of 1; and a maximum of 2 vocational course takers, minimum of 1, and a mean of 1.

All in all, among the 315 households which will be affected by the project, there is a maximum of 6 preschoolers, minimum of 1, and a mean of 2; a maximum of 5 elementary graders, minimum of 1 and a mean of 2; a maximum of 4 high school students, minimum of 1, and a mean of 2; a maximum of 8 college students, minimum of 1, and a mean of 1; and a maximum of 2 vocational course takers, minimum of 1, and a mean of 1.

Given these figures, it is therefore imperative that related resettlement projects must ensure that education from preschool through vocational and college must be conveniently accessible.

Table 140. Distribution of Respondents by Number of Schooling Household Members

Type of Respondents		Preschool	Elementary	Highschool	College	Vocational
Directly Affected Household	Mean	2	2	2	1	1
	Minimum	1	1	1	1	1
	Maximum	6	5	4	8	1
Indirectly Affected Household	Mean	1	1	2	1	1
	Minimum	1	1	1	1	1
	Maximum	4	3	4	2	2
Total	Mean	2	2	2	1	1
	Minimum	1	1	1	1	1
	Maximum	6	5	4	8	2

Source of Educational Support. Table 141 shows the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the source of support of the schooling members. As shown by the figures, among the 140 households which will be directly affected, majority that is 110 or 78.6 percent, are relying on their parents for educational support; 4 or 2.9 percent are supported by relatives; 1 or 0.7 percent has barangay scholarship; also 1 or 0.7 percent has city government scholarship; still 1 or 0.7 percent is a beneficiary of CCT or 4Ps; another 1 or 0.7 percent is supported by a categorized source; and 22 or 15.7 percent did not respond to this item.

Table 141. Distribution of Respondents According to the Source of Educational Support

Support to Education	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Parents	110	78.6	121	69.1	231	73.3
Relative	4	2.9	2	1.1	6	1.9
barangay scholar	1	0.7	0	0.0	1	0.3
City/Provincial Scholar	1	0.7	1	0.6	2	0.6
CCT/4Ps	1	0.7	2	1.1	3	1.0
Others	1	0.7	5	2.9	6	1.9
No Response	22	15.7	44	25.1	66	21.0
Total	140	100.0	175	100.0	315	100.0

Likewise, among the 175 households which will be indirectly affected, a good majority that is 121 or 69.1 percent rely on parents for educational support; 5 or 2.9 percent have uncategorized source of educational support; 2 or 1.1 percent receive support from relatives; also 2 or 1.1 percent are beneficiaries of the Conditional Cash Transfer (CCT) better known as the 4Ps; 1 or 0.6 percent is a city government scholar; and 44 or 25.1 percent did not respond to this item.

In summary, of the 315 households which will be affected by the project directly or indirectly, a great majority of 231 or 73.3 percent rely on their parents for educational support; 6 or 1.9 percent are getting support from relatives; also 6 or 1.9 percent are getting support from

uncategorized sources; 3 or 1 percent are beneficiaries of the Conditional Cash Transfer (CCT) otherwise known as 4Ps; and 1 or 0.3 percent is a barangay scholar.

Given the figures in this particular table and the conditions earlier discussed, especially that these households are practically low-income, provision of educational support or scholarships by the government agency concerned as a complementary project, is highly favorable.

Number of Members Who Stopped Going to School. Presented in **Table 142** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the number of members who stopped schooling. As can be gleaned from the table, for those households which will be directly affected by the project, there is a maximum of 6 household members who stopped schooling, a minimum of 1, and a mean of 1. Similarly, among those households which will be indirectly affected, there is a maximum of 6 members who stopped schooling, a minimum of 1, and a mean of 1. In the entirety, there is a maximum of 6 members who stopped schooling, a minimum of 1, and a mean of 1.

Table 142. Distribution of Households by Number of Members who Stopped Schooling

Type of Respondents	Number of Members Stopped Going to School		
	Mean	Minimum	Maximum
Directly Affected Household	1.1525	1	6
Indirectly Affected Household	1.2901	1	6
Average	1.2249	1	6

Reasons to Stop Going to School. Table 143 shows the distribution of respondents from the households which will be affected by the flood control project according to the reasons for its members to stop going to school. As shown by the figures, among those from households which will be directly affected, unfortunately, a great majority that is 121 or 86.4 percent did not respond to this item; 9 or 6.4 percent said the stoppage was due to financial support problems; 6 or 4.3 percent have other uncategorized reasons; 3 or 2.1 percent stopped because of the need to work instead; and 1 or 0.7 percent is due to the distance of the school from their house.

Similarly, among the respondents from those households which will be indirectly affected, it is also unfortunate that a great majority that is 143 or 81.7 percent did not respond to this item; 11 or 6.3 percent responded that it was due to financial issues; 16 or 9.1 percent have various uncategorized reasons; 4 or 2.3 percent said they had to work instead; and 1 or 0.6 percent answered that it was because of the distance of the school from their home. Therefore, another information supporting the favorability of scholarship and other forms of educational support as a complementary project.

Table 143. Distribution of Respondents by Reasons to Stop Schooling

Reasons of Stopped Schooling	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Distant school	1	0.7	1	0.6	2	0.6
Financial Support	9	6.4	11	6.3	20	6.3
Had to work	3	2.1	4	2.3	7	2.2
others	6	4.3	16	9.1	22	7.0
No Response	121	86.4	143	81.7	264	83.8
Total	140	100	175	100	315	100

Household Members with Illness. Presented in **Table 144** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the number of ill members. As can be gleaned from the table, for those households which will be directly affected by the project, there is a maximum of 8 household members with illness, a minimum of 1, and a mean of 1.8772. Similarly, among those households which will be indirectly affected, there is a maximum of 8 members who are ill, a minimum of 1, and a mean of 2.0538. In the entirety, there is a maximum of 8 members who are ill, a minimum of 1, and a mean of 1.9867.

Table 144. Distribution of Households by Number of Household Members with Illness.

Type of Respondents	Household Members with Illness		
	Mean	Minimum	Maximum
Directly Affected Household	1.8772	1	8
Indirectly Affected Household	2.0538	1	8
Average	1.9867	1	8

These illnesses which types are identified in the next table can be because of their environment. Given the figures, relocating them to a healthier environment and making health services accessible, are among the most important considerations in planning for the complementary projects of resettlement for those affected to ensure that illnesses will be lessened or the number of sick days be minimized, and household members with illnesses will be properly cared for.

Type of Illnesses. Presented in **Table 145** is the distribution of households that will be directly and indirectly affected by the proposed flood control project of Davao City according to the type of illnesses experienced by its members. Among the 140 households that will be directly affected, cough and cold are the most common illness which was experience by 44 respondents or 31.4 percent; followed by fever, 31 or 22.1 percent; then diarrhea with 3 or 2.1 percent. Some 35 per cent opted not to answer. Similar illnesses were observed to be experienced by those indirectly affected household respondents. It implies that illnesses experienced by the households are both viral and bacterial wherein proper hygiene and sanitation can be a preventive help.

Table 145. Distribution of Households by Type of Illnesses Experienced

Type of Illness	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Cough and Cold	44	31.4	72	41.1	116	36.8
Fever	31	22.1	49	28.0	80	25.4
Diarrhea	3	2.1	1	0.6	4	1.3
Infection	2	1.4	6	3.4	8	2.5
Others	10	7.1	21	12.0	31	9.8
No Response	50	35.7	26	14.9	76	24.1
Total	140	100.0	175	100.0	315	100.0

As to the leading causes of mortality and morbidity, no data on barangay level is available. The City Health Office provided District level data which could be found in Annex I. Undetermined natural cause, diabetes mellitus, cerebrovascular accident and heart diseases are among the common causes of mortality across the districts of Davao City while hypertension, acute respiratory infection and urinary tract infection are the common causes of morbidity.

Place of Medication. As can be gleaned from **Table 146**, 36 or 25.7 percent of the directly affected household practiced self-medication while 26 respondents go to either private or government hospitals for treatment. More than half of the respondents opted not to response.

Among the indirectly affected households, some 30.9 per cent practiced self-medication, about 26 per cent go to hospitals and 0.6 per cent seek the help of faith healer (albularyo) when sick.

Table 146. Distribution of Respondents by Place of Medication for Illnesses

Place of Medication	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Self-medication	36	25.7	54	30.9	90	28.6
Private Hospital	13	9.3	30	17.1	43	13.7
Government Hospital	13	9.3	16	9.1	29	9.2
Albularyo	0	0.0	1	0.6	1	0.3
Others	0	0.0	5	2.9	5	1.6
No Response	78	55.7	69	39.4	147	46.7
Total	140	100.0	175	100.0	315	100.0

Manner of Garbage Disposal. Among the respondents, majority are relying on the government's scheduled garbage collection. Other solid waste disposal methods practiced by the respondents are use of owned garbage bins/cans; composting; and, burning.

Of the 175 households which will be indirectly affected, more than half are relying on the government's scheduled garbage collection; 58 households (or 33.1 percent) have their own garbage bins/cans; 15 (or 8.6 percent) practice burning or incineration; 5 or 2.9 percent have

compost pits; also 5 or 2.9 percent did not specify the manner their garbage is disposed; and 3 or 1.7 percent did not answer.

Table 147. Distribution of Households by Manner of Garbage Disposal

Place of Medication	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Garbage can	47	33.6	58	33.1	105	33.3
Compost pit	9	6.4	5	2.9	14	4.4
City Government system	73	52.1	89	50.9	162	51.4
Incineration	8	5.7	15	8.6	23	7.3
Others	2	1.4	5	2.9	7	2.2
No Response	1	0.7	3	1.7	4	1.3
Total	140	100.0	175	100.0	315	100.0

Data revealed that majority of the residents Davao is dependent on the city government's garbage collection scheme. The burning remains an option. The environment-friendly composting is at least being practiced by some respondents.

Channel of Communication. Communication plays a vital role in human life. A good and consistent source can help gain and spread knowledge and information. The top 3 sources of information for the direct and indirectly affected respondents were TV (27.3%), cellphone (21.8%), and the local government (19.7%). Some respondents also answered two-way radio, newspapers, and the internet. This finding would suggest that mass media platforms like a TV broadcast, cellphone, and internet can intensify the information, education, and communication campaign to improve the community's awareness, understanding, and acceptance of the proposed project. Moreover, the efforts by local government to communicate directly to citizens bears several inherent characteristics within which its importance lays such as it offers authentic and reliable information (**Table 148**).

Table 148. Distribution of Respondents According to Channels of Communication.

Channel of Communication	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Two-way Radio	83	18.9	91	16.9	174	17.8
TV	124	28.2	143	26.5	267	27.3
Newspaper	6	1.4	6	1.1	12	1.2
Cellphone	93	21.2	120	22.2	213	21.8
Internet	39	8.9	81	15.0	120	12.3
Local Government	94	21.4	99	18.3	193	19.7
Total	439	100.0	540	100.0	979	100.0

*Multiple Response

Organization Membership. Organizations are essential components of social and physical environments, as they exert considerable influence over people's choices. Based on the perception survey, however, majority of the direct (67.1%) and indirectly affected households (55.4%) were not members of any organization, while the remaining 36.2 percent declared membership to a specific organization (**Table 149**).

Table 149. Distribution of Respondents by Membership of Organization

Organization Membership	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Yes	40	28.6	74	42.3	114	36.2
No	94	67.1	97	55.4	191	60.6
No Response	6	4.3	4	2.3	10	3.2
Total	140	100.0	175	100.0	315	100.0

Type of Organization. With organizational membership, out of 114 respondents of both direct and indirectly affected households who are members of a specific organization, 34.2 percent are associated to Women's Organization, 29.8 percent are members of Senior's Organization, 3.5 percent in Youth Organization, 1.8 percent in Farmers Organization, while others revealed to be members of a religious organization, driver's association, cooperatives, private groups, etc. (**Table 150**).

Table 150. Distribution of Respondents by Type of Organization

Type of Organization	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Senior's Organization	10	25.0	24	32.4	34	29.8
Farmers Organization	1	2.5	1	1.4	2	1.8
Women's Organization	13	32.5	26	35.1	39	34.2
Youth Organization	2	5.0	2	2.7	4	3.5
Others	14	35.0	21	28.4	35	30.7
Total	40	100.0	74	100.0	114	100.0

4.4.2.6 Common Issues and Problems Encountered

Part of the perception survey is investigating issues and problems encountered by the respondents. The thirteen barangays affected by the proposed project face many problems. Based on multiple response analysis, the topmost problem in the area is flooding, which is encountered by most directly affected (39.1%) and indirectly affected households. The second most common problem is landslide (12.9%), third is unemployment (12.2%), fourth is poverty (10.01%), and fifth is the lack of potable water supply 5.9%). Most of the areas in Davao City prone to flooding are those close to rivers and creeks. The 41 problem areas that have been

geotagged by the Davao City Risk Reduction and Management Office (CDRRMO) were constantly experiencing flooding caused by the swelling of Davao River, Matina River, Lasang River, overflow of highly silted canals or creeks. Some of these are identified as low elevated areas or areas on high elevation but are lower than their surrounding areas. Other respondents also revealed issues and problems in agriculture, education, health, government aid and livelihood programs, waste disposal, and others (**Table 151**).

4.4.2.7 Perception of the Proposed Project

This section elaborates the insights of the affected households on the proposed Priority Projects for Flood Control of Davao River in Davao City.

Awareness of the Proposed Project. One of the challenges in the drive to build a prepared, adaptive, and disaster-resilient community is to promote public awareness. Awareness is the state of being conscious of something. More specifically, it is the ability to directly know and perceive, feel, or be cognizant of events in the surrounding. It is considered a starting point to influence adoption decisions towards any developmental change, such as the proposed Davao River Flood Control Project.

Table 151. Distribution of Respondents by Issues and Problems Encountered.

Common Issues and Problems Encountered	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Flood	135	39.1	57	19.0	192	29.8
Landslide	47	13.6	36	12.0	83	12.9
Jobless	33	9.6	46	15.3	79	12.2
Poverty	25	7.2	40	13.3	65	10.1
No potable water supply	18	5.2	20	6.7	38	5.9
No irrigation system	21	6.1	14	4.7	35	5.4
Lack of food	14	4.1	16	5.3	30	4.7
Inadequate school supply	8	2.3	22	7.3	30	4.7
Education assistance	11	3.2	9	3.0	20	3.1
Inadequate livelihood assistance	6	1.7	10	3.3	16	2.5
Shortage of teacher	10	2.9	5	1.7	15	2.3
No financial capital	6	1.7	9	3.0	15	2.3
Inadequate hospital access	2	0.6	4	1.3	6	0.9
Inadequate transportation facility and infrastructure	2	0.6	4	1.3	6	0.9
Inadequate facility for farming/fishing/aquaculture	5	1.4	0	0.0	5	0.8
Inadequate assistance to level up the organization	1	0.3	3	1.0	4	0.6
Wrong solid waste management	1	0.3	3	1.0	4	0.6
Others	0	0.0	2	0.7	2	0.3
Total	345	100.0	300	100.0	645	100.0

*Multiple responses

The survey revealed that most of the directly (64.3%) and indirectly affected households (57.7%) are aware of the DPWH Proposed Davao River Flood Control Project. Meanwhile, 35.7 percent of direct and 42.3 percent of indirectly affected households are still unaware (**Table 152**). The analysis was extended by looking into households' awareness by project locations. As shown in the table below, 5 out of 10 directly affected households are aware of the retarding ponds in their barangay. Also, most of the directly affected households in cut-off work and dredging areas are aware of the proposed project. This scenario is also the same in indirectly affected areas of the project.

Table 152. Distribution of Respondents by Awareness on the Proposed Project.

Component	Category	Type				Total	
		Direct		Indirect			
		F	%	F	%	F	%
Retarding Ponds	Yes	4	50.0	34	57.6	38	56.7
	No	4	50.0	25	42.4	29	43.3
Total		8	100.0	59	100.0	67	100.0
Cut-off Works	Yes	26	66.7	1	50.0	27	65.9
	No	13	33.3	1	50.0	14	34.1
Total		39	100	2	100	41	100
Dredging	Yes	89	65.4	77	57.5	166	61.5
	No	47	34.6	57	42.5	104	38.5
Total		136	100.0	134	100.0	270	100.0

Sources of Information. The joint responsibility of the government and the representative organizations is to ensure that representatives of the most vulnerable and marginalized groups of the active population are associated as closely as possible with the formulation and implementation of the proposed flood control project. Raising public awareness of the project helps the community become cognizant of getting involved to ensure their rights and privileges are heard and considered. The majority of the direct (51.5%) and indirectly affected households (52.3%) were informed about the project through the efforts of barangay council officials and employees. In addition, 29.3 percent revealed that they heard it through word of mouth, 2.9% were aware through government public held meetings while others (15.9%) were informed through TV news, social media, in their workplace, and others (**Table 153**).

Table 153. Distribution of Respondents According to Sources of Information.

Sources of Information	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Word of Mouth	33	33.3	28	25.7	61	29.3
Barangay Council Officials and Employees	51	51.5	57	52.3	108	51.9
government meetings	4	4.0	2	1.8	6	2.9
Others	11	11.1	22	20.2	33	15.9
Total	99	100.0	109	100.0	208	100.0

Community's Acceptance of the Project. The decision to establish the project is somehow affected by the community's understanding, perspective, and genuine support. Based on the survey, almost all of the respondents of direct (88.6%) and indirectly affected households (97.7%) are willing to accept the proponent in implementing the proposed project. The community's positive thoughts towards the project can explain the high support. On the other hand, 6.3 percent of total respondents, especially the directly affected households (11.4%), are still on the opposing side because of the disadvantages it would cause in their lives (**Table 154**).

Specifically, most of the directly and indirectly affected households are willing to accept the proposed Retarding Pond and Dredging components of the project. In addition, the entire household-respondents in the indirectly affected areas of cut-off works also expressed willingness to accept and support the government project. The result implies the community's high acceptability of the proposed flood control project in the Davao River. There is a need, however, to investigate the views and opinions of people who will be affected directly by the cut-off work component in Barangay Ma-a.

Table 154. Distribution of Respondents According to Acceptance of the Project

Component	Category	Type				Total	
		Direct		Indirect			
		F	%	F	%	F	%
Retarding Ponds	Yes	7	87.5	57	96.6	64	95.5
	No	1	12.5	2	3.4	3	4.5
Total		8	100	59	100	67	100
Cut-off Works	Yes	0	0.0	37	100.0	37	100.0
	No	0	0.0	0	0.0	0	0.0
Total		0	0	37	100	37	100
Dredging	Yes	121	89.0	133	98.5	254	93.7
	No	15	11.0	2	1.5	17	6.3
Total		136	100.0	135	100.0	271	100.0

Perceived Advantages of the Project. The positively skewed support can be explained by the optimistic thoughts of the community towards the project (**Table 155**). Most directly (44%) and indirectly affected households (29.1%) respondents believed it would stop or reduce flooding occurrence of flooding in their area. Others (30.4%) also presumed that the flood control project would lessen the volume of floodwater flowing downstream where the city is situated. In addition, 18.2 percent believed that it would prevent the erosion of riverbanks, while some (13.4%) hoped it would create job opportunities, especially during the construction phase of the proposed project.

Table 155. Distribution of Respondents by Reason of Acceptance

Reason of Acceptance	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Flood control	187	44.0	103	29.1	290	37.2
Flood water will be reduced	133	31.3	104	29.4	237	30.4
Erosion control Davao River bank	67	15.8	75	21.2	142	18.2
Employment during construction	37	8.7	67	18.9	104	13.4
Others	1	0.2	5	1.4	6	0.8
Total	425	100.0	354	100.0	779	100.0

*Multiple Response

Perceived Disadvantages of the Project. While most of the household respondents expressed support for the project, many were apprehensive of some hindrances the project might create. For example, out of 49 directly affected households who opposed the project, 31 or 63.3 percent believed that it would result in the loss of homes and properties, especially for the households living along the Davao River. Furthermore, 23.4 percent of direct and indirectly affected households said that the project would affect their lands, resulting in the loss of their source of income, while 8.2 percent of directly affected predicted that it would cause chaos to the project-affected communities due to possible relocation or resettlement (**Table 156**).

Table 156. Distribution of Respondents According to Reason of Disapproval

Reason of Disapproval	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Displacement of residents along Davao River	31	63.3	11	73.3	42	65.6
Loss of livelihood	12	24.5	3	20.0	15	23.4
Conflict due to relocation	4	8.2	0	0.0	4	6.3
Others	2	4.1	1	6.7	3	4.7
Total	49	100.0	15	100.0	64	100.0

*Multiple Response

Willingness to Support the Proposed Flood Control Project. Overall, the survey shows a positive response based on willingness to support the proposed project. The majority of direct (89.3%) and indirectly affected households (96.6%) express their willingness to support the proponent in implementing this proposed flood control project, while 5.7 percent still do not approve (**Table 157**). As to specific area, it was found out that majority of the directly and indirectly affected household-respondents are willing to support the proposed retarding ponds and dredging project. Also, more than half of the indirectly affected households are supportive in the cut-off works in Ma-a and 19-B areas of Davao City. However, directly affected households of this component, especially those located in Purok 27 of Barangay Ma-a, are consistently unwilling to cooperate even in the data collection and community consultation process.

Table 157. Distribution of Respondents by Willingness to Support the Project

Component	Category	Type				Total	
		Direct		Indirect			
		F	%	F	%	F	%
Retarding Ponds	Yes	7	87.5	57	96.6	64	95.5
	No	1	12.5	2	3.4	3	4.5
Total		8	100	59	100	67	100
Cut-off Works	Yes	0.0	0	22	51.0	22	51.0
	No	0.0	0	21	49.0	21	49.0
Total		0	0		100		100
Dredging	Yes	121	89.0	133	98.5	254	93.7
	No	15	11.0	2	1.5	17	6.3
Total		136	100.0	135	100.0	271	100.0

Government Actions for the Affected Land and Houses. The initial results of the survey indicated three crucial actions of the government or demands of affected household respondents for the damage to their properties. First, most direct, and indirectly affected households demand just compensation for the damaged properties of the proposed flood control project (80.7%). In addition, 23.5 percent of directly affected households requested for a relocation site if the proposed project will be approved, while 3.5 percent said they would support the government plans by expressing no objections to their proposed projects (**Table 158**).

Table 158. Distribution of Respondents by Demands to the Government

Demands to the Government	Directly Affected Household		Indirectly Affected Household		Total	
	F	%	F	%	F	%
Government must pay for the affected land and houses	84	73.0	96	88.9	180	80.7
Relocation site for affected households	27	23.5	12	11.1	39	17.5
Give the affected land/house to the government for free	4	3.5	0	0.0	4	1.8
Total	115	100.0	108	100.0	223	100.0

4.4.2.8 In-Migration/Proliferation of Informal Settlers

As can be seen from Table 134, a total of 126 informal settlers within the project site and immediate vicinity were recorded. Of the 126 ISF, 56 households are directly affected and 70 households are indirectly affected because they are residing outside the site of the flood control infrastructures. These ISF are occupying and tilling either a private or government lands. Once the project is implemented and operational, the flooding on the area will be eliminated or minimized, hence, the site becomes conducive for settlement. Increase in the number of ISF is expected to rise dramatically.

4.4.2.9 Cultural/Lifestyle change (especially on Indigenous People, if any)

With reference to Table 118, the households residing within the project site and immediate vicinity come from different ethnic origins. Majority of them are native of Davao. Others are Ilonggo, Boholano, Indigenous People (IP) and others coming from other parts of the country. These people are living harmoniously in the area. As observed during the survey, most of them, if not all to have adapted the lifestyle of mixed culture and just privately practice some cultural rituals unique to their ethnic origin.

Although the directly and indirectly affected households are coming from different ethnic origin, majority are members of Roman Catholic, INC, SDA or Protestant congregations. Some belong to other religious affiliations like Muslim.

The mitigation of flooding in the area would possibly increase the in-migration rate in the area. The increase of migrants, however, would not adversely change the culture and lifestyle of the community because at present the people are adapted to a mixed culture lifestyle.

4.4.2.10 Sand and Gravel Concessionaires

There about 70 sand and gravel (SAG) concessionaires operating along the stretch of the Davao River (**Figure 45**). These sand gravel operators are not residing within the project sites and are operating in medium to big scale. They are holders of SAG permits which expired in 2019 and some in 2020. The SAG permit is only valid for one (1) year renewable and is issued by the City Government. In 2019, however, there was a moratorium for the sand and gravel operations in Davao River because of the Resource Sustainability and Geohazards Assessment to be conducted to the whole stretch of the Davao River.

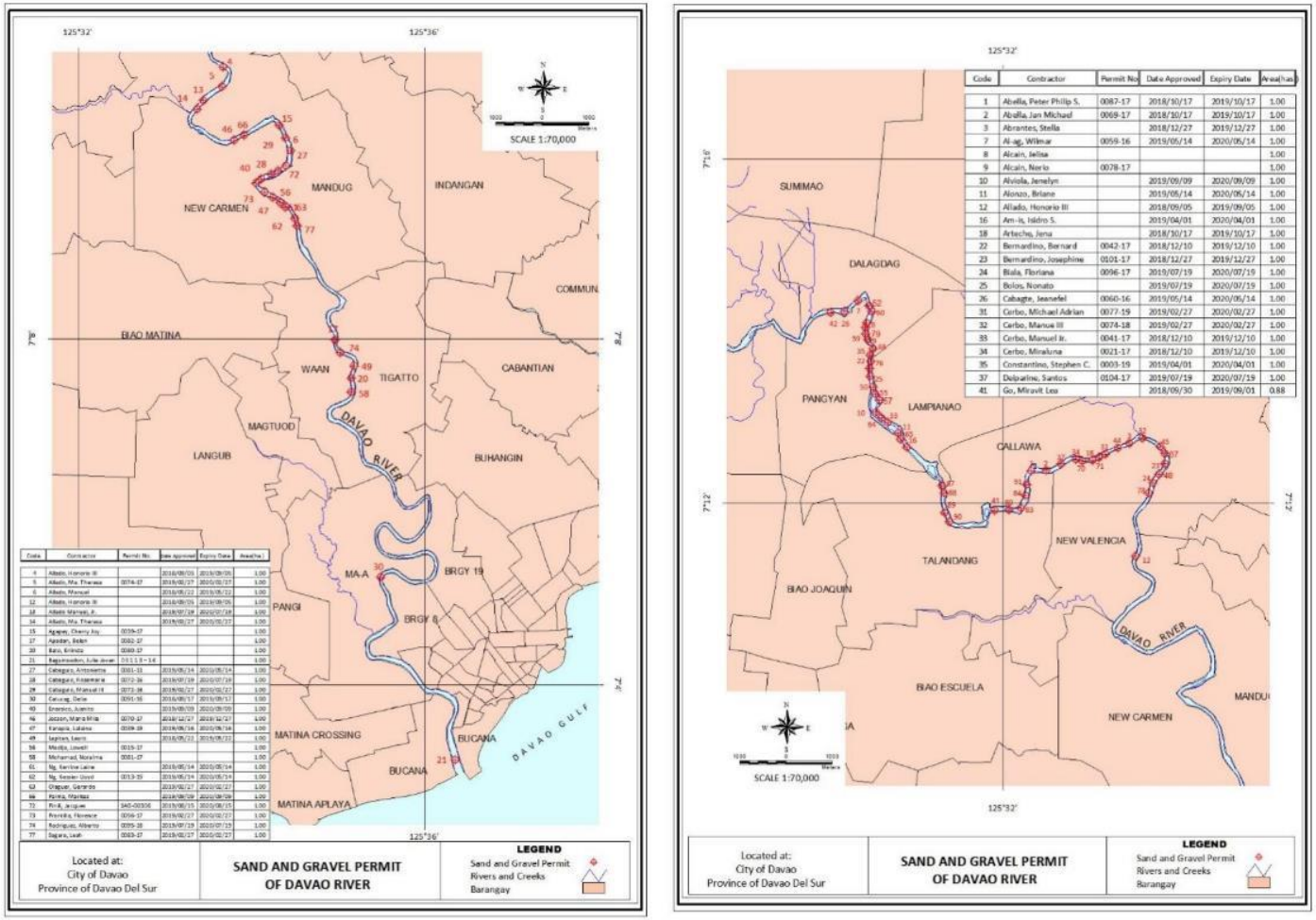


Figure 45 Sand and Gravel Operators along Davao River

4.4.2.11 Kagan Community

The Kagan (also referred to as Kalagan) is one of the 11 tribes present in Davao City. They are the only Islamized Indigenous Peoples (IPs) in the Davao Gulf area and are also considered one of the Muslim minority groups in Mindanao. They converted to Islam either through intermarriage or contact with Muslim missionaries in the early 16th century from their neighboring communities, the Maguindanaon and Tausug in western Mindanao. The Kagan are identified as a sub-group of the Mandaya-Mansaka who originally inhabited the areas within Davao del Sur, Compostela Valley (now Davao de Oro), Davao del Norte, Davao Oriental and North Cotabato. Most are in an area between the interior uplands and the western coast of the Davao Gulf. Their lifestyle and culture are considered very similar to that of the Maguindanao.

Kagan came from the native word *'kaag'* which means to inform, alert, or warn. It was used when they needed to inform their community members and other neighboring communities like the Mandaya-Mansaka about something about to happen as they were living near the rivers and coastal areas of Davao.

The Kalagan language (sometimes referred to as Kinagan) is like the Tagakaolo language but has also incorporated some Maguindanaon and Tausug words. It is also related to the Mandaya language while other words are influenced by the Arabic language. Some also know Visayan, Tagalog (Filipino), and English.

In Davao City, the Kagan live in different areas but most of them are concentrated in Sirawan, Toril, the first barangay they resided in after they migrated from Davao Oriental in search of a safe place to cultivate their community. They settled in the area during the early 1900s. Other areas where the Kagan has settled are Barangays Wa-an and Maa.

In the context of flood control project, around 96 ISFs in the *Kagan* community in barangay Maa will be affected by the proposed dredging and cut-off work components. However, due to the opposition expressed by the *Kagan* ISFs, only 3 candidate near-site relocation areas are included in the baseline study. These priority candidate households are residing in around 1.6 hectares of Alienable & Disposable (A & D) land and found to be without title.

Acknowledging the sensitivity of the issue as it involves the *Kagan* community, the National Commission for Indigenous People (NCIP) in Region XI was consulted by the RAP and EIS team. The NCIP conducted a thorough investigation of the affected community. As a result, the office issued CNO or Certificate of Non-overlap wherein IP plan is not required of the project. In addition, the decision by the NCIP could match the requirement from the JICA Guideline for Environmental and Social Considerations and the World Bank OP 4.10 [Indigenous Peoples].

However, since Kagan community is mostly informal settlers, and their income level is low, sufficient compensation and social support is highly recommended.

4.4.2.12 Impact of the project and mitigating measures

Based on the analyses of primary and secondary data, the following potential impacts are identified with corresponding prevention, mitigation, or enhancement measures. The project is expected to create some adverse effects in the psycho-social, economic, health and safety, and peace and order conditions of the directly and indirectly affected households.

List of Key Impacts	Phase Occurrence			Discussion/Options for Prevention, Mitigation or Enhancement
	Pre-Construction	Construction	Operation	
Psycho-social issues:				
Advent of fear among directly affected communities due to loss of areas which are source of their living especially in retarding pond areas	√	√	√	• IEC on the nature and operation of the environmental enhancement project, including mitigating measures and benefits to the community • Financial, social supports, etc. shall be given to them based on the IEC and or public consultation
Fear of flooding (overflow) in nearby communities of retarding ponds	√	√	√	• IEC on the nature, design, and operation of the retarding ponds and risk management measures to be imposed • Creation and implementation of disaster risk management plan • Conduct IEC on disaster risk management • Community seminars/training on disaster risk preparedness, mitigation, adaptation, response, recovery, and rehabilitation • Support BDRRMC in the provision of equipment and supplies in responding to and recovery from natural disasters
Negative perception towards the project or the social acceptability of the community	√			• Extensive IEC campaign and community level consultations to enhance awareness, attitude, and acceptability among stakeholders
Stress due to noise and air pollution during civil works		√		• Proper and regular maintenance of heavy equipment • Installation of mufflers • Proper work schedule at daytime

List of Key Impacts	Phase Occurrence			Discussion/Options for Prevention, Mitigation or Enhancement
	Pre-Construction	Construction	Operation	
Fear of road accident and traffic congestions		√		• Creation of road network and traffic management plan • Provision of speed limits in major roads and built-up areas • Establishment of construction buffer zones and containment barriers • Coordination with concerned government agencies like the City Traffic Management Office, and BLGUs
Economic issues:				
Income loss from agricultural production due to removal of crops and utilization of land for the proposed flood control projects		√		• Preferential hiring of qualified barangay residents (LGCP R.A. 7160; 1995 PMA R.A. 7942) • Creation of RAP which include "just compensation" of affected properties
Local employment generation during construction works		√		• Priority hiring of qualified local workforce • Conduct of specialize training program of the host communities to enhance competencies of local residence • Creation of RAP plan that includes livelihood assistance for the affected households
Termination of workers		√		• Advance notice shall be given to workers • Provision of compensation packages for construction workers
• Health and safety issues:				
Threat to health due to dust generation / dispersion during construction phase		√		• Creation and implementation of health-related programs and services for the host communities • Implementation of dust suppression techniques like covering of trucks loaded with spoils/filling materials when in transit, pre-wetting or watering of road surface • Creation of occupational safety plan
Increase in traffic flow causing air (dust) and noise pollution	√	√	√	• Proper scheduling of hauler trucks to avoid late hours hauling and road congestion. • IEC on the community in terms of traffic safety • Sprinkling of roads during dry seasons • Assistance to the LGU on traffic management

List of Key Impacts	Phase Occurrence			Discussion/Options for Prevention, Mitigation or Enhancement
	Pre-Construction	Construction	Operation	
				• Provision of safety facilities
Peace and Order				
Public chaos due to opposing individuals or groups who will be dislocated or relocated	√	√		• Conduct of community consultations • Creation of grievance and redress system and Resettlement Action Plan
Proliferation of illegal settlers	√	√		• Coordination with the Barangay LGU to ensure authorized establishments and control of unauthorized entry of outsiders before and during the implementation of the project • Geotagging of affected households in the pre-implementation phase
Others				
Histrical heritage, land scape		√	√	• No historical heritages are observed in the Project site. On the other hand, The Corocodile Park, located near the area COW, is one of the most famouse torisim spot; it is imporatant to design a new river canal, to control construction works to avoid to impare the value of the Park.

4.4.2.12 Traffic Assessment

Traffic count survey was conducted to clarify the order of priority for the construction of bridges in Barangay Maa, Davao City, one of the sub projects for the proposed cut-off works under the Davao River Flood Control Project. Cut-off works will be installed at the downstream near Crocodile Park to shorten the river line and is expected to quickly discharge flood water into the sea and to increase flow capacity. The objective of the traffic count survey is to understand the present traffic magnitude, type of vehicles and traffic flows near the project site. The bridge to be constructed at the two (2) different sites will serve as an access going to the Davao Crocodile Park while the other one will link commuters to Purok Padaman, Barangay Maa, Davao City. Figure below shows the proposed location of the bridge of Component B Cut-off Works. **Figure 46** presents the traffic location survey.

Methods

Manual Classified Traffic Counts (MCTC) was used. MCTC survey is done by tallying recorded vehicles based on their classification passing through an identified traffic survey station within a predetermined period. In order to count the vehicles, a survey form is used (**Annex G**);

- At Intersection – to provide comprehensive information on the volume of vehicles using the intersection by showing the volume of each mode per turning movement per unit of time

The traffic data was manually tallied every 30 minutes per vehicle type and travel direction (Leg) and then consolidated and summarize to hourly per directional flow and station.

- ☐ Traffic counts were conducted at two (2) intersections for a period of 24 hours from 6:00AM of Friday, February 4, 2022 to 6:00AM of Saturday, February 5, 2022.
- ☐ Vehicles were counted according to their direction of movement, and mode classification (i.e., motorcycle, tricycle, passenger car, passenger jeepney, goods utilities, small bus, large bus, rigid truck (2 axles), rigid truck (3 axles), semi-trailer truck (3 and 4 axles), semi-trailer truck (5+ axles), trailer truck (4 axles), and trailer truck (5+ axles).
- ☐ Traffic volumes were counted and aggregated for each 30-minute period and further summarized into an hourly count.

The leg details of the Manual Classified Traffic Count conducted is shown in **Table 159**

Table 159. Details of the Traffic Survey

Proposed Bridge A (Going to Crocodile Park)		Proposed Bridge B (Going to Padaman Riverside)	
Survey ID	Number of Legs	Survey ID	Number of Legs
ITC01	3 Legs	ITC02	3 Legs

Data Processing and Analysis

Vehicles were classified according to the type of vehicle according to the existing DPWH Highway Planning Manual 2015 (**Table 160**).

Table 160. Vehicle Classifications

No.	Vehicle Type
1a	Motor-Tricycle
1b	Motorcycle
2	Passenger Car
3	Passenger Utility
4	Goods Utility
5	Small Bus
6	Large Bus
7	Rigid Truck 2-Axle
8	Rigid Truck 3-Axle
9	Truck Semi-Trailer 3-4 Axle
10	Truck Semi-Trailer 5 Axle

11	Truck Trailer 4 Axle
12	Truck Trailer 5 Axle

Estimation of Annual Average Daily Traffic (AADT)

The Average Annual Daily Traffic (AADT) was calculated in three steps:

1. Applying to the one-day counts with the expansion factor by vehicle type, which converts the 16-hour traffic into a 24-hour traffic.
2. Applying to the one-day expanded 24-hour traffic counts with the Daily Factors (DF) by vehicle type, which converts the 24-hour traffic into average daily traffic counts.
3. Applying to the Average Daily Traffic (ADT) the Seasonal Factors (SF) by vehicle type, which converts the ADT into the Annual Average Daily Traffic (AADT).

The AADT was computed using the formula:

$$AADT = (24 - EF)\ x\ DF\ x\ SF\ x\ TC$$

Where:
AADT = Annual Average Daily Traffic
24-EF = 24 Hour Expansion Factor
DF = Daily Factor
SF = Seasonal Factor
TC = Traffic Count

DPWH Traffic Count Data

Traffic Adjustment Factors were taken from a National Road Traffic Survey Program (NRSTP) survey station nearest site with historical data of traffic from the DPWH RTIA survey site, which is SV11036MN_MC. The reference site is in section ID S00022MN, Buhangin Lapanday. The traffic adjustment factor is presented in **Table 161.**

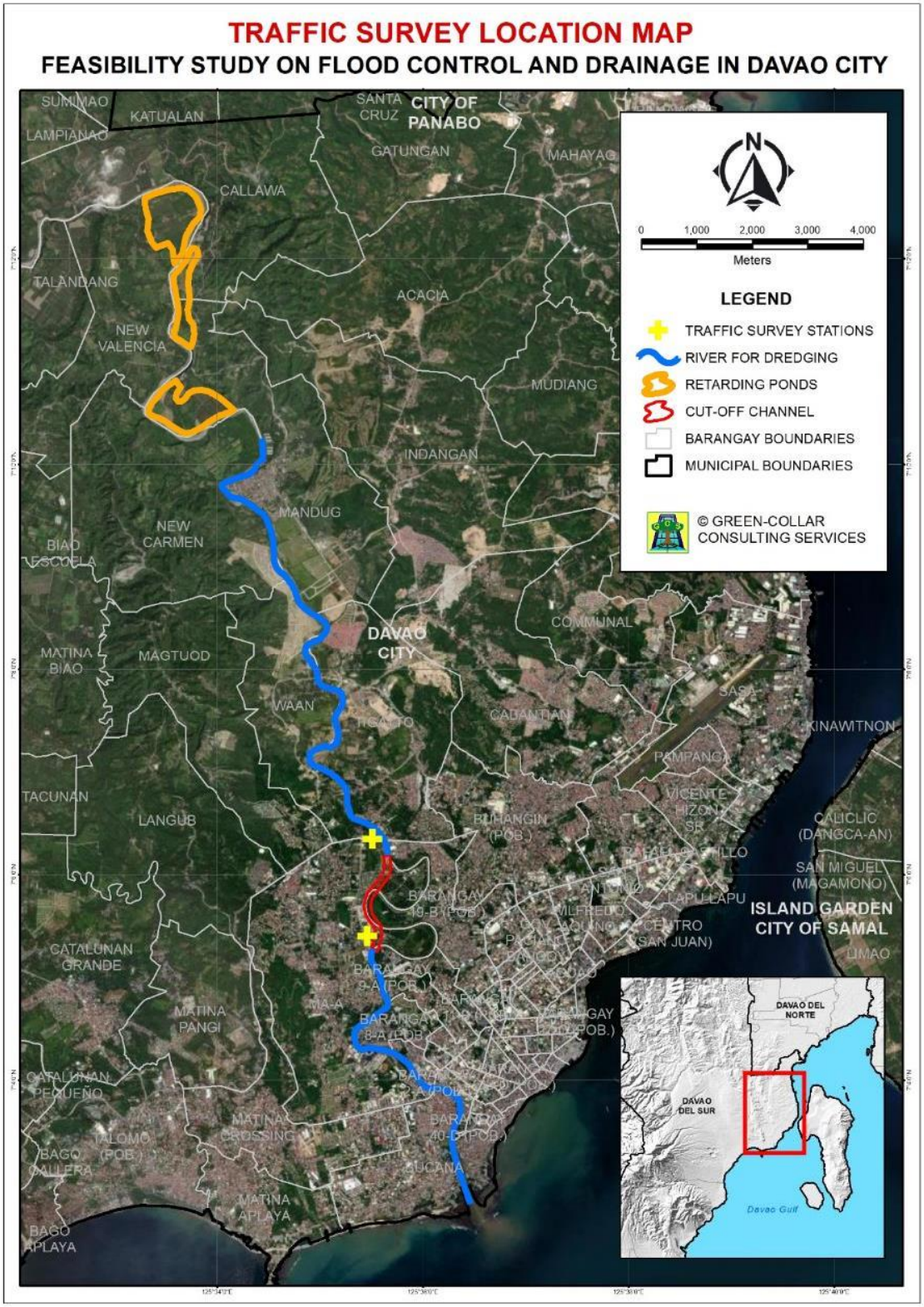


Figure 46 Location of Traffic Survey

Result and Discussion

1. ITC 01 – Entrance going to the Davao Crocodile Park

The AM peak-traffic flow of vehicles in Station 1 (ITC 01) was recorded between 8:00AM to 9:00AM with a total of 3,894 vehicles, while the PM peak-traffic was observed between 1:00PM to 2:00PM and 5:00PM to 6:00PM comprising of 2,481 and 2302 vehicles, respectively. A total of 42,422 vehicles were tallied in this survey site in a span of 24-hours. Traffic gradually declined from 7:00 PM to 4:00AM and steadily increased after 4:00AM. Peak hours followed the usual trend that is 8:00 to 9:00 in the morning and 5:00 to 6:00 in the afternoon. Perhaps, these observed peak hour traffic were caused by commuters catching their work in the morning and going home in the afternoon (**Table 162).**

The volume of vehicles at Station 1 (Buhangin Diversion Road – Davao Crocodile Park – Maa-Diversion Road) is very high. Passenger cars continued to be the highest observed vehicle type with a total of 19,699 vehicles and the number of trucks using the diversion road to deliver their cargoes on time is noticeable. Tricycles and motorcycles were relatively high in terms of traffic volume as these types of vehicles are commonly seen plying in the streets following the fast and ongoing development happening in this southern city (**Figure 47**).

The volume of vehicles at Station 1 (Buhangin Diversion Road – Davao Crocodile Park – Maa-Diversion Road) is very high. Passenger cars continued to be the highest observed vehicle type with a total of 19,699 vehicles and the number of trucks using the diversion road to deliver their cargoes on time is noticeable. Tricycles and motorcycles were relatively high in terms of traffic volume as these types of vehicles are commonly seen plying in the streets following the fast and ongoing development happening in this southern city (**Figure 47**).

Table 161. Traffic Adjustment Factors

For Monday, April	1a	1b	2	3	4	5	6	7	8	9	10	11	12
	Motor-Tricycle	Motorcycle	Passenger Car	Passenger Utility	Goods Utility	Small Bus	Large Bus	Rigid Truck 2-Axle	Rigid Truck 3-Axle	Truck Semi-Trailer 3&4 axles	Truck Semi-Trailer 5+ axles	Truck Trailer 4-Axle	Truck Trailer 5-Axle
Expansion	1.6542	1.6542	1.8485	1.6047	1.2805	1.4641	1.3520	1.5662	1.3385	5.0000	2.2857	1.0000	1.0000
DF	1.0214	1.0214	0.9872	0.9865	1.1709	1.3954	1.1635	0.9848	1.0394	1.8571	0.8750	1.0000	1.0000
SF	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Source: DPWH

Table 162. ITC 01 Traffic Count (Hourly Volume Count)-All Directions

Time		Vehicle Classification													
		1a	1b	2	3	4	5	6	7	8	9	10	11	12	
From	To	Motor-Tricycle	Motor cycle	Passenger Car	Passenger Utility	Goods Utility	Small Bus	Large Bus	Rigid Truck 2-axle	Rigid Truck 3-axle	Truck and Semi-Trailer 3&4 axle	Truck Semi-Trailer 5+ axle	Truck Trailer 4-axle	Truck Trailer 5-Axle	Total
6:00	7:00	7	1188	1007	1	48	2	10	55	12	1	0	0	0	2331
7:00	8:00	16	1558	1724	17	70	0	17	157	40	2	5	1	1	3608
8:00	9:00	10	1934	1602	7	206	4	10	89	24	3	4	0	1	3894
9:00	10:00	17	893	1185	12	135	3	17	93	94	21	38	5	17	2530
10:00	11:00	14	766	720	7	132	5	13	182	121	0	11	9	33	2013
11:00	12:00	20	595	886	3	91	3	8	106	85	3	18	2	17	1837
12:00	13:00	4	623	860	2	71	1	12	94	74	2	10	3	15	1771
13:00	14:00	11	708	1269	14	104	3	14	182	126	3	12	8	27	2481
14:00	15:00	11	342	802	8	90	3	12	123	91	8	3	6	10	1509
15:00	16:00	18	617	1092	22	230	3	16	126	61	13	12	1	31	2242
16:00	17:00	4	738	1206	6	114	3	9	77	26	4	1	5	18	2211
17:00	18:00	13	824	1275	8	61	2	8	67	31	2	1	4	6	2302
18:00	19:00	30	987	961	15	44	3	16	18	15	0	0	0	0	2089
19:00	20:00	24	926	1054	13	38	1	17	22	35	5	10	0	0	2145
20:00	21:00	19	722	891	7	63	0	13	104	169	31	70	0	0	2089
21:00	22:00	9	557	682	3	45	0	15	66	80	8	34	0	0	1499
22:00	23:00	10	366	561	2	31	0	9	58	59	14	52	0	0	1162
23:00	0:00	3	272	387	0	32	0	5	48	53	11	34	0	0	845
0:00	1:00	2	187	263	0	26	0	5	58	59	10	36	0	0	646
1:00	2:00	3	133	170	0	32	0	1	56	49	17	31	0	0	492
2:00	3:00	4	116	161	0	28	0	5	34	54	5	20	0	0	427
3:00	4:00	9	122	187	0	44	0	7	49	46	8	37	0	0	509
4:00	5:00	15	186	261	3	43	5	19	43	46	17	31	0	0	669
5:00	6:00	17	351	493	5	58	6	19	61	60	13	38	0	0	1121
24-Hour Count		290	15711	19699	155	1836	47	277	1968	1510	201	508	44	176	42422

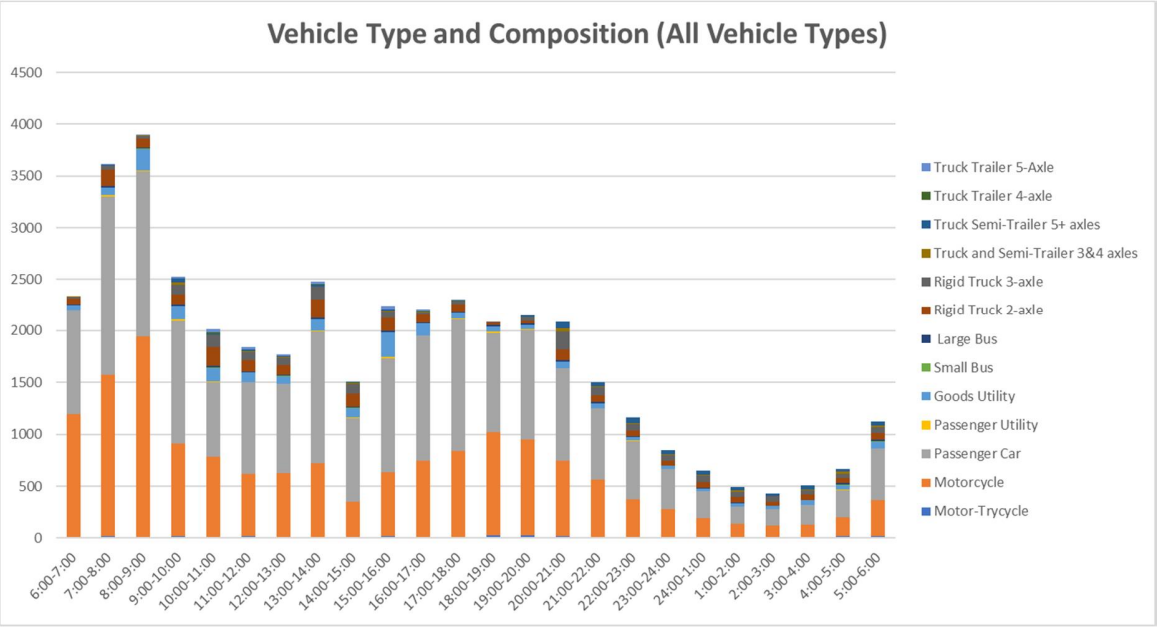


Figure 47. ITC 01 Vehicle Composition, All directions

Since the intersection traffic count is a survey recording the turning movements, the traffic count was further summarized into total AADT in each intersection leg/approach. The following shows the intersection diagram and the total AADT in each leg.

Based on the result of manual traffic count survey, the F1 and F6 route (Maa Diversion Road to Buhangin Diversion Road and Buhangin Diversion Road to Maa Diversion Road) has the highest volume of vehicles at over 17,000 vehicles per day. This result is expected as this route is used to avoid and mitigate congestion in Davao City. The travel time between Brgy. Sirawan in Toril District Davao City and Brgy. J.P. Laurel in Panabo City of 1 hour and 44 minutes via the Pan-Philippine Highway Diversion Road is expected to be reduced to 49 minutes via the Davao City Bypass. Other routes (going in and out of Crocodile Park) were observed to have a daily traffic volume of less than 1000 vehicles per day.

Using the formula to obtain the Average Annual Daily Traffic, passenger cars posted the highest AADT with an overall vehicle share of 46 percent. This is followed by motorcycle (37.04%), Rigid truck 2-axle (4.64%), Goods Utility (4.33%), Rigid truck 3-axle (3.56%), and Truck Semi-Trailer 4-axle (1.20%). The remaining vehicle classification garnered an overall vehicle AADT share of less than one percent. **Table 163 and Figure 48** present the AADT per flow of ITC 01 on a 24-hour average and flow diagram of ITC 01, respectively.

Table 163. AADT Per Flow of ITC 01 24-Hour Average

Traffic Station	Vehicle Classification													
	1a	1b	2	3	4	5	6	7	8	9	10	11	12	Total
	Motor-Tricycle	Motor cycle	Passenger Car	Passenger Utility	Goods Utility	Small Bus	Large Bus	Rigid Truck 2-axle	Rigid Truck 3-axle	Truck and Semi-Trailer 3&4 axle	Truck Semi-Trailer 5+ axle	Truck Trailer 4-axle	Truck Trailer 5-Axle	
F1	114	6697	8092	46	751	7	114	724	825	122	286	5	80	17863
F2	8	237	408	4	1	0	0	22	2	0	0	0	0	682
F3	10	247	404	16	8	0	0	23	1	0	0	0	0	709
F4	2	121	337	7	8	0	0	8	1	0	0	0	0	484
F5	13	259	500	10	1	0	0	23	0	0	0	0	0	806
F6	143	8150	9958	72	1067	40	163	1168	681	79	222	39	96	21878
Total AADT	290	15711	19699	155	1836	47	277	1968	1510	201	508	44	176	42422
% Share	0.68	37.04	46.44	0.37	4.33	0.11	0.65	4.64	3.56	0.47	1.20	0.10	0.41	100.0

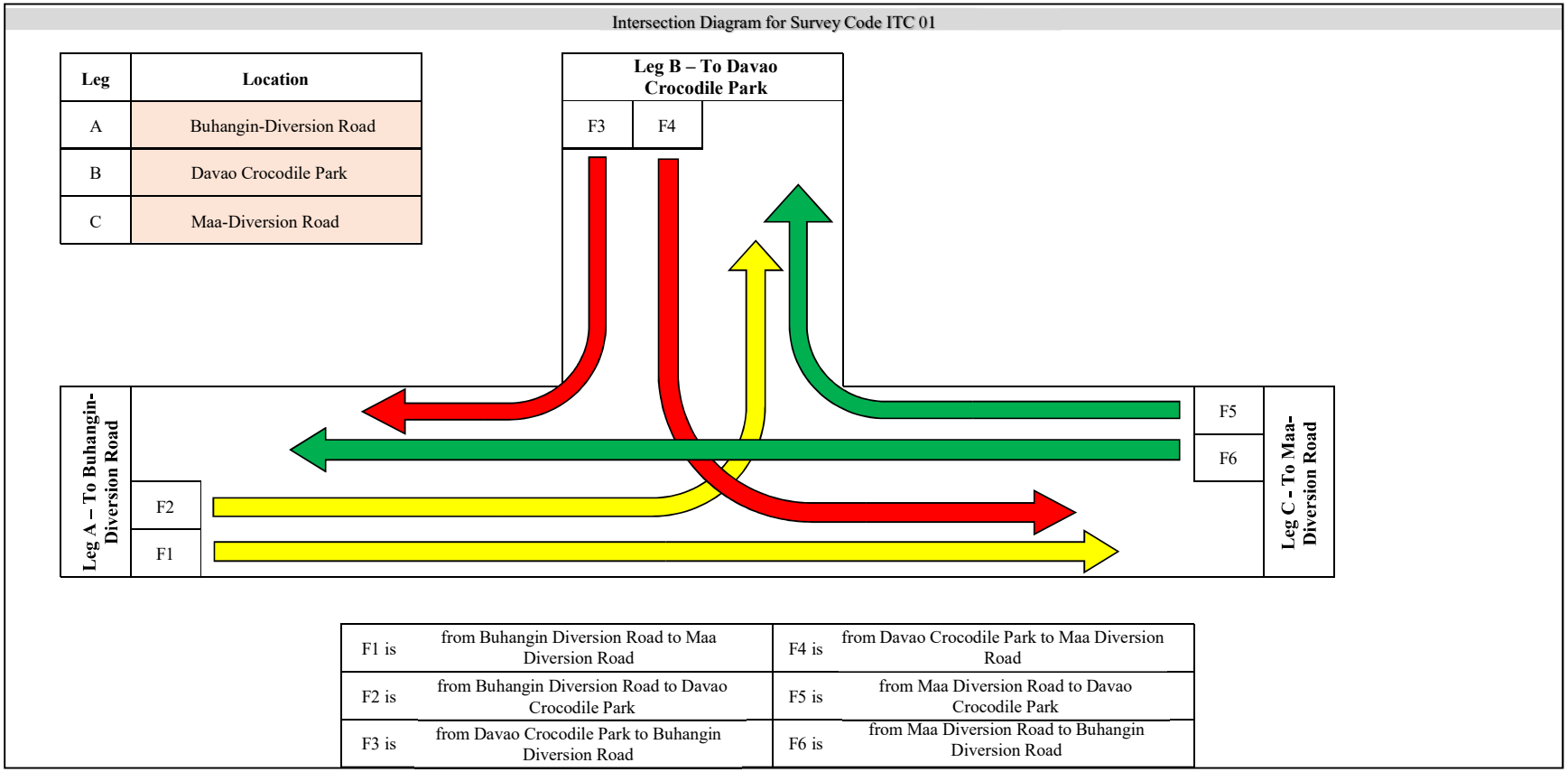


Figure 48. Flow Diagram of ITC 01

2. ITC 02 – Entrance going to Padaman Riverside

Peak hour at Station 2 (ITC 02) was observed at 8:00 to 9:00 in the morning. Significant volume of traffic was also observed during afternoon peak hour at 5:00PM to 6:00PM. Also, the intersection is carrying a heavy traffic which is more than one thousand vehicles per hour from 7:00AM to 6:00PM. Traffic drastically declined from 6:00PM onwards with an observed traffic volume of less than one thousand vehicles per hour. This road is usually used to by daily commuters as alternative route going to the downtown area and to avoid traffic congestion in the Diversion Road (**Table 164).**

Traffic composition at Station 2 showed typical mixing of different transport mode in the road network. Passenger cars registered the highest observed vehicle type passing this intersection with a total of 10,731 vehicles, followed by motorcycles and motor tricycles. The share of trucks was also significant due to the presence of several manufacturing companies and batching plants (**Figure 49**).

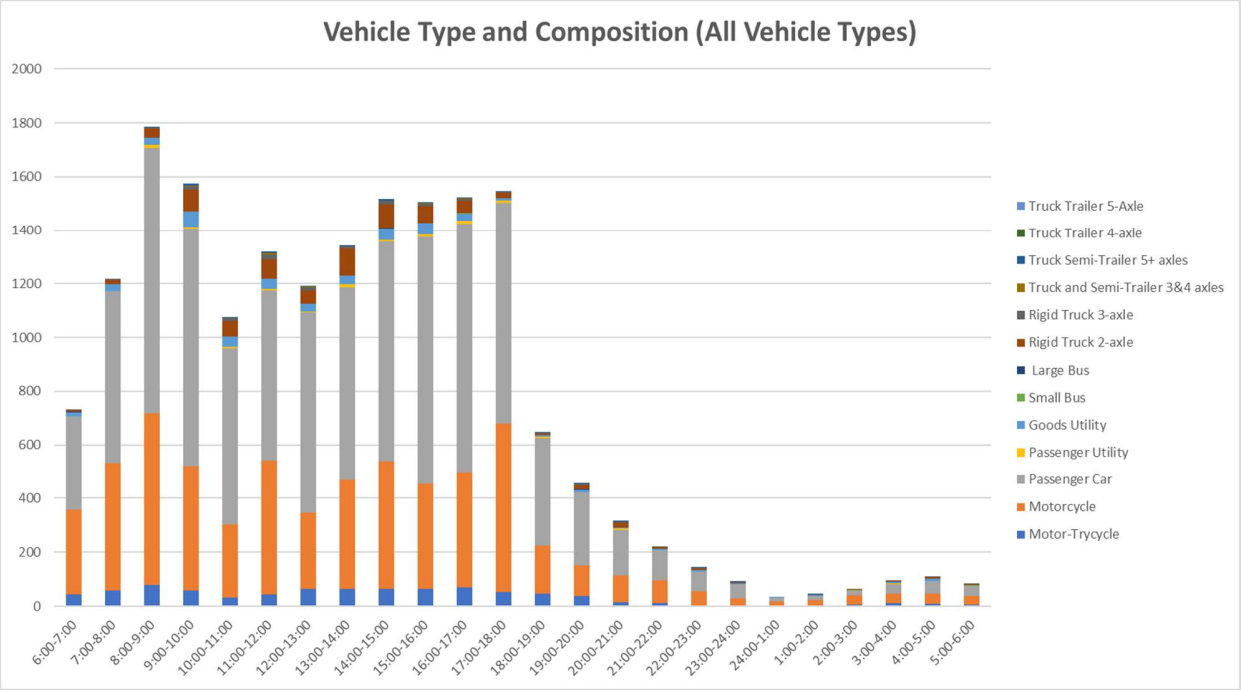


Figure 49. Vehicle Compositions-All Directions (ICT 02)

Table 164. ITC 02 Traffic Count (Hourly Volume Count)-All Directions

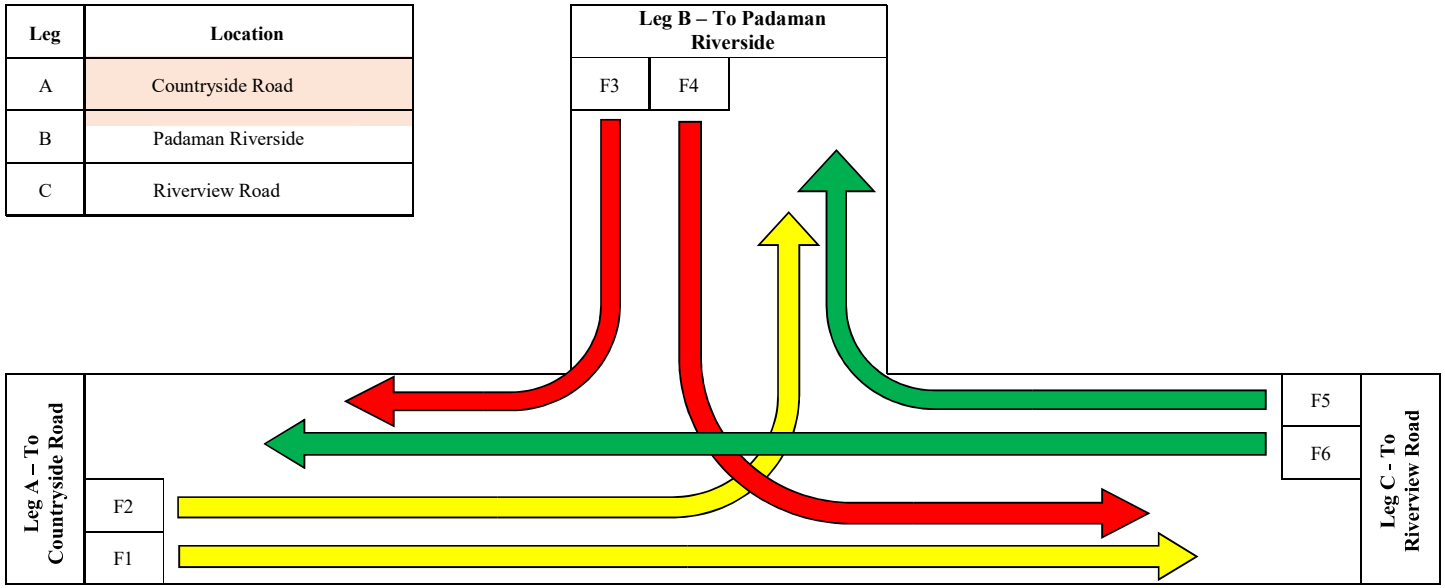
Time		Vehicle Classification													
		1a	1b	2	3	4	5	6	7	8	9	10	11	12	
From	To	Motor-Tricycle	Motor cycle	Passenger Car	Passenger Utility	Goods Utility	Small Bus	Large Bus	Rigid Truck 2-axle	Rigid Truck 3-axle	Truck and Semi-Trailer 3&4 axle	Truck Semi-Trailer 5+ axle	Truck Trailer 4-axle	Truck Trailer 5-Axle	Total
6:00	7:00	43	315	350	0	14	0	1	8	2	0	0	0	0	733
7:00	8:00	59	471	643	0	26	0	0	14	5	0	0	0	0	1218
8:00	9:00	77	640	989	13	26	0	0	34	5	0	1	0	0	1785
9:00	10:00	57	461	890	6	57	0	0	82	12	2	5	0	1	1573
10:00	11:00	33	269	657	6	39	0	0	57	12	1	3	0	0	1077
11:00	12:00	44	495	635	6	40	0	0	70	20	4	5	0	0	1319
12:00	13:00	63	284	747	3	28	0	0	51	12	1	2	0	0	1191
13:00	14:00	64	405	719	9	33	0	0	102	9	1	2	0	0	1344
14:00	15:00	64	470	825	6	44	0	1	87	14	2	4	0	0	1517
15:00	16:00	65	390	921	9	43	0	1	63	9	4	2	0	0	1507
16:00	17:00	70	425	931	10	28	1	0	46	7	2	1	0	0	1521
17:00	18:00	53	627	824	9	8	0	0	21	2	0	1	0	0	1545
18:00	19:00	45	180	401	4	7	1	0	5	3	0	1	0	0	647
19:00	20:00	37	114	270	1	9	0	1	15	6	0	2	0	0	455
20:00	21:00	14	98	170	7	1	0	1	16	6	0	1	0	0	314
21:00	22:00	12	84	110	0	6	0	1	4	1	0	1	1	0	220
22:00	23:00	3	53	72	1	6	0	0	4	2	0	1	0	0	142
23:00	0:00	1	29	50	0	4	0	0	3	2	0	5	0	0	94
0:00	1:00	2	14	16	0	2	0	0	0	0	0	0	0	0	34
1:00	2:00	3	19	16	0	3	0	0	1	1	0	1	0	0	44
2:00	3:00	5	37	15	0	2	1	0	2	0	0	0	0	0	62
3:00	4:00	11	36	34	2	8	0	0	3	1	0	0	0	0	95
4:00	5:00	10	36	47	1	7	0	1	6	2	0	0	0	0	110
5:00	6:00	5	32	39	0	0	1	0	4	2	0	0	0	0	83
24-Hour Count		840	5984	10371	93	441	4	7	698	135	17	38	1	1	18630

Based on the result of manual traffic count survey, the F1 and F6 route (Maa Diversion Road to Buhangin Diversion Road and Buhangin Diversion Road to Maa Diversion Road) has the highest volume of vehicles with an observed value of more than 17,000 vehicles per day. This result is expected as this route is used to avoid and mitigate congestions in Davao City. The 1 hour and 44 minutes travel time from Brgy. Sirawan in Toril District, Davao City to Brgy. J.P. Laurel in Panabo City via the Pan-Philippine Highway Diversion Road will be reduced to 49 minutes via the Davao City Bypass Road. Other routes (going in and out of Crocodile Park) were observed to have a daily traffic volume of less than 1000 vehicles per day. The intersection diagram is shown in **Figure 50.**

Using the formula to obtain the Average Annual Daily Traffic, vehicle classification with the highest AADT belongs to passenger car with an overall vehicle share of 46 percent. This is followed by motorcycle (37.04%), Rigid truck 2-axle (4.64%), Goods Utility (4.33%), Rigid truck 3-axle (3.56%), and Truck Semi-Trailer 4-axle (1.20%). The remaining vehicle classification garnered an overall vehicle AADT share of less than one percent (**Table 165**).

Intersection Diagram for Survey Code ITC 02

Leg	Location
A	Countryside Road
B	Padaman Riverside
C	Riverview Road



F1 is	from Countryside Road to Riverside Road	F4 is	from Padaman Riverside to Riverview Road
F2 is	from Countryside Road to Padaman Riverside	F5 is	from Riverview Road to Padaman Riverside
F3 is	from Padaman Riverside to Countryside Road	F6 is	from Riverside Road to Countryside Road

Figure 50 Flow Diagram of ITC 02

Table 165. AADT Per Flow of ITC 02 24-Hour Average

Traffic Station	Vehicle Classification													
	1a	1b	2	3	4	5	6	7	8	9	10	11	12	
	Motor-Tricycle	Motor cycle	Passenger Car	Passenger Utility	Goods Utility	Small Bus	Large Bus	Rigid Truck 2-axle	Rigid Truck 3-axle	Truck and Semi-Trailer 3&4 axle	Truck Semi-Trailer 5+ axle	Truck Trailer 4-axle	Truck Trailer 5-Axle	Total
F1	206	2574	5164	31	182	2	0	303	53	6	15	0	0	8536
F2	143	155	64	5	4	0	1	13	3	1	1	0	0	390
F3	128	200	60	6	10	0	0	24	1	0	0	0	1	430
F4	76	142	74	2	0	1	1	17	0	0	0	0	0	313
F5	67	94	59	1	2	0	2	10	0	0	0	0	0	235
F6	220	2819	4950	48	243	1	3	331	78	10	22	1	0	8726
Total AADT	840	5984	10371	93	441	4	7	698	135	17	38	1	1	18630
% Share	4.51	32.12	55.67	0.50	2.37	0.02	0.04	3.75	0.72	0.09	0.20	0.01	0.01	100.0

Impact of the project and mitigating measures

The Impacts Management Plan (IMP) for traffic management is formulated to minimize the potential adverse impacts of the proposed bridge construction while enhancing the beneficial effects of implementation of the project. This IMP, as summarized below, shall serve as the implementing guideline to ensure that all requirements are met during pre-construction, construction, and operation phase. The following strategies will be observed in coordination and partnership with the concerned agencies in traffic management. Programs and proposed mitigation indicated can be updated during the monitoring of the perceived project impacts.

List of Key Impacts	Phase Occurrence			Discussion/Options for Prevention, Mitigation or Enhancement
	Pre-Construction	Construction	Operation	
Fear of road accident and traffic congestions	√	√		• Creation of road network and traffic management plan • Provision of speed limits in major roads and built-up areas • Establishment of construction buffer zones and containment barriers • Installation of signages like traffic signs and hiring of spotters • Proper scheduling of hauler trucks to avoid late hours hauling and road congestion • Implement alternative route (rerouting) to avoid delays and traffic congestion near project site • Provision of sufficient sidewalks and access routes during construction phase • Coordination with concerned government agencies like the City Traffic Management Office and BLGUs • Conduct of road safety communication campaign through advertisements (e.g., television, radio, social media, billboards, etc.)
Increase in traffic flow causing air (dust) and noise pollution	√	√		• Proper scheduling of hauler trucks to avoid peak traffic hours hauling and road congestion. • IEC on the community in terms of traffic safety • Sprinkling of roads during dry seasons • Assistance to the LGU on traffic management • Provision of road safety equipment

5.0 Environmental Management Plan

Table 166 presents the summary of the impact assessment of the flood control project. The summary of impacts will serve as the implementing guidelines in formulating the Impact Management Plan.

Table 166. Summary of Assessment environmental impacts and issues, DFCDMP

Environmental Issue/Impact	Impact Assessment				
	Classification	Probability	Reversibility	Time Scale	Magnitude
Air Pollution	-	L	R	St	I
Loss of terrestrial flora	-	L	Ir	Lt	S
Loss of terrestrial fauna	-	L	Ir	Lt	S
Loss of freshwater biota	-	L	Ir	Lt	M
Loss of livelihood	-	L	R	St	M
Loss of agriculture	-	L	Ir	Lt	S
Change in landform	-	L	Ir	Lt	S
Water Pollution	-	L	R	Lt	S
Solid Waste	-	L	R	St	S
Employment	+	L	R	St	S
Reduce flood	+	L	Ir	Lt	S
Displacement of people	-	L	Ir	Lt	S
Traffic Accidents	-	L	R	St	M

+ Positive **L** - Likely **R** – Reversible **St –** Short Term **S** – Significant
- Negative **U –** unlikely **Ir** – Irreversible **Lt –** Long Term **M** – Moderate
I – Insignificant

Air pollution is likely to happen. Emissions from heavy equipment and vehicles during the dredging activities, construction of retarding ponds and cut-off works are expected. The impact is short term and reversible and the magnitude is insignificant.

Loss of terrestrial flora and fauna are impacts associated with the removal of vegetation in the retarding ponds area. These impacts are negative and irreversible and the time scale is long term. The magnitude is significant because the area will be used to detain water during flooding incidence. There will be a change in the landform and land-use of the proposed parcel of lands for retarding ponds. From the existing of commercial and agriculture use, these will be changed to ponds to detain water. This change will be permanent and significant in magnitude since the area covered is big.

Loss of freshwater biota is a negative secondary impact which is an offshoot of siltation during dredging activities, and cut-off works. Although the probability is likely and irreversible but the magnitude is placed at moderate in significance because the species found are not plenty and

are not in the red list. Solid waste generation in terms of dredged and excavated materials is one of the negative impacts with significant magnitude. It is significant because the volume is enormous and the dredged material contains heavy metals.

The community presently residing in the parcel of land for retarding ponds and along the cut-off works will be displaced. This is significant in magnitude because it involves people who would lost permanently loss their land devoted to agriculture, livelihood, and residence. These people will be relocated and compensated. Accidents specially related to traffic congestion is expected to happen during the construction period. In addition, sand and gravel concessionaires will be displaced and will lose their means of income.

Employment generation and reduction of inundated areas due to flooding are the positive impacts of the project. During the construction, there will be substantial number of manpower that will be needed both skilled and unskilled workers. Upon completion of the project, the areas that will be flooded in Davao City will be greatly reduced which will have positive impact to the economic development of the city. The value of the land previously affected by the floods will increase significantly.

5.1 Impact Management Plan

This section presents the Impacts Management Plan (IMP) of Flood Control of the Davao River Project formulated to minimize the potential adverse impacts of the project and enhance the beneficial effects of implementing the project. This plan shall be used to systematically manage the implementation and monitoring of the recommended mitigating measures that are intended to address the identified possible environmental impact of the implementing the project.
Table 167 presents the summary of the IMP of Flood Control of Davao River Project. The IMP will serve as the implementing guidelines to ensure compliance of environmental requirements during project construction and can be regularly updated during the monitoring of the perceived impacts associated to the flood control project.

Degradation of water quality of Davao River, loss of tree species in RPs and CoW sites, displacement of households and loss of livelihood (sand and gravel concessionaire) are the major impacts during the construction of the retarding ponds and cut of works. Degradation of water quality (siltation) can be mitigated using silt curtains, planting trees along the buffer zone and around the retarding ponds to re-establish the habitat for faunal species. For the social impacts such as displacement of households, and loss of livelihood can be addressed with the Resettlement Action Plan (RAP). Details of the environmental impacts and mitigating measures are presented in a matrix below. Expected residual impacts include disruption of freshwater biota, fragmentation of habitat leading to the loss of faunal species found in the area such as bats. Aesthetic alteration especially along cut-off-works is one of the residual impacts.

Despite of the engineer design and utilization of safety technology, risk and uncertainty could not be completely avoided. The collapse of retarding ponds although remote but it might happen. It

is uncertain that recolonization will be successful because re-establishment of habitat will take time. Faunal species might have migrated to other habitat where there is source of foods.

In general, the responsible entities in carrying out the implementation of the IMP are UPMO, DPWH XI, concerned departments of the Davao City government like CSSDO, Planning, CHO, CENRO, contractor and barangay LGU. The pre-construction phase will produce both positive and negative impacts. The positive impact is more on employment while the negative impact will be displacement of directly PAPs. A Resettlement Action Plan will be crafted to address the displacement of residents.

Table 167. Summary of Impact Management

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
Pre-construction						
Retarding pond Cut-off works	Resettlement	- One (1) household/ person to be relocated - Approximately 100 households or 540 persons to be relocated	- Incorporate adequate prevention to minimize the scale of land acquisition and resettlement with construction method and design - Proper compensation package base on the RAP - Reflect needs from the PAPs through proper consultation using procedure of Project Cycle Management - Comply with Philippines legal system and JICA Guideline in the compensation	UPMO-DPWH, Contractor	Resettlement cost	
Construction						
Dredging	Air quality	- Emission from heavy equipment - Dust during loading/ unloading	- Use least emission equipment to meet exhaust gas quality standards. - Regular maintenance of equipment	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Water quality	- Siltation of Davao River (turbid water) - leachate from oil/ waste	- Store waste at designated area - Prevent leachate of toxic from waste, fuel oil etc. (ex. Cover with sheet, use a drum can, install side ditch to prevent leachate). - Install adequate toilet, drainage in the basecamp. - Control of dredging schedule to minimize expansion of turbid water, and use silt fence if necessary	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Waste	- Dredged soil - Construction debris	- Follow designated waste management by the Davao City.	UPMO-DPWH,	Environmental	Part of the Dredging Master Plan

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
		- Contamination in the dredged soil	- Advance check of contamination of dredged/ excavated soil. Encourage reuse/ recycle of waste.	DPWH-XI, CLGU, Barangay, Contractor	budget: 0.17B pesos Part of the FS Cost	
	Soil contamination	- Contamination by waste, oil/ grease	- Store waste at the designated area - Prevention of leachate, of toxic from waste and fuel oil. - Education to workers to follow working guideline.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC Incl in the DED and Incl in ECC conditions
	Noise and vibration	- Noise generation by construction equipment	- Use least noise equipment. - Adequate maintenance and repair. - Adequate construction management. - Monitoring noise level.	UPMO-DPWH, DENR/EMB, Barangay, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Ecosystem	- Loss of aquatic biota	- Investigate condition of aquatic flora/ fauna - Transfer benthos to the other area where dredging is completed if necessary	UPMO-DPWH, CENRO, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Utilization of land and local resources	- Disturbance to sand mining activity	- Prior information of the schedule to the sand mining workers, residents who taking fishing activity, etc. - Encourage to reuse of dredged soil - Support to sand mining activity. - Prevention of turbid water by silt protection, etc.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Labor conditions	- Working environment - Health and safety	- Pollution control. - Awareness and education on labor environment and safety. - Provide safety equipment to workers	UPMO-DPWH, IATF, Contractor	Environmental budget: 0.17B pesos	Incl in the contractor's contract

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
	Accident	- Construction accident - Traffic accident	- Safety manual, training on accident - Install first-aid station, firefighting equipment. - Installation of fire extinguishing equipment - Compliance traffic rule.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	Incl in the contractor's contract
Retarding ponds	Air quality	- Emission from heavy equipment - Dust during loading/ unloading	- Use least emission equipment to meet exhaust gas quality standards. - Regular maintenance and repair of equipment. - Spread water during dry season. - Cover stored excavated soil with sheet to avoid dust spread.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Water quality	- Siltation of Davao River (turbid water) - leachate from oil/ waste	- Store waste at designated area - Prevent leachate of toxic from waste, fuel oil etc. (ex. Cover with sheet, use a drum can, install side ditch to prevent leachate). - Install adequate toilet, drainage in the basecamp.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Waste	- Excavated soil - Construction debris - Contamination in the excavated soil -	- Follow designated waste management by the Davao City. - Advance check of contamination of dredged/ excavated soil. - Encourage reuse/ recycle of waste. - Install adequate disposal site - Encourage recycle/ reuse	UPMO-DPWH, DPWH-XI, CLGU, Barangay, Contractor	Environmental budget: 0.17B pesos Part of the FS Cost	Part of the Dredging Master Plan
	Soil contamination	- Contamination by waste, oil/ grease	- Store waste at the designated area - Prevention of leachate, of toxic from waste and fuel oil. - Education to workers to follow working guideline.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Incl in the DED and Incl in ECC conditions

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
	Noise and vibration	- Noise generation by construction equipment	- Use least noise equipment. - Adequate maintenance and repair. - Adequate construction management. - Control of speed of vehicles and construction at night time near residential zone - Install temporary wall, sound barrier - Adequate construction plan to mitigate noise and vibration	UPMO-DPWH, DENR/EMB, Barangay, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Ecosystem	- Endangered fauna/ flora (mostly LC in IUCN categorization). - Narra (EN in IUCN) is planted by community - Ecosystem commonly observed in Davao City.	- Re-plantation based on the EMB guideline (Memorandum Circular N0. 2012 – 02, 50 trees per one (1) tree cut) - Transfer endemic/ endangered fauna (Amphibia, e.g.) - Environmentally friendly design for restoring habitats. - Encourage to use for eco-tourism, amenity	UPMO-DPWH, CENRO, Contractor	Environmental budget: 0.17B pesos	UPMO-DPWH in coordination with the City Government and DENR to implement the programs and projects
	Hydrology	- Interruption of drainage by excavation work	- Install temporary drainage.	UPMO-DPWH, Contractor	Inc. construction cost	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Poor/Vulnerable	- Slum area is not found - Loss of agricultural work	- Secure accessibility to IEC, public consultation - Assistance to access social welfare and support. - Secure adequate compensation and support indicated in the RAP.	UPMO-DPWH, Barangay, Contractor		
	Local economies	- Traffic disturbance likely causing interruption of agricultural work	- Traffic control to prevent disturbance. - Prioritize to use local resources (labor, materials, goods, etc.) - Prioritize local support to communities. - Encourage public consultation and consensus building.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
			- Secure adequate compensation and support indicated in the RAP.			
	Existing social infrastructures and services	- Demolition or interruption of local road, utilities -	- Prior notice of relocation of electric line, street lights, etc. - Provide detour - Traffic control	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Utilization of land and local resources	- Change landuse, decrease farmland	- Encourage public consultation and consensus building. - Secure adequate compensation and support indicated in the RAP. - Support to sand mining activity. - Proper design in consideration with accessibility for the community (stairway, etc.)	UPMO-DPWH, City Planning, Barangay, Contractor		UPMO-DPWH in coordination with the City Government on the re-zoning of the site
	Gender	- No adverse impact expected, however recommend to pay attention in the Project	- Encourage women to be involved in the public consultation. - Priority recruitment for women, widows. - Installment of female toilet, locker room. - Adequate labor condition (maternity leave, etc.).	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Children's rights	- No adverse impact expected, however recommend to pay attention in the Project	- Financial and social support for children of ISFs (Commute to school, counseling, etc.) - Prevent child labor. - Secure safety in school zone.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Infectious diseases	- Spread infectious diseases in the base camp, by increase of number of construction workers	- Management of construction site and basecamp (Sanitary toilet, proper waste storage, secure clean water, etc.). - Public awareness and education on infectious diseases. - Anti COVID management	UPMO-DPWH, IATF, Barangay, Contractor	Environmental budget: 0.17B pesos	

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
	Labor conditions	- Air/ water pollution - Safety, accident	- Pollution control. - Awareness and education on labor environment and safety. - Provide safety equipment to workers	UPMO-DPWH, IATF, Barangay, Contractor	Environmental budget: 0.17B pesos	Incl in the contractor's contract
	Accident	- Traffic accident due to traffic congestion, damage of road	- Safety manual, training on accident - Install first-aid station, firefighting equipment. - Installation of fire extinguishing equipment - Compliance traffic rule. - Prevention of water accident (fence, public education, etc.)	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
Cut-off works	Air quality	- Emission from heavy equipment - Dust during loading/ unloading	- Use least emission equipment to meet exhaust gas quality standards. - Regular maintenance and repair of equipment. - Spread water during dry season. - Cover stored excavated soil with sheet to avoid dust spread.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Water quality	- Siltation of Davao River (turbid water) - leachate from oil/ waste	- Store waste at designated area - Prevent leachate of toxic from waste, fuel oil etc. (ex. Cover with sheet, use a drum can, install side ditch to prevent leachate). - Install adequate toilet, drainage in the basecamp.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Waste	- Dredged soil - Construction debris - Contamination in the dredged soil	- Follow designated waste management by the Davao City. - Advance check of contamination of dredged/ excavated soil, and adequate treatment in case of contaminated - Provide adequate disposal site - Install adequate storage site to prevent from splash, spillage	UPMO-DPWH, DPWH-XI, CLGU, Barangay, Contractor	Environmental budget: 0.17B pesos Part of the FS Cost	Part of the Dredging Master Plan

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
			- Encourage reuse/ recycle of waste			
	Soil contamination	- Contamination by waste, oil/ grease	- Store waste at the designated area - Prevention of leachate, of toxic from waste and fuel oil. - Education to workers to follow working guideline.	UPMO-DPWH, DENR/EMB, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Noise and vibration	- Noise generation form construction equipment	- Use least noise equipment. - Adequate maintenance and repair. - Adequate construction management. - Control of speed of vehicles and construction at night time near residential zone - Install temporary wall, sound barrier - Adequate construction plan to mitigate noise and vibration	UPMO-DPWH, DENR/EMB, Barangay, Contractor	Environmental budget: 0.17B pesos	Inc. contractor's contract. UPMO_DPWH to ensure compliance to ECC
	Ecosystem	- Loss of habitat of aquatic biota	- Re-plantation based on the EMB guideline (Memorandum Circular N0. 2012 – 02, 50 trees per one (1) tree cut) - Environmentally friendly design of new canal	UPMO-DPWH, CENRO, Contractor	Environmental budget: 0.17B pesos	
	Hydrology	- Interruption of drainage by excavation work	- Install temporary drainage. - Monitor groundwater level if necessary.	UPMO-DPWH, Contractor	Environmental budget: 0.17B pesos	
	Poor/Vulnerable	- Relocation of ISFs in particular Kagan	- Secure accessibility to IEC. public consultation - Assistance to access social welfare and support. - Secure adequate compensation and support indicated in the RAP.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
	Local economies	- Traffic disturbance likely causing interruption of local economy	- Traffic control to prevent disturbance. - Prioritize to use local resources (labor, materials, goods, etc.) - Prioritize local support to communities. - Encourage public consultation and consensus building. - Secure adequate compensation and support indicated in the RAP.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Existing social infrastructures and services	- Demolition or interruption of local road, utilities	- Prior notice of relocation of electric line, street lights, etc. - Provide detour - Traffic control	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	UPMO-DPWH in coordination with the City Government on the re-zoning of the site
	Community severance	- Split of the land by new river canal	- Traffic control - Encourage public consultation and consensus building.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Utilization of land and local resources	- Change of landuse	- Adequate landuse control - Encourage public consultation and consensus building. - Secure adequate compensation and support indicated in the RAP. - Support to sand mining activity. - Proper design of new river canal in consideration with accessibility to river.	UPMO-DPWH, City Planning, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Landscape	- Interruption of landscape in particular Crocodile Park	- Reflect the opinion from residents, academics, etc. - Adequate design with harmonization with landscape.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Gender	- No adverse impact expected, however	- Encourage women to be involved in the public consultation.	UPMO-DPWH,	Environmental	

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
		recommend to pay attention in the Project	- Priority recruitment for women, widows. - Installment of female toilet, locker room. - Adequate labor condition (maternity leave, etc.).	Barangay, Contractor	budget: 0.17B pesos	
	Children's rights	- No adverse impact expected, however recommend to pay attention in the Project	- Financial and social support for children of ISFs (Commute to school, counseling, etc.) - Prevent child labor. - Secure safety in school zone.	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Infectious diseases	- Spread infectious diseases in the base camp, by increase of number of construction workers	- Management of construction site and basecamp (Sanitary toilet, proper waste storage, secure clean water, etc.). - Public awareness and education on infectious diseases.	UPMO-DPWH, IATF, Barangay, Contractor	Environmental budget: 0.17B pesos	
	Labor conditions	- Air/ water pollution - Safety, accident	- Pollution control. - Awareness and education on labor environment and safety. - Provide safety equipment to workers	UPMO-DPWH, IATF, Barangay, Contractor	Environmental budget: 0.17B pesos	Incl in the contractor's contract
	Accident	- Traffic accident due to traffic congestion, damage of road	- Safety manual, training on accident - Install first-aid station, firefighting equipment. - Installation of fire extinguishing equipment - Compliance traffic rule. - Prevention of water accident (fence, public education, etc.)	UPMO-DPWH, Barangay, Contractor	Environmental budget: 0.17B pesos	
Demobilization						
Dredging, Retarding ponds,	Demolition	- construction materials/ debris, Demobilize base camp	- Clean debris and dispose properly: solid waste according to RA 9003, used oil according to RA 6969	Contractor	Cost of Contractor	Included in the contractor's contract

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
Cut-off works						
Operation						
Dredging	Utilization of land and local resources	- Affect to the sand mining activity during maintenance	- Prior information of the schedule to the sand mining workers - Encourage reuse of dredged soil - Support to sand mining activity.	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
Retarding pond	Infectious diseases	- Mosquito bleeding at water remains after flood	- Control of remaining water area to prevent mosquito bleeding after flooding - Public awareness and education on infectious diseases.	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
	Accidents	- Accident during water stored	- Safety manual, IEC. - Formation of network with communities. - Prevention of water accident (fence, public education, etc.) - Patrol around the retarding ponds	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
Cut-off works	Existing social infrastructures and services	- Land split by the new river canal	- Traffic control inc. bridges - Support for ferry services	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
	Community severance	- Land split by the new river canal	- Traffic control - Encourage public consultation and consensus building.	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
	Landscape	- Landscape with Crocodile Park	- Adequate design with harmonization with landscape through consultation with academic, community, etc.	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program

PROJECT PHASE AND COMPONENT	ENVIRONMENTAL ASPECT AFFECTED	POTENTIAL IMPACT	OPTION FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE/FINACIAL ARRANGEMENT
	Infectious diseases	- Mosquito breeding in the new river canal	- Control of stagnation of river water, remaining water area, etc. to prevent mosquito bleeding after flooding - Public awareness and education on infectious diseases.	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
	Accidents	- Water accident	- Safety manual, IEC. - Formation of network with communities. - Install a perimeter fence under the bridge - Prevention of water accident - Patrol at the new river canal	UPMO-DPWH, DPWH-XI, Davao city, Barangay	Annual budget	Under DPWH program and LGU program
Issues raised during Public Scoping and Public Hearing						
- Efficacy of the retarding ponds			- Detailed Engineering Design	UPMO, DPWH	Project cost	Part of project activity
- Flush flood in Barangay Ma-a			- Detailed Engineering Design	UPMO, DPWH	Project cost	Part of project activity
- Old river bed should not be used as relocation site			- To be considered in RAP	RAP team	Project cost	Part of project activity
- Raise awareness of stakeholders on the flood control project			- IEC and series of consultation before implementation	UPMO, DPWH		Part of project activity
- Displacement of sand and gravel concessionaire			- Alternative livelihood, - employment during construction, - Compensation in accordance with government guidelines	UPMO, DPWH	Project cost	Part of project activity
- Dredged material to be used by the LGU			- MOU	UPMO and LGU	Project cost	Part of project activity
- Possible isolation of the Kagan community			- Provision of bridges	UPMO, DPWH	Project cost	Part of project activity

During the construction of the different structural components will result to the alteration of topography, removal of vegetation, water pollution, air and noise pollution, habitat fragmentation, freshwater biota disruption, production of excavated soil and dredged materials and emissions of air pollutants and noise. Traffic is also expected in areas of retarding ponds, cut-off works and dredging activities.

The potential impacts of flood control project on water resources are water pollution, siltation and changes in the drainage morphology. These impacts are generic to all flood control development since dredging, cut off works and river widening will be done. These can be abated and controlled with proper planning and sound engineering practices like provision of appropriate drainage, silt traps, settling ponds and reforestation.

The community within the retarding ponds and along the cut-off works, as well as the sand and gravel concessionaire operating along Davao River will be displaced. This can be mitigated by crafting a good Resettlement Action Plan.

5.2 Resettlement Action Plan

The results of the socio-economic assessment led to the consideration of the Social Development Plan as shown in Table 169. This plan is concentrated into four major issues – resettlement of directly affected people; just compensation package for the loss or damage properties/assets; regular monitoring/ patrolling to mitigate ISFs' proliferation within project sites (e.g. bridges) due to emerging economic opportunities; and, addressing potential social conflicts. A comprehensive discussion of these items were made in "the study for the Resettlement Action Plan".

5.3 IEC Framework

The indicative IEC strategies are shown in **Table 169.** The purpose of launching IEC program is to reach out the communities and other stakeholders and informed them of the projects in order to eliminate doubts and clarify the misconceptions. Mechanisms that can be utilized to disseminate project related information are broad cast and print media. Forum and dialogues can also be a venue to hear the issues and concerns of the stakeholders regarding the implementation of the project. Leaflets, flyers or posters showcasing the good practices of the company are also effective means of IEC

Table 168. Indicative Resettlement Action Plan

Concern	Responsible Community Member/ Beneficiary	Government Agency/ Non-Government Agency & Services	Proponent	Indicative Timeline	Source of Fund
Resettlement of directly affected people	Barangay Chairman • Project affected people (PAPs)	• City Planning Office • Department of Human Settlements and Urban Development (DHSUD) • City Social Welfare and Development Office (CSWD) • Department of Social Welfare and Development (DSWD)	• UPMO-DPWH	• Pre-construction	LGU – IRA
Just compensation package for the loss or damage properties/assets	Barangay Chairman • Project affected people (PAPs)	• City Assessors Office • City Planning Office	• UPMO-DPWH	• Pre-construction	DPWH Budget
Livelihood support program (ex. cash for work) for the displaced households	Barangay Chairman • Project affected people (PAPs)	• City Planning Office • Department of Labor and Employment (DOLE) • City Social Welfare and Development Office (CSWD) • Department of Social Welfare and Development (DSWD)	• UPMO-DPWH	• Pre-construction[22]	LGU – IRA
Regular monitoring/ patrolling to mitigate ISFs' proliferation within project sites (ex. Bridges) due to emerging economic opportunities	Barangay Chairman • Project affected people (PAPs)	• City Planning Office • City Disaster Risk Reduction and Management Office (CDRRMO) • Philippine National Police (Enforcement)	• UPMO-DPWH	• Operation	LGU – IRA

[22] Completion of support depends on condition of livelihood recovery

Table 169. Indicative IEC Plan for Flood Control Project, DFCDMP, 2021

Target Sector	Major Topics of Concerning Relation to Project	IEC Scheme/ Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost (PhP)
- Community (Youth, Women, Men Senior Citizen, Farmers) - Education sector - Health sector - Local Government - Business sector - Religious sector	Full Information about: - The EIA processes - The Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River) - Benefits of the Project on their Sociocultural/economic and bio-physical environment - Consequential impact of the operation to residents of the community - Compliance with the ECC conditions - Social Development Plan (RAP)	**Primer/ Brochure** This strategy effectively explains the subject matter in detail, done in a simplified manner and the people's language. This strategy likewise uses illustrations to clarify the components of the project further. a. The EIA process illustrated and simplified in the local dialect of the affected community written in English and Visaya/Cebuano, b. The Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River): **Consultations** These are face-to-face encounters where participants and facilitators develop strategies in response to the needs of the communities in	- Print media - Mass media - Community Consultations	- Pre-Operation Phase - Construction/ Installation Phase - Operation & Maintenance Phase	1,000,000.00

Target Sector	Major Topics of Concerning Relation to Project	IEC Scheme/ Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost (PhP)
		the context of what is appropriate for their capabilities and resources. Using the interpersonal approach, DPWH will implement regular consultations with the barangays for an open dialogue on the issues, problems, and concerns related to the implementation and sustainability of the project. Group discussions of the sectoral groups affected by the project activities, the legal processes with resettlement and just compensations, and other benefits. **Preparation of IEC materials** - Posters and Wall Comics - A graphic illustration of information on "What is being developed?" and the project's rationale in the context of their experiences. **Stakeholders Consultation**			

Target Sector	Major Topics of Concerning Relation to Project	IEC Scheme/ Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost (PhP)
		Using the feedback mechanism through information booths in the city and the concerned barangays. **Community Forum** This strategy enables the community to discuss the project's progress with key persons from the proponent. This approach also encourages multi-sectoral interest groups to ask questions. The establishment of open-line communication (hotlines) with the concerned barangays/ communities through the grievance redress committee/office to be created ensures prompt resolution of community concerns.			

5.4 Emergency Response Policy and Generic Guidelines

To address the urgent remedies required during emergency situations involving damage to property and other resources and loss of life, an extensive system of identifying potential for the occurrence of these emergencies and the appropriate response procedures must be documented, well communicated/disseminated to all personnel to acquire additional knowledge on the procedures.

The procedure needs to include an emergency plan that shows an outline of actions to be taken when there is a specific emergency. The external parties' involvement during emergency planning and response must be clearly identified and communicated.

Moreover, the required emergency equipment must be identified, acquired, and provided in right quantities. The emergency equipment includes the alarm systems for emergency cases, emergency lightning and power during power interruptions. Other emergency facility and equipment are the means of escape or what they call exit, safe refuge, critical isolation valves, switches and cut-outs, fire extinguishers, first aid equipment and communication facilities. A periodic emergency drills must be conducted to test and measure the readiness of the procedure of the emergency response teams.

A. Crisis Management Plan

The organization of a Crisis Management Team (CMT) and its supporting unit is the highly prioritized item when the activities for the project construction will be in full swing. This team must immediately respond when emergency cases arise. A Crisis Officer must be designated to spearhead the chronological response to any reported emergency.

The following teams must be created:

- First Aid Team;
- Rescue and Recovery;
- Logistics;
- Security and Crowd Control;
- Fire brigade; and,
- Internal and External Communication; and

Procedures to be undertaken by each team must be formulated to effectively implement the general emergency procedures.

B. Emergency Procedures

Each type of emergency situations must have a documented and updated procedure which will govern the automatic response in the shortest possible time. All of the response procedure must undergo an intensive training and drill which is conducted regularly.

1. Fire

An emergency fire procedure must be covered in a fuel handling and in the facilities of storage to ensure the safety of the workers. All the essential fire prevention, warning, suppression, and equipment need to be provided. Fire prevention and fire-fighting procedures must be established and operated by qualified personnel constantly to handle fire emergencies that may occur at fire risk areas.

2. Kidnapping & Unrest

Handling this type of emergency need the participation of the external authorities, like the police. Legal and criminal aspects for such events should be in place. As a rule, the project must strictly observe the no ransom policy.

3. Oil/ Fuel Spills

The procedures for handling, transport storage and use of oils and fuels must be incorporated with steps in controlling the potential and actual occurrence of the spillages and leakages. The essential control and clean up equipment, supplies and personal protective equipment for emergency personnel shall always be available in the right quantities. To ensure safety in the working area, workers must observe good housekeeping practices. When there are spills of oil or fuel, it must be collected right away and be placed in plastic containers and stored in a designated area.

4. Flooding, Storm, and Heavy Rains

Enough notifications about the early warning and the wide dissemination of urgent information about disaster must be ensured to these types of emergency procedures. Preparation to implement evacuation procedures must also be ensured. Regular open channel of communication with government agencies on the weather conditions announcement and disaster response procedures must be maintained for the personnel to be updated about impending emergencies. The workers must be alert on his situation to prevent loss of life, damage to properties and others.

5. Vehicular Accidents

This unpredictable accident must have a proper first aid and medical evacuation procedures in handling injured persons involved. Part of the SOP are policies and guidelines of DPWH to prevent vehicular accidents within and outside the project area. The contactors and workers of the project are bound to comply with these guidelines and crucial penalties are to be applied.

6. Animal Bites

If this form of accidents happens to a person, medical first aid procedures must be applied immediately. The contractor must ensure the availability of medicines and specific treatment drugs (i.e., anti-venom serum) for the workers.

5.5 Abandonment/Decommissioning/Rehabilitation Policy and Guidelines

The flood control projects are environmental enhancement projects hence, these will continue to operate and will not be abandoned in the future. The decommissioning discussed in this section pertains to the last activity of the construction phase wherein the contractors will cease to operate and turn over the project to the DPWH. Once the construction is completed, the contractor(s) must comply with the following activities:

1. Dismantle the temporary facilities such as workers' quarters, warehouse, motor pool and wastewater facilities like septic tanks following the guidelines set under the Building Code of the Philippines and the Sanitary Code;

2. Cover the temporary settling/siltation pond for surface run-off;

3. Dispose of solid waste in accordance with RA 9003. No construction debris should be left behind or thrown into the river; and,

4. Treat contaminated soil with oil and grease properly before leaving the site. DPWH should check and monitor the activity.

5.6 Environmental compliance and monitoring

DENR Memorandum Circular 2010-14 and the Revised Procedural Manual DAO 30 series of 2003 required project proponents to frame an Environmental Compliance and Monitoring System in order to reduce or avoid adverse environmental impacts associated to the construction of the flood control infrastructure in Davao River. The key elements of monitoring and compliance as per PD 1586 discussed in this section are the following:

a. Environmental Monitoring Plan; and,
b. ECC compliance

Although the flood control project is Category B in the Philippines EIS system, it is essential to craft an Environmental Monitoring Plan as it is expected to cause detrimental effects on Davao River (downstream) and Davao Gulf. An environmental monitoring plan is crafted in order to continually appraise the construction activities and be advised of any regulatory requirement. The proposed monitoring plan is presented in **Table 170.** An Environmental Quality Performance Level (EPQL) is identified for parameters associated with project impacts. EPQL is a proactive tool which will alert the company of any exceedances of the level of discharges and emission relative to the guideline values set by EMB-DENR. The EPQL is only applicable for water and air emission regulations and the thresholds for each pollutant are based on the guidelines set by the government, i.e., DAO 2016 - 08 for the water and the Clean Air Act for air emissions. Compliance to ECC conditions is the responsibility of the contractors with the strict supervision of the designated environmental officer of UPMO.

Table169. Environmental Monitoring Plan for Davao Flood Control Project, DFCDMP, 2021

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
Pre-construction													
Retarding ponds Cut-off works	Involuntary resettlement	Loss of land, Involuntary resettlement	Hearing, public consultation Site observation External monitoring with advices	After relocation and every year	Construction site and relocation site	DPWH, LGUs							
Construction													
Dredging	Air quality	NO_2, SO_2, CO	24-hr ambient averaging period	Quarterly	Baseline sampling / or may vary depending on the final project design and construction schedule	Proponent thru environmental officer	75,000/ sampling	NO_2= 150g /cm SO_2= 200g/ Ncm CO= 1.0ppm	NO_2= 200g /cm SO_2= 290 g/ Ncm CO= 1.0ppm	NO_2=260g/Ncm SO_2= 340g/ncm CO= 1.0ppm	Check equipment emission	Change oil, replace filters	Quarterly maintenance
		PM_{10}, $PM_{2.5}$	8-hr ambient averaging period	Quarterly	Appropriate stations base on the project's activities / progress at the construction site	Environmental Officer contractor	25,000 /monitoring	PM_{10} = 75 g/ Ncm $PM_{2.5}$ = 25 g/ Ncm	PM_{10} = 100g/ Ncm $PM_{2.5}$ = 30 g/Ncm	PM_{10} = 150 g/ Ncm $PM_{2.5}$= 35 g/Ncm	Check equipment emission	Change oil, replace filters	Quarterly maintenance
		Dust	Direct observation	Weekly									

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
	Water quality	Oil and grease (mg/L) Fecal Coliform (MPN/100mL) Total Suspended Solid (TSS) (mg/L) Inorganic phosphate (mg/L) pH DO BOD Heavy metals (Pb, Hg, As, Cd Cr^{6})	Grab sampling method; laboratory analysis	Quarterly	Baseline sampling / or may vary depending on the final project design at the construction site, Davao River mouth near Davao Gulf	Environmental Officer	75,000/ sample	0.25 mg/L 0.02 mg/L	0.50 mg/L Class A <=25mg/L Class B <=30mg/L 0.025mg/L	Class A=1 mg/L Class B = 1 mg/L 200MPN /100mL Class A = 50 Class B = 65mg/L 0.025 mg/L 6.5-8.5 >=5 mg/L Class A: <=3 mg/L Class B: <=5 mg/L Pb: 0.01mg/L Hg: 0.001mg/L As: 0.01mg/L Cd: 0.03mg/L Cr^{6+}: 0.01mg/L	Check source of O & G Check sanitary facilities i.e., septic tank Check status of silt curtains Check spillage of liquid waste Check sanitary condition Check oil storage	O & G detection Repair any leaks Repair and replace silt curtains Repair storage, drainage, etc. Repair Repair	Monthly maintenance of equipment Conduct regular repair and maintenance Monthly repair and replacement

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
		Turbidity	Direct Observation	Weekly									
	Waste	- Treatment/ disposal materials and volume	Check record, manifest Direct observation	Every month Everyday	Construction site	Environmental Officer	-						
	Soil contamination	- As, Cd, Cr, Pb, Hg Leakage of toxic	Sediment/ soil sampling and measuring Direct observation of contamination by leakage of toxic substances from the waste, oil, etc.	Before dredging/ excavation at the site of RPs, COW and dredging. Weekly	Dreading site	Environmental Officer	50,000/ sampling				Check contamination[23]	Separately stored	included in the monitoring
	Noise and vibration	Construction noise	Noise/ vibration measurement Hearing with communities	Noise: Quarterly Vibration Every year Every week	Construction site	Environmental Officer	Included in the cost for air quality measurement	Noise = 45 – 55dB A[2)]	Noise= 45 – 55dBA	Noise= 45 – 55dBA	Check equipment	Change silencers	Quarterly maintenance
	Ecosystem	Biological indices of	Visual observation	Quarterly	Construction site	Environmental Officer							

[23] The Philippines has not stated the limitation/ standard of toxic in the soil; Canadian Environmental Quality Guidelines (2001) and NOAA Sediment Quality Guidelines are temporally refered. .

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
		freshwater biota	(aquatic biota only) Hearing with communities, etc.										
	Utilization of land and local resources	Interruption of sand mining operators	Utilization of land and local resources Hearing with Sand mining operator Monitoring of sand mining Hearing on The condition of recreational/ private fishing Visual observation, hearing with residents	Monthly	Construction site	Environmental Officer							
	Labor conditions	Working environment Labor condition	Observation of construction site Hearing and public consultation Record of accident	Monthly Ever half year	Construction site	Environmental Officer							
	Accident	Traffic accident Water accident	Visual observation Hearing and public consultation	Monthly 2 times a year	Construction site	Environmental Officer							

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
			Records of accident										
Retarding ponds	Air quality	NO_2, SO_2, CO	24-hr ambient averaging period	Quarterly	Baseline sampling / or may vary depending on the final project design and construction schedule	Proponent thru environmental officer	75,000/ sampling	NO_2= 150g /cm SO_2= 200g/ Ncm CO= 1.0ppm	NO_2= 200g /cm SO_2= 290 g/ Ncm CO= 1.0ppm	NO_2=260g/Ncm SO_2= 340g/ncm CO= 1.0ppm	Check equipment emission	Change oil, replace filters	Quarterly maintenance
		PM_{10}, $PM_{2.5}$	8-hr ambient averaging period	Quarterly	Appropriate stations base on the project's activities / progress at the construction site	Environmental Officer contractor	25,000 /monitoring	PM_{10} = 75 g/ Ncm $PM_{2.5}$ = 25 g/ Ncm	PM_{10} = 100g/ Ncm $PM_{2.5}$ = 30 g/Ncm	PM_{10} = 150 g/ Ncm $PM_{2.5}$= 35 g/Ncm	Check equipment emission	Change oil, replace filters	Quarterly maintenance
		Dust	Direct observation	Weekly									
	Water quality	Oil and grease (mg/L)	Grab sampling method; laboratory analysis	Quarterly	Baseline sampling / or may vary depending on the final project design at the construction site,	Environmental Officer	75,000/ sample	0.25 mg/L	0.50 mg/L	Class A=1 mg/L Class B = 1 mg/L	Check source of O & G	O & G detection	Monthly maintenance of equipment
		Fecal Coliform (MPN/100mL)								200MPN /100mL	Check sanitary facilities i.e., septic tank	Repair any leaks	Conduct regular repair and maintenance

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
		Total Suspended Solid (TSS) (mg/L) Inorganic phosphate (mg/L) pH DO BOD Heavy metals (Pb, Hg, As, Cd Cr^{6}) Turbidity	Direct Observation	Weekly	Davao River mouth near Davao Gulf			0.02 mg/L	Class A <=25mg/L Class B <=30mg/L 0.025mg/L	Class A = 50 Class B = 65mg/L 0.025 mg/L 6.5-8.5 >=5 mg/L Class A: <=3 mg/L Class B: <=5 mg/L Pb: 0.01mg/L Hg: 0.001mg/L As: 0.01mg/L Cd: 0.03mg/L Cr^{6+}: 0.01mg/L	Check status of silt curtains Check spillage of liquid waste Check sanitary condition Check oil storage	Repair and replace silt curtains Repair storage, drainage, etc. Repair Repair	Monthly repair and replacement
	Waste	- Treatment/ disposal materials and volume	Check record, manifest Direct observation	Every month Everyday	Construction site	Environmental Officer	-						

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
	Soil contamination	- As, Cd, Cr, Pb, Hg Leakage of toxic	Sediment/ soil sampling and measuring Direct observation of contamination by leakage of toxic substances from the waste, oil, etc.	Before dredging/ excavation at the site of RPs, COW and dredging. Weekly	Dreading site	Environmental Officer	50,000/ sampling				Check contamination[24]	Separately stored	included in the monitoring
	Noise and vibration	Construction noise	Noise/ vibration measurement Hearing with communities	Noise: Quarterly Vibration Every year Every week	Construction site	Environmental Officer	Included in the cost for air quality measurement	Noise = 45 – 55dBA[2)]	Noise= 45 – 55dBA	Noise= 45 – 55dBA	Check equipment	Change silencers	Quarterly maintenance
	Ecosystem	Biological indices of Terrestrial biota Los of natural land	Visual observation Hearing with communities, etc. Condition of utilization for eco-tourism	Quarterly	Construction site	Environmental Officer							
	Hydrology	Interruption of drainage network	Observation of drainage condition Hearing with residents Record of floods	During floods	Construction site	Environmental Officer, DPWH							

[24] The Philippines has not stated the limitation/ standard of toxic in the soil; Canadian Environmental Quality Guidelines (2001) and NOAA Sediment Quality Guidelines are temporally referred. .

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
	Poor/Vulnerable	Loss/ decrease income source	Public consultation, condition of GRM Record of social support	Monthly	Construction site and relocation site	DPWH, LGUs							
	Local economies	Interruption of local economic condition	Hearing, public consultation Traffic record Record of social services	Monthly	Construction site and relocation site	DPWH, LGUs							
	Existing social infrastructures and services	Interruption of social infrastructure, utilities	Hearing, public consultation Visual monitoring of relocation of utilities Traffic record	Monthly	Construction site and relocation site	Contractor, DPWH, LGUs							
	Utilization of land and local resources	Change landuse, loss of local resources	Hearing with sand mining operators Monitoring of sand mining Visual observation, hearing with residents	Monthly	Construction site and relocation site	Contractor, DPWH, LGUs							
	Gender Children's rights	Imbalance of job condition between Men and women Child labor	Visual observation Hearing and public consultation Confirm labor, health record	Monthly Every half year	Construction site	Contractor, DPWH, LGUs							
	Infectious diseases	Increase health problem, COVID spread	Visual observation	Monthly	Construction site	Contractor,	PHP50,000	Early symptoms	Fever and loss of smell	0 case of	RPT test	Isolate workers	Monthly random RPT test

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
			Hearing and public consultation Health record	Every half year		DPWH, LGUs				COVID 19			
	Labor conditions	Working environment Labor condition	Observation of construction site Hearing and public consultation Record of accident	Monthly 2 times a year	Construction site	Environmental Officer							
	Accident	Traffic accident Water accident	Visual observation Hearing and public consultation Records of accident	Monthly 2 times a year	Construction site	Environmental Officer							
Cut-off works	Air quality	NO_2, SO_2, CO	24-hr ambient averaging period	Quarterly	Baseline sampling / or may vary depending on the final project design and construction schedule	Proponent thru environmental officer	75,000/ sampling	NO_2= 150g /cm SO_2= 200g/ Ncm CO= 1.0ppm	NO_2= 200g /cm SO_2= 290 g/ Ncm CO= 1.0ppm	NO_2=260g/Ncm SO_2= 340g/ncm CO= 1.0ppm	Check equipment emission	Change oil, replace filters	Quarterly maintenance
		PM_{10}, $PM_{2.5}$	8-hr ambient averaging period	Quarterly	Appropriate stations base on the project's activities / progress at the	Environmental Officer contractor	25,000 /monitoring	PM_{10} = 75 g/ Ncm	PM_{10} = 100g/ Ncm $PM_{2.5}$ = 30 g/Ncm	PM_{10} = 150 g/ Ncm $PM_{2.5}$= 35 g/Ncm	Check equipment emission	Change oil, replace filters	Quarterly maintenance

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
		Dust	Direct observation	Weekly	construction site			$PM_{2.5}$ = 25 g/ Ncm					
	Water quality	Oil and grease (mg/L) Fecal Coliform (MPN/100mL) Total Suspended Solid (TSS) (mg/L) Inorganic phosphate (mg/L) pH DO BOD	Grab sampling method; laboratory analysis	Quarterly	Baseline sampling / or may vary depending on the final project design at the construction site, Davao River mouth near Davao Gulf	Environmental Officer	75,000/ sample	0.25 mg/L 0.02 mg/L	0.50 mg/L Class A <=25mg/L Class B <=30mg/L 0.025mg/L	Class A=1 mg/L Class B = 1 mg/L 200MPN /100mL Class A = 50 Class B = 65mg/L 0.025 mg/L 6.5-8.5 >=5 mg/L Class A: <=3 mg/L Class B: <=5 mg/L Pb: 0.01mg/L	Check source of O & G Check sanitary facilities i.e., septic tank Check status of silt curtains Check spillage of liquid waste Check sanitary condition Check oil storage	O & G detection Repair any leaks Repair and replace silt curtains Repair storage, drainage, etc. Repair	Monthly maintenance of equipment Conduct regular repair and maintenance Monthly repair and replacement

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
		Heavy metals (Pb, Hg, As, Cd Cr^{6}) Turbidity	Direct Observation	Weekly						Hg: 0.001mg/L As: 0.01mg/L Cd: 0.03mg/L Cr^{6+}: 0.01mg/L		Repair	
	Waste	- Treatment/ disposal materials and volume	Check record, manifest Direct observation	Every month Everyday	Construction site	Environmental Officer	-						
	Soil contamination	- As, Cd, Cr, Pb, Hg Leakage of toxic	Sediment/ soil sampling and measuring Direct observation of contamination by leakage of toxic substances from the waste, oil, etc.	Before dredging/ excavation at the site of RPs, COW and dredging. Weekly	Dreading site	Environmental Officer	50,000/ sampling				Check contamination[25]	Sperately stored	included in the monitoring
	Noise and vibration	Construction noise	Noise/ vibration measurement	Noise: Quarterly Vibration Every year	Construction site	Environmental Officer	Included in the cost for air	Noise = 45 – 55dBA[2)]	Noise= 45 – 55dBA	Noise= 45 – 55dBA	Check equipment	Change silencers	Quarterly maintenance

[25] The Philippines has not stated the limitation/ standard of toxic in the soil; Canadian Environmental Quality Guidelines (2001) and NOAA Sediment Quality Guidelines are temporally referred. .

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
			Hearing with communities	Every week			quality measurement						
	Hydrology	Interruption of drainage network, underground water	Observation of drainage and underground condition Hearing with residents Record of Floods	Beginning of construction Quarterly	Construction site	Environmental Officer, DPWH							
	Ecosystem	Biological indices of Terrestrial biota	Visual observation Hearing with communities, etc. Condition of trees planted	Quarterly	Construction site	Environmental Officer							
	Poor/Vulnerable	Loss/ decrease income source	Public consultation, condition of GRM Record of social support	Monthly	Construction site and relocation site	DPWH, LGUs							
	Local economies	Interruption of local economic condition	Hearing, public consultation Traffic record Record of social services	Monthly	Construction site and relocation site	DPWH, LGUs							
	Existing social infrastructures and services	Interruption of social infrastructure, utilities	Hearing, public consultation Visual monitoring of relocation of utilities Traffic record	Monthly	Construction site and relocation site	Contractor, DPWH, LGUs							

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
	Community severance	Split of community by new river canal	Hearing and public consultation	Monthly	Construction site	Contractor, DPWH, LGUs							
	Utilization of land and local resources	Change landuse, loss of local resources	Hearing with san mining operators Monitoring of sand mining Visual observation, hearing with residents	Monthly	Construction site and relocation site	Contractor, DPWH, LGUs							
	Landscape	Change landscape at Crocodile Park	Consultation with academics, etc. for designing and construction Clean and organize construction site Public hearing and monitoring	Beginning of constriction and beginning of operation.	Near Crocodile park	Contractor, DPWH, LGUs							
	Gender Children's rights	Imbalance of job condition between Men and women Child labor	Visual observation Hearing and public consultation Confirm labor, health record	Monthly Every half year	Construction site	Contractor, DPWH, LGUs							
	Infectious diseases	Increase health problem, COVID spread	Visual observation Hearing and public consultation Health record	Monthly Every half year	Construction site	Contractor, DPWH, LGUs							

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
	Labor conditions	Working environment Labor condition	Observation of construction site Hearing and public consultation Record of accident	Monthly 2 times a year	Construction site	Environmental Officer							
	Accident	Traffic accident Water accident	Visual observation Hearing and public consultation Records of accident	Monthly 2 times a year	Construction site	Environmental Officer							
Demobilization													
Dredging, Retarding ponds, Cut-off Works		Pollution, Waste same as in construction											
Operation													
Dredging	Utilization of land and local resources	Interruption to sand mining activity during maintenance	Hearing with sand mining operators Monitoring through hearing/ meeting with residents	Yearly during Dredging	Construction site	Contractor							
Retarding ponds	Infectious diseases	Mosquito breeding in water area	Visual observation Hearing and public consultation Health record	Every year	Davao River	DPWH, LGUs	PHP50,000	Early symptoms	Fever and loss of smell	0 case of COVID 19	RPT test	Isolate workers	Monthly random RPT test
	Accident	Water accident	Visual observation	Every year	Davao River	DPWH, LGUs							

Key Environmental Aspects	Potential Impacts per sector	Parameters to be monitored	Sampling and Measurement Plan			Lead person	Estimated cost (PHP)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
			Hearing and public consultation Health record										
Cut-off works	Existing social infrastructures and services	Traffic disturbance by new river canal	hearing, public consultation Traffic survey	Every year (suppose for 3 years)	New river canal and bridges	DPWH, LGUs							
	Community severance	Split of community by new river canal	Traffic survey Monitoring through meeting/ hearing with residents	Every year (suppose for 3 years)	New river canal and bridges	DPWH, LGUs							
	Landscape	Interruption to Crocodile Park	Consultation with intellectual (before operation) Public hearing.	Beginning of construction	New river canal	DPWH, LGUs							
	Infectious diseases	Mosquito breeding in water area	Visual observation Hearing and public consultation Health record	Every year	New river canal	DPWH, LGUs							
	Accident	Water accident	Visual observation Hearing and public consultation Health record	Every year	New river canal, bridge	DPWH, LGUs							

1) Vibration is monitored by direct observation in parallel with monitoring of noise
2) Depend on the location and time

5.7 Institutional Plan for EMP Implementation

Since this a project of the national government, the implementation will be under the DPWH Central Office through the UPMO in coordination with the DPWH XI. An Environmental Officer will be designated/appointed by UPMO-DPWH in lieu of the Pollution Control Officer (PCO) as required by EMB – DENR in compliance with DAO 30-03. The environmental officer will be directly reporting to UPMO. **Figure 51** present the organizational structure of the flood control project implementation.

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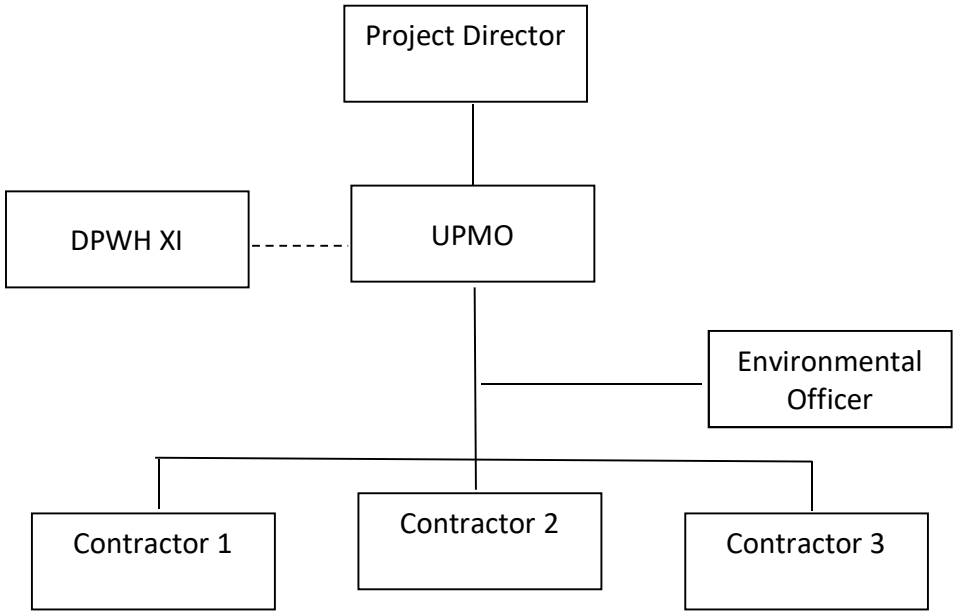

Figure 51. Organizational Structure

The responsibilities of UPMO – DPWH are as follows:

- Provide general direction and supervision for the successful completion of the project;
- Set guidelines for the project implementation;
- Set sanctions and penalty for the contractors for any violations of the contract; and,
- Ensure that the environmental management measures and programs are effectively implemented.

The DPWH XI will have the following functions:

- Coordinate with UPMO in the implementation of the project;
- Assist the environmental officer in the implementation of environmental measures for the adverse impacts;

- Assist the environmental officers in the implementation of the environmental enhancement plan; and,
- Assist the UPMO in the coordination with the CLGU and BLGU.

The environmental officer will have the following function:

- Monitoring and police compliance of contractors on their implementation of the provisions of ECC;
- Monitoring and evaluation of the effectiveness of the mitigating and enhancement measures;
- Planning and implementing modifications or additional measures needed to effectively protect the environment;
- Submit compliance report to EMB;
- Coordinating with concerned oversight agencies and other entities and organization including the local government units to ensure active participation in the implementation of ECC; and,
- Ensure compliance to ECC conditions and reporting requirements of the DENR-EMB.

Responsibilities of Contractor:

- Implement the environmental programs, mitigating and enhancement measures as stipulated in the contract.
- Cooperate with the environmental officer, CLGU, BLGU.
- Report to the environmental officers any accident in the work place.
- Undertake measures in dealing with accidents.
- Ensure compliance to ECC and contract.

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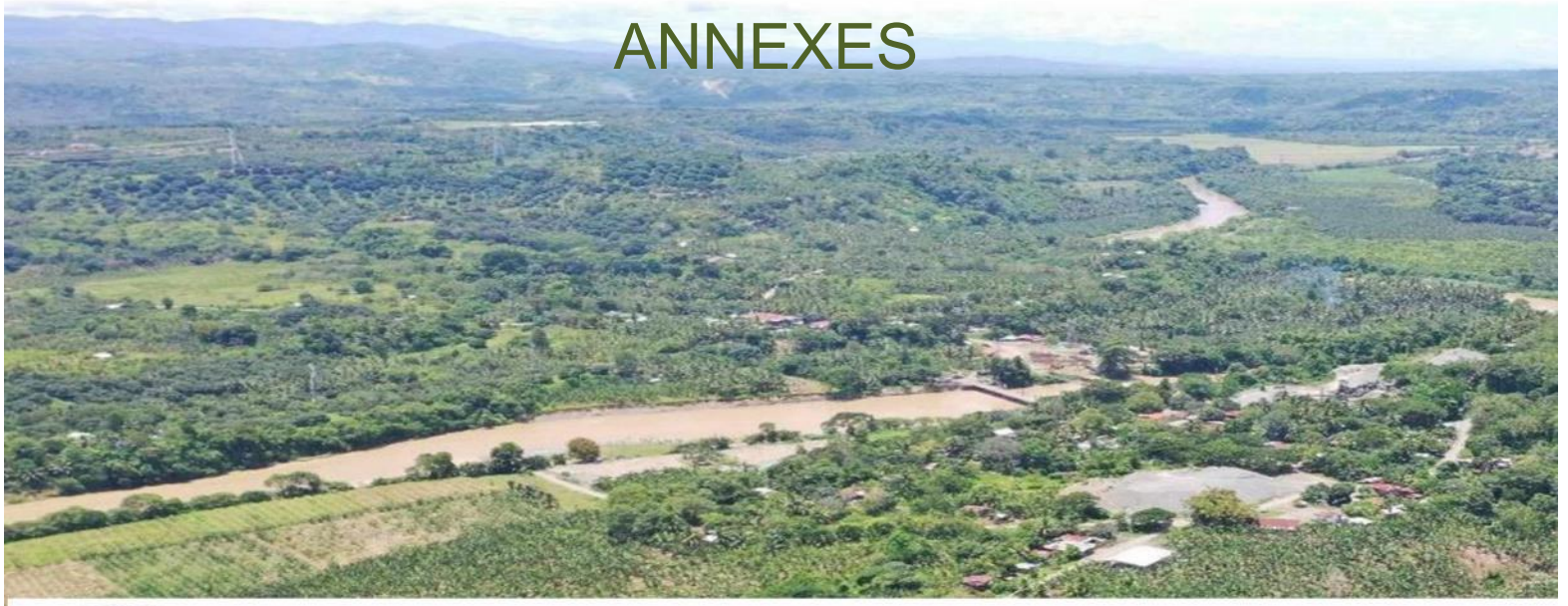
ENVIRONMENTAL IMPACT STATEMENT

Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)

ANNEXES



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EIS Preparer

Table of Contents

ANNEX A – GAP ANALYSIS BASED ON THE JICA GUIDELINE

Gap Analysis between JICA Guideline and Philippine System

	JICA Guidelines	Philippine Legislation	Main Gap and Countermeasure
Principle	• Environmental impact must be assessed and examined from the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impact must be examined and incorporated into the project plan (JICA GL Appendix1).	• At an early stage of decision-making, consideration and evaluation from an environmental perspective are stipulated as a planning tool in House Bill, No.145 (2019)	No significant gap/ No applicable
Information Disclosure	• 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; • 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 (JICA GL Appendix 2).	• It is stipulated that language used should be understood for target communities in Environmental Impact Statement, Presidential Decree No, 1568, 1978 and Revised Procedural Manual (DAO 03-30, 2003). No detailed description for local language except English and Tagalog. • The report is kept at DENR/EMB's regional office and can be viewed. Also, each barangay will keep a copy of the summary.	In case of that language other than English and Tagalog is necessary, facilitate to respond.
Public Consultation	• For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.(JICA GL Appendix 1: Social Acceptability) • 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; • Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the 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 (JICA GL Appendix 2).	• Public consultations are conducted on Scoping stage and finalized EIA stage, reflect them to project plans for system in Philippine. Prior to Scoping, project contents will be made known. • Minutes of Meeting will be prepared for Stake holders Meetings DENR DAO 2017-05、Guidelines on Public Participation under EIS System,	No significant gap/ No applicable

	JICA Guidelines	Philippine Legislation	Main Gap and Countermeasure
Impacts to be Asset	• The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. • In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project (JICA GL Appendix 1).	• The scope of the EIS survey covers ecosystems, pollution-related issues such as water and air, waste, and social impacts. • Scoping will be conducted to identify "Target area of study" and "Study items and its method" related to the projects categorized A and B. Then after discussion and approval by DENR/EMB, study will be able to start. • There are no clear provisions regarding "supplementary facilities" and "cumulative impact", however "permits must be obtained based on the Programmatic Environmental Impact Statement System when the projects consist of multiple activities such as sector development. It stipulates the implementation of a complex and comprehensive impact assessment. Presidential Decree No. 1586, 1978, Revised Procedural Manual (DAO-03-30、2003)	Related to the derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project, discussion will be conducted to decide target area and study methods.
Monitoring, Grievance Redress Mechanism	• Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders. • When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems (JICA GL Appendix 1)	• The results of monitoring will be disclosed. Revised Procedural Manual (DAO-03-30、2003) • According to laws and guidelines, the project proponent has jurisdiction over grievance processing, however in many cases, the local government in the target area (especially barangay) is the direct contact point. DENR DAO 2017-05、Guidelines on Public Participation under EIS System、LARRIPP	No significant gap/ No applicable
Ecosystem & Biota	• Project must not involve significant conversion or significant degradation of critical natural habitats and critical forests. • Projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage	• Especially important ecological areas are designated as ECAs (Environmentally Critical Areas), and careful impact assessment is required. Presidential Decree No. 1586, 1978, Revised Procedural Manual (DAO-03-30、2003)	In principle, JICA projects cannot be conducted within the protected area, so alternatives outside the protected area will be considered.

	JICA Guidelines	Philippine Legislation	Main Gap and Countermeasure
Indigenous Propels	• Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.	• Within the Ancestral Domain, An Ancestral Domains Sustainable Development and Protection Plan (ADSDPP) shall be formulated, and then Indigenous Political Structure (IPS) committee will be established in each group. The IPS committee has the authority to approve the project in the area and must take measures to avoid or mitigate the impact (RA 8371, Indigenous Peoples Rights Act of 1997).	No significant gap/ No applicable. ADSDPP could function as IPAP (Indigenous Peoples Action Plan).
Involuntary Resettlement	• Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	• By the Constitution, in the defense of public law, life, liberty and private property cannot be expropriated without legal proceedings. The DPWH guidelines (LARRIPP) stipulate that "involuntary relocation of residents should be avoided and minimized as much as possible."	No significant gap/ No applicable
	• When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected. • People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.	• If it will not be able to avoid, appropriate compensation, mitigation measures and livelihood assistance will be provided. • Not only land and asset compensation, but also compensation for temporary obstruction, income, rental fee, transportation cost, vocational training, etc. will be included. (LARRIP)	No significant gap/ No applicable
	• Compensation must be based on the full replacement cost as much as possible.	• Compensation shall be in cash or in-kind payment at the replacement cost for the affected asset. The replacement price is the price required for replacement / improvement based on the current market price (LARRIPP). • Project proponent must be advance the compensation not only for land and structures but also crops and trees (RA10752).	Encourage to add taxes, material hauling, and labor costs
	• Compensation and other kinds of assistance must be provided prior to displacement.	• Compensation will be paid when replacement and transfer of ownership will be completed (RA10752).	Request for paying compensation before resettlement.
	• For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.	• In LARRIPP and DO327-2003, it is stipulated that land acquisition and resettlement action plan will be prepared, and explain them through public participation and consultation in that process in this process.	No significant gap/ No applicable
	• In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	• All affected people will be provide information through information campaigns (LARRIPP) • It is stipulated that land acquisition and resettlement action plan will be prepared, and explain them through public participation and consultation in that process in this process (DO 327-2003).	No significant gap/ No applicable
	• When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.	• Public Consultation will be held with support by local office. Leaflets and materials to be used are to be prepared in a language that the target people can understand (LARRIPP).	No significant gap/ No applicable

	JICA Guidelines	Philippine Legislation	Main Gap and Countermeasure
	• Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.	• Internal monitoring by project proponent, or external monitoring by organization consisting qualified and experienced personnel will be conducted (LARRIPP).	No significant gap/ No applicable
	• Appropriate and accessible grievance mechanisms must be established for the affected people and their communities	• Affected people can file a written complaint with the Resettlement Implementation Committee (RIC) to resolve the complaint, and the RIC and DPWH regional offices will respond. It can be filed a proceeding with the court (LARRIPP).	No significant gap/ No applicable
	• Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey, preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits	• The cut-off date is the start date of the registration survey of affected families within the project boundaries, and those who are not resident at the start of the registration survey are not eligible for compensation. (LARRIPP).	No significant gap/ No applicable
	• Eligibility of Benefits include, the PAPs who have formal legal rights to land, the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying (WB OP4.12).	• Not only legal landowners, but also cultivated land users who do not have land titles or tax returns, peasants, structure owners and lessors are eligible for compensation (LARRIPP). • Within the easement area set by Davao city, illegal residents who have actually lived before 1992 have eligibility of compensation.	Facilitate residents who migrated after 1992 to be provided equal compensation or support.
	• Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based (WB OP 4.12)	• If feasible, at the available place based on the Zoning Act, alternative land such as land of equal value of market price or larger place will be compensated near relocation sites with social infrastructure and service (LARRIPP).	Encourage to comply with LARRIPP
	• Provide support for the transition period between displacement and livelihood restoration (WB OP 4.12).	• Through the Monitoring, supporting will be continue until livelihood recovered (LARRIPP)	No significant gap/ No applicable
	• Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP 4.12)	• Set conditions, requirements and safeguards for plans, programs and projects that affect indigenous peoples. It is necessary to prepare Indigenous People Action Plan (IPAP) and develop Indigenous People Plan (IPP) if indigenous people will be affected negative impacts. Women and the elderly among the affected people must also participate in the consultation, and reflect and implement the resettlement plan to recover their livelihood and other social welfare (LARRIPP).	No significant gap/ No applicable
	• For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared (WB OP 4.12).	• Regardless of the scale of the resettlement, an appropriate resettlement plan will be prepared and implemented (LARRIPP).	No significant gap/ No applicable

Source: Project team

ANNEX B – SCOPING CHECKLIST

	TECHNICAL SCOPING CHECKLIST *Scoping and Procedural Screening Checklist for Environmental Impact Statement*
Project Name	**Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)**
Proponent Name	**DPWH Flood Control Management Cluster (UPMO-FCMC)**
Project Location	**Brgys. 1, 2, 5, 8, 19, 76-A Bucana, Tigatto, Ma-a, New Carmen, Waan, Mandug, New Valencia, and Callawa, Davao City, Davao del Sur, XI (*change to downstream to upstream order of barangays*)**
Proponent Address	**DPWH 2nd St., Port Area, Manila**
Proponent Contact Person	**Ramon A. Arriola III – Project Director**
Proponent Means of Contact	Mobile No**: 632-534-3813/ +632-534-3752** Email: **arriola.ramon@dpwh.gov.ph**
EIA Consultant	**Green-Collar Consulting Services**
Consultant Address	**Toog Ave., Purok 4, Brgy. 2, San Francisco, Agusan del Sur**
EIA Consultant Contact Person	**Dr. Carmelita Martinez – Team Leader**
Consultant Means of Contact	Mobile No: **09177027356** Email: **ryanjoyofmel@yahoo.com**
EMB/DENR Scoping Representatives	**Ma. Dolores R. Batoctoy Miralou Blanco Dulce Hufancia Alfredo Hocamis Maria Stella Corpuz**
Place of Scoping	**Microsoft Teams**
Date of Scoping	**January 5, 2022**

A. GENERAL ("MUST") REQUIREMENTS ON EIS REPORT OUTLINE, FORMAT AND CONTENT

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
Project Fact Sheet	Information highlights from Executive Summary on Project Description; Project Specific EIA Process, Baseline Profile, Key Impacts, Key environmental management measures and monitoring plans; include 0.25 page of project regional site location on Philippine Map inset.					
Table of Contents	Include all sections of the EIS for procedural Screening purposes; list of tables, figures, annexes					

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		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
Executive Summary	Maximum					
1.0 Brief Project Description	(tabulated) : project location & area (with 0.25 – 0.50 page project regional location on Philippine map inset), rationale, components, project phases/stages, process/ technology (as applicable), products and production capacity or rate (as applicable), types & estimated generation rate of major waste streams, manpower, project cost, project duration and schedule					

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				YES	NO	
2.0 Brief Summary ofProject's EIA Process	(tabulated): name/expertise of preparer team, study period, study area (and attach I page map), EIA method, summary of public participation in scoping and conduct of EIA study					
3.0 Summary of Baseline Characterization	(tabulated): Present integrated key findings/conclusions per ecosystem (Land, Water Air and People) in terms of criticality of environmental quality status. No need to detail findings per module.					

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				YES	NO	
4.0 Summary of Impact Assessment and Environmental Management Plan	1) Impacts Mitigation Summary 1st column: Key project activities per phase (i.e. most critical environmental aspects which are the sources of key impacts); 2nd column: environmental component or module affected, nature and magnitude of most significant impacts; 3rd column: proposed options for prevention and mitigation of impacts Present a statement each for Social Development Plan					

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				YES	NO	
	Framework (RAP), IEC Framework,, ERP Policy, Abandonment Policy					
5.0 Summary of the Environmental Monitoring Plan	1) Summary of EMoP Matrix of Proponent – focused only on 1-3 most important objectives and corresponding parameters to be monitored per phase of the project, limit level to be complied with, station description to be monitored and what frequency Summary of MMT or public participation framework in post-ECC monitoring (pre- and	MMT – not applicable				

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				YES	NO	
	during construction)					
6.0 EMF and EGF Commitments	Present EMF and EGF amount committed	Not applicable				
DRAFT MAIN EIS						
1.BASIC PROJECT INFORMATION	(tabulation of Project name, location,/address (from Sitio to Region) (brgys. From downstream to upstream order) ; nature of project; threshold limits applied for; Proponent Name, address, contact numbers, brief profile; EIA Preparer Name, address, contact					

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				YES	NO	
	numbers. Attach project site map in NAMRIA topographic (or nautical, if applicable) map in 1:50,000 scale					
2.DESCRIPTION OF THE PROJECT'S EIA PROCESS						
2.1 EIA TOR	Tabulate the main issues raised by the EIARC (see below Summary of Most Significant Issues) and the community (refer to List of Issues During Public Scoping) and state where/how each was addressed in the EIA Study; attach the detailed Scoping checklists					

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				YES	NO	
	(Public and Technical) as an annex					
2.2 EIA Team	Tabulate data on EIA Team: list of team members, field of expertise, module assigned to both proponent and preparer team					
2.3 EIA Study Schedule	Inclusive periods of study/field surveys, state climate/season					
2.4 EIA Study Area	Present area from project site up to extent of coverage of study: Show study area in NAMRIA topographic (and nautical, if					

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				YES	NO	
	applicable) map of 1:50,000 scale					
2.5 EIA Methodology	Tabulate only generic EIA approach and data sources					
2.6 Public Participation	Tabulate chronologically the following: EIA stage, dates, sectors involved, issues raised, committed actions by the Proponent where relevant; and explain or shed light on succeeding public's response/ reactions/ participation or explain prevailing perceptions/ actions by the public. On sectors and issue, differentiate the list into supportive and opposing sectors as well as issues					

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				YES	NO	
	considered valid and invalid.					
3.PROJECT DESCRIPTION						
3.1 Project Location & Area	Presented in legible maps (use clearly scanned or original NAMRIA topographic (or nautical, if applicable) map of 1:50,000 or appropriate scale) showing both project site up to regional location with Philippine map as inset; Regional and provincial vicinity map (showing major landmarks, existing industries, settlements, etc) Show title, legend, scale, project location and political boundaries					

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				YES	NO	
	(from sitio/barangay to region); delineation of areas of primary and secondary impact areas, Present geographic coordinates Present applicable ECA categories and statement on technical description on environmental criticality of the site					
3.2 Project Rationale	Present need for project based on national & local economic development and in terms of contribution to sustainable development agenda or current development thrusts of the					

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				YES	NO	
	Philippines; Briefly justify/describe existence of expected commercial quantities of resources to meet local/national development or sectoral objectives (e.g. describe geologic resource for metallic/non-metallic mining, petroleum /geothermal reservoir, etc); Attach detailed Economic Geology as Annex					
3.3 Project Alternatives	Present criteria used in determining preliminary options for facility siting; development design; process/technology	Cost-benefit analysis				

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				YES	NO	
	selection; resource utilization					
3.4 Project Development Plan, Process/ Technology Options and Project Components	Attach tentative/options of Physical Plan/Site Development Map being considered at the FS stage (e.g., present annual program of development for a mine project); discuss processes/technologies being considered; tabulate project components and estimated dimensions/specifications (facilities/infrastructures, other single projects supporting the main project) and locate in map at a level of detail feasible at FS Stage	Provide the facilities per component Indicate the total volume to be dredged/excavated spoils Indicate the volume of retention ponds				

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				YES	NO	
3.5 Description of Project Phases, Aspects, Wastes, Other Issues, Built- in Measures	Tabulate project phases, activities/ environmental aspects, associated wastes*, other key environmental and social issues; and built-in pollution control measures *Under the column on Waste Generation: subheadings are as follows: types of wastes, estimated waste generation rate, estimated volume for the duration of the project phase)					
3.6 Manpower Requirements	Present manpower requirements per project phase; specify expertise needed; nature & estimated number of jobs					

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				YES	NO	
	available for men; nature and number of jobs available for women; specify strategy and tentative scheme for sourcing locally from host and neighboring LGUs and those from outside					
3.7 Project Cost						
3.8 Project Duration and Schedule	Present estimate per project phase					
4. BASELINE ENVIRONMENTAL CONDITIONS, IMPACT ASSESSMENT AND MITIGATION	For each module, present a) Methodology of EIA Modular Study including tabulation of stations with coordinates and qualitative description, as well					

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				YES	NO	
	as NAMRIA topographic map of the study area in 1:50,000 or more detailed scale; Summary of primary and secondary data (present detailed info as annexes; c) highlights of findings and conclusions on the baseline profile as to sensitivity to project impacts. On Baseline: MINIMUM DATA TO BE HIGHLIGHTED ARE THOSE ASKED IN THE PEMAPS QUESTIONNAIRE IN ANNEX 2-7d OF THE RPM. Subsequently,					

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				YES	NO	
	focus on 3-5 key findings on the baseline profiling per relevant module. No need to present or attach ALL primary data. Important to present highlights of analysis of baseline data: present summary analysis of physico-chem, bio and social data in terms of how the values compare with environmental standards, how the biostatistics compare with typical ecological values, how social data compare with national and local norms or Philippine statistics. present estimates and relative					

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				YES	NO	
	percentages of total area likely to be utilized, total volumes of soils to be excavated, # watersheds and total vegetation to be cut, # of rivers and extent of coastal/marine waters to be affected, total households to be displaced, etc… present and statistical highlights of ecologically and economically most important species and ECAs which may be affected; state nature of impact of project and how this can be prevented or mitigated. presence of any physico-chem,					

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				YES	NO	
	biological & social indicators (pseudo-indicators) of project impacts for monitoring purposes On Impacts: Focus on 1-3 most significant impacts/issues of the most critically affected modules under Land, Water, Air, People across each project phase. Include discussion of residual, unavoidable and cumulative impacts, where relevant and appropriate. On Mitigation: present major interventions/actions for each identified significant issue.					

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				YES	NO	
4.1 THE LAND	Discuss Land Use/classification and associated Terrestrial Biology (flora and fauna); Discuss only relevant aspects of Geology which will explain the geohazards; (Note: For Metallic and Non-metallic Mining Projects, Geothermal Exploration and other similar projects, other aspects of Geology particularly which describe the geologic resource in relation to the project proposal must be described as part of Project Description to justify geologic resource use)					

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				YES	NO	
	Discuss Geomorphology (i.e. land forms/topography/slope/ terrain) which explain the limitations or nature of the land use and distribution of population and nature of and vegetation/wildlife forms; Discuss Pedology (main soil type and quality) which rationalize/explain and lend support to the land use, population and biota profile					
4.2 THE WATER	Discuss relevant modules: Hydrology and Hydrogeology, Oceanography, Water Quality,					

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				YES	NO	
	Freshwater and Marine Biology Note #1: Identify which surface and groundwater systems will be affected by the project; present water quality status with highlight on the most relevant parameters, critical uses and the users of these water bodies; present the most important species likely to be affectedby the project; present conclusions of modeling (where relevant) of extent of physical and chemical dispersion/trajectory of most relevant parameter and resulting concentrations with					

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				YES	NO	
	increasing distance and depth from the source as basis for deriving a mixing or buffer zone and delineating the DIA from the IIA; map out the economically and ecologically critical areas/resources and superimpose on the biophysical data; Note #2: Present key findings and conclusions of analysis of surface and groundwater quality; Identify key potential impacts of the project across project phases and propose corresponding measures					

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				YES	NO	
4.3 THE AIR	Meteorology (Note: For most projects, the relevant parameters are only the climate types. seasons, rainfall profile, wind roses and climatological extremes as the latter pose environmental hazards; the rest of the climatological data can be attached as an Annex); Air Quality (& Noise, if relevant) : Present highlight of air quality status with highlight on the most relevant parameters; present conclusions of modeling (where required) on extent of physical and					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
	chemical dispersion/trajectory of most relevant parameter and resulting ground level concentrations with increasing distance from the source as basis for deriving a buffer zone and delineating the DIA from the IIA; superimpose on the economically and ecologically critical areas/resources and population/significant socio-cultural features Note: Present key findings and conclusions of analysis of air quality; Identify key potential					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
	impacts of the project across project phases and propose corresponding measures					
4.4 THE PEOPLE	Present highlights of primary and secondary data on the DIA and IIA, including highlights of perception survey; Present key findings and conclusions of analysis of the Socio-cultural Environment; Identify key potential impacts of the project considering biophysical findings across project phases and propose					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
	corresponding measures					
5 ENVIRONMENTALRISK ASSESSMENT (WHEN APPLICABLE)						
6. ENVIRONMENTAL MANAGEMENTPLAN						
6.1 Impacts Management Plan	Use Annex 2-17 of RPM – limit to most significant impacts per project phase and per environmental component arising from key environmental aspects					
6.2 Social Development Framework (RAP)	Use Annex 2-18 of RPM					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
6.3 IEC Framework	Use Annex 2-19 of RPM					
6.4 Emergency Response Policy and Generic Guidelines	The policy and generic guidelines are to be consistent with the relevant agencies' requirements that are to be complied with after the ECC is issued					
6.5 Abandonment /Decommissioning /Rehabilitation Policy and Generic Guidelines	Statement on Proponent's policies and generic procedures; Detailed Abandonment/Decommissioning Plan to be submitted post-ECC, within a timeframe specified in the ECC					
6.6.1 Self-Monitoring Plan	Use Annex 2-20 of RPM					

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				YES	NO	
	(including costing) and applicable parts of Annex 3-1 on ECC Compliance Monitoring of the Proponent; Attach filled out PEMAPS Questionnaire (Annex 2-7d) – present a statement on the existence of a PATHWAY, criticality of the RECEPTOR, status of perception of ENVIRONMENTAL PERFORMANCE from supportive or opposing groups.					
6.6.2 Multi-sectoral Monitoring Framework	For projects with MMT requirement, tabulate the following: list of stakeholder					

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				YES	NO	
	community sectors or representatives who are proposed to be likely members of the MMT as validated by EIA process, basis of priority selection, proposed MMT role, and scope of MMT responsibilities/activities; strategy or approach in establishing and monitoring Environmental Quality Performance Levels (EQPLs) in coordination with the MMT's program of identifying pseudo/quasi- indicators of environmental damage. Refer to					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
	Annexes 3-2 and 3-4 of the RPM.					
6.6.3 Environmental Guarantee and Monitoring Fund Considerations	Present a proposed amount of EMF (based on a draft AWFP in Annex3-4 and consistent with guidelines in Annex 3-5); Present a committed amount of EGF and the basis for the estimate, following the guidelines in Annex 3-6	Not applicable				
6.7 Institutional Plan for EMP Implementation	Discuss the Table of Organization of the Proponent where the reporting line and manpower complement/positions of the EU, MEPEO or equivalent units to higher management and	Specify the in-charge for monitoring (eg. EU/PCO)				

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
	relationships with operating departments are shown					
7. BIBLIOGRAPHY/ REFERENCES						
8. ANNEXES						
8.1 Scoping Checklist	Use Annex 2-7a of the RPM (signed off document) with attached signed off Public Scoping List of Issues, as applicable (Annex 2-7c)					
8.2 Original Sworn Accountability Statement of Proponent	Use Annex 2-21 of RPM					
8.3 Original Sworn	Use Annex 2-22 of RPM					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
Accountability Statement of Key EIS Consultants						
8.4 Proof of Public Participation	Attendance Sheets of IEC, Public Scoping, Public Consultation/Public Hearing; Proof of public participation in the EIA Study					
8.5 Baseline Study Support Information	Detailed analysis of primary and secondary information per module; perception survey analysis with sample questionnaire; Lab analytical results for soil, ground and surface freshwater and marine					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
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				YES	NO	
	waters, air quality, noise – all tables compared with relevant Philippine standards, Philippine typical baseline values, Philippine statistics or other equivalent reference standards. The rest of the baseline data obtained by the Preparer shall be presented during the EIA Review Meetings in case the Review Team has items to validate against detailed baseline info. Thesecan also be used by the Proponent in its self-monitoring and MMT validation activities.					

GENERAL CONTENTS/ REQUIREMENTS	SPECIFIC CONTENTS/REQUIREMENTS	FOR SCOPING USE	FOR PROCEDURAL SCREENING USE			
		Clarifications/Changes/ Special Instructions by EIARC/EMB	Page/s in the EIA Report	Validated Acceptable by EMB Case Handler?		Remarks
				YES	NO	
8.6 Impact Assessment and EMP Support Information	ERA, PEMAPS Questionnaire, etc.					

DURING TECHNICAL SCOPING: OTHER INSTRUCTIONS BY THE EIARC/EMB ON THE FORMAT AND CONTENT OF THE EIA REPORT TO BE SUBMITTED			DURING PROCEDURAL SCREENING: OTHER OBSERVATIONS/COMMENTS/REMARKS BY THE EMB CASEHANDLER ON THE FORMAT AND CONTENT OF THE SUBMITTED EIA REPORT
1)	How about the dredged materials – will be discussed with the DPWH and JICA consultants	1)	
2)	Public consultations in the EIS Report must be thoroughly discussed.	2)	
3)		3)	

B. Key Environmental Impacts to be included in the Assessment and Formulation of Management and Monitoring Plan to be reflected in the EIS

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
I. Land							
1.1. Land Use and Classification							
1.1.1 Impact in terms of compatibility with existing land use	Description & Map showing the project area in relation to existing land use.	Assessment of the compatibility of the proposed project vis-a- vis actual land use	29				

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
1.1.2 Impact on compatibility with classification as an Environmentally Critical Area (ECA)	Identify ECA where the project is located or near the project area. Identify areas vulnerable/ susceptible to natural hazards where the project is located or near the project area (include map/s).	and the approved comprehensive land use plan/zoning classification, ECA Classification and/or the coastal resource management plan of the LGU if any. Identify and assess	29				

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
1.1.3 Impact in existingland tenure issue/s	Determine if the project area is under CARP or withCADC / CADT / CALC/ CALT, with IFMA/ CBFMA, within COC, within MPSA or other tenurial instruments and identify corresponding existingtenure issues including presence of informal	impact in terms of landtenure issues in relation to project implementation					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	settlers						
1.1.4 Impairment of visualaesthetics	Visually significant landforms/ landscape/ structures	Identify and assess impact of the project on these visually significant landforms/ landscape/ structures					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
1.2 Geology/ Geomorphology							
1.2.1 Change in surface landform/geomorphology /topography/ terrain/slope	Slope and Elevation/ Topographic Map;	Identify and assess project impact in terms of the changes in surface landform/ topography/ terrain/slope including existing hazard as maybe aggravated by climate change as	33	33	33		

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		projected byPAGASA					
1.2.2 Change in sub-surface geology/underground conditions	Regional/General Geological Map Natural Hazard Map (subsurface)	Identify and assess project impact in termsof the changes in sub-surface geology andinducement of					
1.2.3 Inducement of subsidence, liquefaction, landslides, mud / debris flow, etc.	Geological Map as needed.; hazard maps (NAMRIA, NDRRMC, MGB, PHIVOLCS,PAGASA)	subsidence, liquefaction, landslides, mud/debris flow to the environment including the possibility of					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		aggravating existing natural hazards Discuss and assess the impacts of geologic hazards and planned earthworks on the project facilities (e.g., landslides, mudflows, subsidence, ground Shaking from earthquake, liquefaction,					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		flooding,etc.). Note inthe discussion how climatechange can aggravate the hazards and impacts. The geologic hazards map consider the hazards/ exposure/ vulnerability/risk maps of Section 1.1.2.					
1.3Pedology							

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
1.3.1 Soil erosion / Lossof topsoil/overburden	• Summary of Soil Investigation Report on soil type and quality • Soil map showing soiltypes, sampling stations, topography, streams, built-upareas, and planned projectfeatures	Describe capability of the land to accommodate the proposed development with minimal or without soil erosion/loss of topsoil/overburden Describe the physical properties and erodibility potential of the					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	Sediment sources	soil, ongoing erosional process and assess the erosionalimpacts of the project.					
1.4Terrestrial Ecology							

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
1.4.1Vegetation removal and loss of habitat	• Map showing land cover; sampling sites; location of observed important, endangered, and keystone species; ecologically sensitive sites; planned land development works • Flora and fauna species inventory or survey report to cover species	To establish baseline, - Use quadrat sampling for flora to cover all land cover type s - Use transect walk, mist nets, traps, for fauna - show survey locations in a map	42 - 69	69 - 70	70-73		

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	listing, abundance, richness, dominance, diversity, evenness, ecological status, and uses;	Relate discussions to estimated GHG emissions and possible carbon sequestration program/s					
1.4.2 Threat to existence and/or loss of	Summary of endemicity /		66 - 68				

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
local species	conservation status						
1.4.3 Threat to abundance, frequency anddistribution of species	• Summary of abundance, frequency and distribution • Economic importance and uses of significant flora and fauna		68 - 69				
1.4.4 Hindrance to wildlife access	Survey map in relation tothe project site						
2. THE WATER							
2.1 Hydrology/							

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
Hydrogeology							
2.1.1 Change in drainage morphology / inducement of flooding/ Reduction in streamvolumetric flow	Drainage map (also showing local drainage system/infrastructures); Historical flooding/ drought occurrences, stream flow measurements/estimates; Delineation of watershed /sub-	Identify and assessproject impact on the change in drainage morphology/local drainage system andresulting effects of flooding pattern in the project area and surrounding. Include climate	92				

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	watersheds/ floodplain;and identification of aquifers if any	projectionseffects onflooding. (in climate extremes projections discussions) Relate discussions toitem 3.1.1					
2.1.2 Change in stream, lakewater depth	Regional hydrogeological map	Identify and assess project impact in terms of change in stream, lake water depth					
2.1.3 Depletion of water resources /	Current / projected water use	Identify and assess					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
competition inwater use	(groundwater/surface water) in the area and adjacent areas Inventory of water supplysource including springs and wells (indicate depthof water table) and show location in a map of appropriate scale (checkNIA and NWRB; City Engg Office for Rural Water System)	project impact on theexisting water resources and the resulting competitionin the water use using analysis/ estimation of water availability. Include discussions taking into consideration the PAGASA					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		medium to long term projections.					
2.3 Water Quality							
2.3.1 degradation of groundwater quality	Physico-Chemical characterization ofwater: ☐ pH ✓ BOD5 ✓ Oil and grease ✓ TSS ✓ fecal / totalcoliform ☑ sampling site map	Identify and assess project impact in terms of degradation of groundwater, coastal surface water and coastal/marine water quality. Use DENR standard methods and procedures	92 - 100	100	100	206	
2.3.2 degradation of surface water quality							
2.3.3 degradation of coastal/marine water quality							

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		for sampling and analysis. Assess impact on siltation of surface and coastal/marine waters					
2.4 Freshwater Ecology							
2.4.1 Threat to existence and/or loss species of important local and habitat	• Summary of endemicity / conservation status • Abundance of Ecologically	Identify and assess project impact in termsof threats to existence/and or	103 - 112	112	112 - 113	196 - 198	

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	and economically important species (fishes, benthos, planktons); • Presence of pollution indicator species; sampling site map	lossof species, abundance Frequency and Distribution speciesand include discussions on overall impact to freshwaterecology. Relate discussions to air and water quality					
2.4.2 Threat to abundance, frequency and distribution of species							

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
3.0 THE AIR							
3.1Meteorology/ Climatology							
3.1.1 Change in the localmicro-climate e.g. localtemperature	Monthly average rainfalland temperature of the area; Climatological normals/ extremes; Wind rose diagrams; Frequency ofTropical cyclones	Identify and assess project impact in terms of change in the local micro-climate change. Also discuss effects of climate change using PAGASA medium to long					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		term projections					
3.1.2 Contribution in termsof greenhouse gas emissions (or GHG mitigation potential)	Data on Greenhousegasses (i.e. carbon dioxide, nitrous oxide);	Estimate projected greenhouse gases (GHG) using IPCC guidelines; Include carbon sink program for					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
		offsetting. Note: **Per existing DENR – FMB regulations, replacement of treesshall follow the following ratio: 1:50 (50 trees for 1 planted tree cut), and 1:100(100 trees for 1 naturally growing tree cut)**					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
3.2 Air Quality (& Noise)							
3.2.1 Degradation of airquality	Characterization of ambientair quality: ✓ TSP ✓ PM10 ✓ SO2 ✓ NO2 24-hours recommended sampling site map	Use DENR standardmethods and procedures for Sampling and analysis. Show in a map, sampling sites for monitoring purposes based on the above assessment.	119 - 121	122	123, 196 - 198	206	
3.2.2 Increase in	Characterizati	Use DENR	123 - 124	124	125		

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
ambientnoise level	on of ambient noise level **Morning, Day time Evening, and night time**sampling site map (near affected communities)	standardmethods and procedures for sampling and measurement.					
4.0 THE PEOPLE							
4.1 Displacement ofsettler/s Displacement / disturbance of properties	Demographic data of impactarea: - Number of householdsand	Identify and assessproject impacts on demography of affected	Include the quarry concessionaires				

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
Change/conflict in landownership Change/conflict Right ofway Impact on Public Access	household size - Land area, - Population, - Population density /growth - gender and age profile, - literacy rate, profile of educational attainment - settlements map **Per Barangay Latest Data**	communities. Use assessment in the formulation of SDP/IEC Assess availability ofalternative public access and housing options for displacedsettlers. For projectwith displacement/disturbance of	128 - 192	195	196		

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	Focus Group Discussion covering various population sectors (women, men, youth, elderly and others as applicable) shall be undertaken in the impact area/s to gather perception data Census of population / property that will be displaced / disturbed Housing ownership profile/availability of	properties/settlers, change/conflict in landownership and change/conflict rightof way, formula teresettlement framework plan or RAP					
4.2 In-migration proliferation of informalsettlers		Identify and assess project impact due to in-					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	housing/number of informal settlers	migration patterns including proliferation of informal settlers					
4.3 Cultural/Lifestyle change	Demographic data on Indigenous People (if any)and existing Culture/Lifestyle that maybe significantly affected **Beneficiary of project**	Identity and assess project impact in terms of Culture/Lifestyle that may be affected and/or introduced					
4.4 Impacts on physicalcultural	Inventory and description of	Identify all potentialproject					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
resources	physical cultural resources and landscapes that have archaeologic, paleontologic, historical, religious, aesthetic, or cultural significance: Movable or immovable objects, below ground or under water, sites, structures, groups of structures, and natural features - **Tourist**	impacts in an integrated manner considering the type, significance, and value/importance ofthe physical cultural resource/s Identify risks in termsofcapacity and Commitment in managing the					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	destinations that will be accessible - **Farm to Market impacts** Classify cultural interest value/ importance into local, provincial, national, or international level *Sources of information: UNESCO,*	impacts *(protocols in handlingchance finds shall beimplemented)*					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	National Museum (NM), National Historical Commission of the Philippines (NHCP), National Commission for Culture and Arts (NCCA) and the Local Government Units (LGUs) in the project area and other UNor National Publications						

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
4.5 Threat to delivery of basic services /resource competition	Availability of public services in terms of: • Water supply • Power supply • Communications /transportation • Conflict education facilities • recreational facilities / sports facilities	Identify and assess project impact in terms of threats to delivery of basic services including potential for resource competition in the area including effects of in-migration					
4.6 Threat to public healthand safety	Availability of public services in terms of: health	Identify and assess specific threats to public					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	resources (Government and Private) Statistical data / information related to public services: • Morbidity and mortality rates (infants andadults - 5-year trend) • Common diseases in thearea including	health and safety due to project impacts. Relate discussions to land, airand water (Item 1 to 3) Analysis of the impact of project implementation on existing disease profile including					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	endemicdiseases; Environmental Health and Sanitation Profile	weather sensitive diseases and impact aggravation as a result of climate change as projected by PAGASA					
4.7 Generation of LocalBenefits from the project Enhancement of employment and livelihood	Socioeconomic data: • Main sources of Income • Employment rate/profil	Identify and assess local benefits of the project in terms of enhancement of employment and					

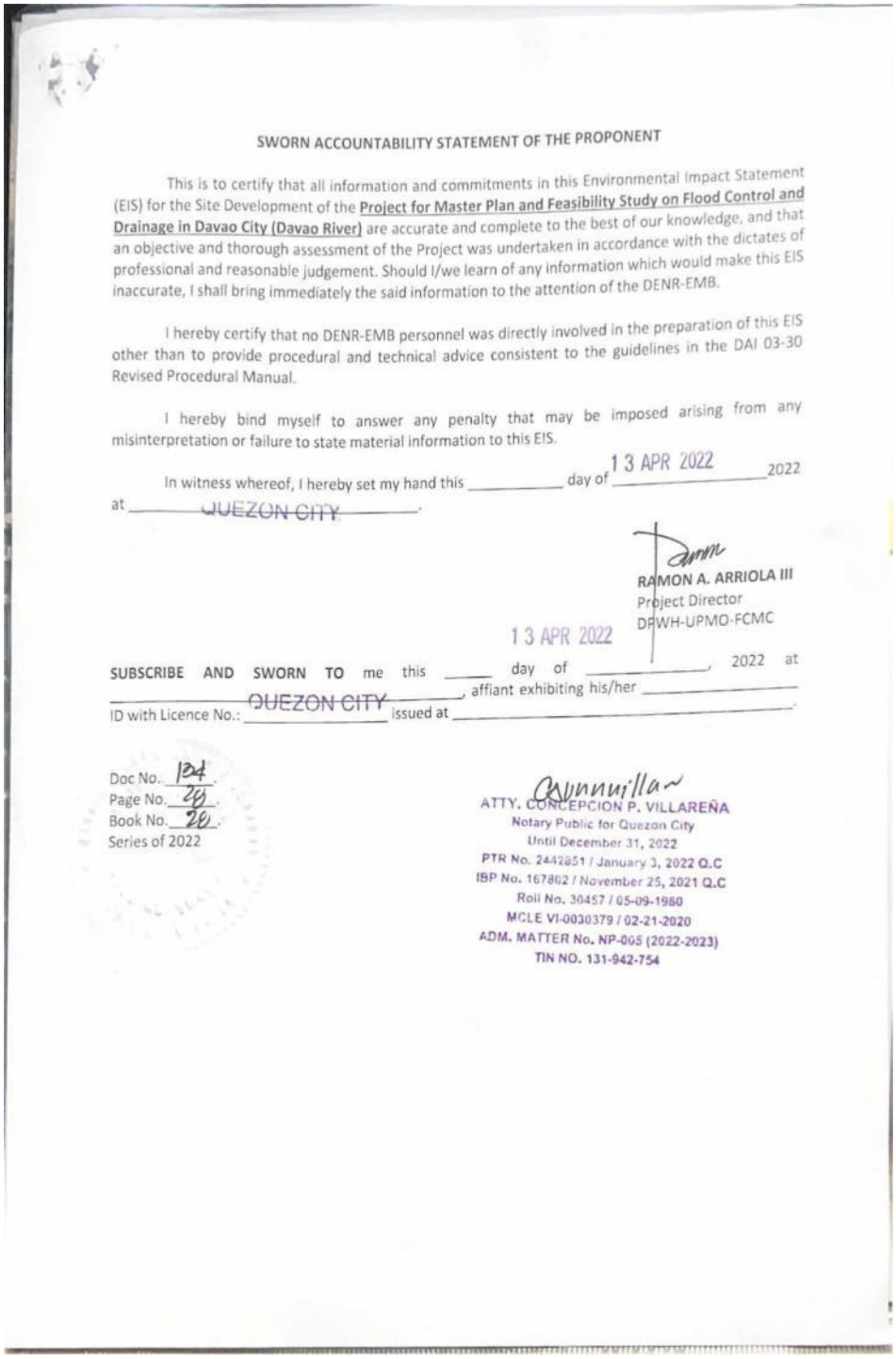
			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
opportunities Increased business opportunities and associated economic activities Increased revenue of LGUs	e • Poverty incidence • sources ofliveliho od • commercial establishm ents andactiviti es banking andfinancial institutions	livelihood opportunities, increased business opportunities and associated economic activities and increased revenue ofLGU					
4.8 Traffic congestion	Road	Identify and					

			For *completeness, page numbers should beprovided uponsubmission of the EIS*				
List of Key Impacts	**Baseline Data Parameter Requirements**	**Required Assessment Methodology / Approach**	Baseline Conditions	Impact Analysis	Mgmt. Plan	Monitoring Plan	**Remarks**
			Page	Page	Page	Page	
	network/ systems Existing Transportation/traffic situation Per component (dredging, cut-off works, retarding pond) construction phase	assess project impact on the traffic situation in the area including congestion based on existing capacity of road system					

ANNEX C – ACCOUNTABILITY STATEMENT

(Proponent and Preparer)

Annex C.1 - Accountability Statement of Proponent



SWORN ACCOUNTABILITY STATEMENT OF THE PROPONENT

This is to certify that all information and commitments in this Environmental Impact Statement (EIS) for the Site Development of the **Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)** are accurate and complete to the best of our knowledge, and that an objective and thorough assessment of the Project was undertaken in accordance with the dictates of professional and reasonable judgement. Should I/we learn of any information which would make this EIS inaccurate, I shall bring immediately the said information to the attention of the DENR-EMB.

I hereby certify that no DENR-EMB personnel was directly involved in the preparation of this EIS other than to provide procedural and technical advice consistent to the guidelines in the DAI 03-30 Revised Procedural Manual.

I hereby bind myself to answer any penalty that may be imposed arising from any misinterpretation or failure to state material information to this EIS.

In witness whereof, I hereby set my hand this _____ day of 13 APR 2022 2022 at QUEZON CITY.

RAMON A. ARRIOLA III
Project Director
DPWH-UPMO-FCMC

SUBSCRIBE AND SWORN TO me this 13 APR 2022 day of _____, 2022 at QUEZON CITY, affiant exhibiting his/her _____ ID with Licence No.: _____ issued at _____.

Doc No. 104
Page No. 21
Book No. 20
Series of 2022

ATTY. CONCEPCION P. VILLAREÑA
Notary Public for Quezon City
Until December 31, 2022
PTR No. 2442851 / January 3, 2022 Q.C
IBP No. 167802 / November 25, 2021 Q.C
Roll No. 30457 / 05-09-1980
MCLE VI-0030379 / 02-21-2020
ADM. MATTER No. NP-005 (2022-2023)
TIN NO. 131-942-754

Annex C.2 - Accountability Statement of Preparer

SWORN STATEMENT OF ACCOUNTABILITY OF PREPARERS

This is to certify that all information in this ENVIRONMENTAL IMPACT STATEMENT for the Project for Master Plan and Feasibility Study in Flood Control and Drainage in Davao City (Davao River) are accurate and complete to the best of our knowledge, and that an objective and thorough assessment of the Project was undertaken in accordance with the dictates of professional and reasonable judgement. Should we learn of any information which would make this **EIS Report** inaccurate, we shall immediately bring the said information to the attention of the DENR-EMB.

We hereby certify that no DENR-EMB personnel was directly involved in the preparation of this Project for Master Plan and Feasibility Study in Flood Control and Drainage in Davao City (Davao River) other than to provide procedural and technical advice consistent with the guidelines in the DAO 03-30 Revised Procedural Manual.

We hereby bind ourselves jointly and solidarily to answer any penalty that may be imposed arising from any misrepresentation or failure to state material information in this **EIS Report**.

In witness whereof, we hereby set our hands this 28 FEB 2022 day of _____ at _____.

Name	Expertise	Signature
Dr. Carmelita P. Martinez	Environmental Mgt, Water Quality, Marine	
For. Raul R. Buñao	Terrestrial Flora & Fauna & Soil Quality	
Dr. Silverio V. Magallon, Jr.	Socio-economics	
Dr. Ana P. Ocenar	Fresh Water and Marine Bio	
Berkman, Inc.	Air and Noise Quality	

SUBSCRIBE AND SWORN TO me this 28 FEB 2022 day of _____, 2022 at _____, affiants exhibiting their Passport/Community Tax Certificate/License Information as follows:

Name	Proof of Identification		
	Passport/CTC/License	Place of Issue	Date of Issue/Availability
Carmelita P. Martinez	LO6-96-048088	Davao City	07/16/2022
Raul Buñao	PRC No. 004088	Davao City	09/29/2021
Silverio V. Magallon, Jr.	M07-18-005821	Davao City	05/01/2018
Ana P. Ocenar	CRN-006-0015-0674-3	Davao City	01/13/2017
Berkman, Inc.			

Doc No. 453.
Page No. 92.
Book No. IX.
Series of 2022

KENNETH P. REYUYA
Notary Public
Until December 31, 2022
Roll No. 64044 04/27/15 Davao City
IBP No. 107613 11/6/2020 Davao City
PTR No. 4182830 12/21/2022 Davao City
MCLE Compliance No. VI-0027959
228 Parakeet St. Ecoland Phase
2 Matina Davao City

ANNEX D – PROOF OF PUBLIC PARTICIPATION

Interview of BLGU Workers in Barangay Mandug

Directly affected families of landowners near the Davao River expressing their opinion of the proposed flood control project.

Interview of directly affected household respondents of Barangay New Valencia

Occupants near Davao River working in the quarry site situated in Barangay Waan (left) and (right) interview of the head of the household from barangay New Carmen (right).

Directly affected household respondents from Barangay 1-A (left) and Barangay 2-A (right)

Barangay Health Workers of Barangay 5-A occupying near the Davao River.

PUBLIC SCOPING REPORT

Priority Projects for Flood Control in Davao River of Davao City

DPWH Flood Control Management Cluster (UPMO-FCMC)
Proponent

Green-Collar Consulting Services
EIS Preparer

PROJECT FACT SHEET

Project Name	Priority Projects for Flood Control in Davao River of Davao City
Project Proponent	DPWH Flood Control Management Cluster (UPMO-FCMC)
Office Address	DPWH 2nd St., Port Area, Manila
Type of Project	Environmental Enhancement
Project Location	Davao City, Davao River Basin
Total Project Area	+ River Dredging: Expected excavated volume - 2.0 MCM + Cut-Off Works: Expected excavated volume - 1.7MCM + Retarding Ponds: Expected excavated volume - 28.2MCM + Bridges (2)
Project Contact Person	Ramon A. Arriola III Project Director
Project Contact Number	+632-5304-3813/ +632-5304-3752 arriola.ramon@dpwh.gov.ph

RATIONALE

The Philippines has suffered devastating damage from natural disasters. During the 10 years from 2005 until 2015, 20,000 people were dead and missing, 75 million people have been affected, and the economic loss has reached 182 billion pesos.

Davao City had been less affected by flooding in the past, but flood damage has recently increased due to changes in typhoon tracks. For example, in 2011, 30 people were killed by the flooding of the Davao and Matina Rivers, more than 2,500 people were affected by the flooding of Davao River in 2013, and 22,911 families were affected by flooding due to Typhoon Vinta in December 2017. In addition, there are several problems such as inland flooding, insufficient drainage systems, and storm surges due to the geographical features of the 60 km coastline. Under the above circumstances, the Government of the Republic of the Philippines (GOP) requested assistance from the Japanese Government on the Master Plan and Feasibility Study on Flood Control and Drainage in Davao City.

In response to the official request of the Government of the Republic of the Philippines, JICA conducted a detailed planning survey on the Project and confirmed and signed the minutes of meetings (M/M) on August 11, 2017, and signed the Record of Discussion (R/D) on the 23rd of April 2018. The objective of the Project is to mitigate flood damage in Davao City by implementing flood control measures through the development of the Master Plan for Davao River, Matina River, and Talomo River basin and conducting the Feasibility Study on urgent and priority project(s). The project is expected to i) develop a Master Plan of the flood control and drainage in Davao City, which includes a flood control Master Plan for Davao River, Matina River, and Talomo River basins; ii) analyze the Feasibility Study on urgent and priority project(s); and iii) enhance the capacity of concerned DPWH personnel/Officials in the development of Flood Control and Drainage Master Plan.

The proposed project is an environmental enhancement category of interventions wherein Retarding Pond is under Category B, of which ECC is required per DENR Administrative Order (DAO) Number 30 series of 2003 and EMB MC 004-2015. Therefore, the proponent has to follow the PEIS system to secure the Environmental Compliance Certificate from the EMB regional office with this category.

To facilitate the ECC application, the proponent taps the expertise of Green-collar Consulting Services (GCS), a private firm, to conduct the Environmental Impact Assessment (EIA), which is a requirement for the ECC issuance.

Last December 29-30, 2021, the team successfully conducted the Information, Education, and Communication Campaign. After the activity, the team submitted a documentation report to the EMB Central Office and EMB Regional Office XI and a request to conduct public scoping.

After a thorough review of project documents, EMB Central Office classified the project under Category B, and ECC should be applied at EMB Region XI. The EMB regional office also approves the request of the proponent to conduct an online public scoping on December 7, 2021 (Tuesday).

The ultimate intention of the activity was to present the details of the project and solicit feedback from the affected people and other stakeholders to guide the team in the conduct of the environmental impact assessment study. The implementation of the activity was guided by the EMB Memorandum Circular No. 2020-30 or the "Interim Guidelines on Public Participation in the Implementation of the Philippine Environmental Impact Statement System (PD 1586) during the State of National Public Health Emergency". [1]

The details of the public scoping activity are presented in the succeeding sections of this report.

PRESENTATION OF STAKEHOLDERS

A total of ninety-five individuals have attended the online/on-site public scoping. The complete list of participants is shown in Table 1.

Table 1: List of Participants in the Public Scoping.

Present (Yes=√)	Name of Invitees	Sector/Sub-Sectors/Agency
City Local Government Unit and Other Government Agencies		
√	Gina Santos	Acting PPD Chief, CPDO
√	Gerardo Antonio Castillo	Acting Admin Officer, City Econ Enterprise Office
√	Karl James Magarzo	DENR II
√	Danilo Gonzales	Engineer II, DENR 11
√	Paul John Juson	Technical Assistant, City Engineer's Office
√	Crisil Guyot	EMS II, LGU-CENRO

[1]EMB MC No. 2020-30. Interim Guidelines on Public Participation in the Implementation of the Philippine Environmental Impact Statement System (PD 1586) during the State of National Public Health Emergency. Retrieved at http://eia.emb.gov.ph/wp-content/uploads/2020/07/EMB-MC-2020-30-Interim-Guidelines-on-the-Public-Participation-in-the-Implementation-of-the-PEISS-PD-1586.pdf

√	Alfredo Baloran	CDRRMO
√	Mimia Canja	Presidential Commission for the Urban Poor
√	Virgenia Pusod	Division Chief, CENRO
√	Rodrigo Bustillo	CDRRMO – Davao City
Barangay Local Government Units		
√	Rey Ototan	Kagawad, Mandug
√	Benito Viray	Admin Assistant, Brgy. 19-B
√	Nelda Naraval	Kagawad, Brgy. 2A
√	Arnel Policarpio	Chairman, Brgy. 1A
√	Pacito Cañete	Chairman, Brgy. Ma-a
√	Editha Baybayanon	BHW
√	Nelda Sabijon	Reprepresentative, BLGU Callawa
√	Dinno Cawbruro	BDMRRMC, Mandug
√	Dodong Ocon	Member, BDC of Mandug
√	Maria Nilda A. Rigodon	Member, BDC of Mandug
√	Nil Dwigin Mitra	Kagawad, Mandug
√	Eduardo Yaranon	Kagawad, Mandug
√	Maria Luiz A. Mongas	Kagawad, Mandug
√	Emma A. Alcano	Sitio Leader, Mandug
√	Giorgonio Laput Jr.	Kagawad, New Valencia
√	Casemira Salarda	Staff, Brgy. 2A
√	Jennifer Salibo	Functionary, Brgy. 2A
√	Rosemen Dagook	Staff, Brgy. 5A
√	Sharon Grace Parescal	Treasurer, Brgy. 1A

√	Nenita Camillo	BCW, Mandug
√	Nelo Dagatan	Kagawad, Brgy. 8-A
√	Allan Linao	Kagawad, 76-A
√	Sabelita Parba	President, Women in 76-A
√	Alexis Renee Pili	SK Chairperson
√	Ariel Lacida	Kagawad, Brgy. Callawa
√	Ken Brian De Leon	Representative, Brgy. Ma-a
√	Jobert Dela Cruz	Kawad, Brgy. 2A
√	Ayren Ybañez	Staff, Brgy. 76-A
√	Nelo Dagatan	Kagawad, Brgy. 8-A
Community and Other Sector Representatives		
√	Philip Dizon	Owner, Davao Crocodile Park, Inc.
√	Jaynor Macadawan	Chairperson, Brgy. Waan
√	Maria Victoria Maglana	Convenor, Konsyensya Dabaw
√	Mary Grace Elemino	Representative, Brgy. 5-A
√	Marcos Endrina	Chairman, LABEARBCO
√	Virqie Villacuer	Secretary, LABEARBCO
√	Marillo Amavillo	Representative of Women, Mandug
√	Sherly Lisondir	Representative of Women, Mandug
√	Yolanda Caballera	Representative of Women, Mandug
√	Regino V. Alcano	OIC, JROG Marketing, Mandug
√	Michelle M. Quijano	Liason, SHIRLEY DIMPLE LAJO, Mandug
√	Armando Busalla	BDO, LABEARBCO, Mandug
√	Elsa A. Taga-an	Senior Citizen, New Valencia

√	Ramon Ayala	Senior Citizen, New Valencia
√	Dennis Agbon	Driver, New Valencia
√	Rosemarie P. Plamero	SPA Quarry, Mandug
√	Alma Fox	President, Women
√	Michelle P. Pangihan	Staff, ODF
√	Mary May Porpayas	Staff, Las Arenas, Mandug
√	Nhenfa Mae M. Abellanosa	Staff, Las Arenas, Mandug
√	Louie Jean Ahev	Representative, Community
√	Rosalinda Tomas	Dept. Chair, Ateneo de Davao University
√	Shaira Mae Ando	Representative, Youth
√	Victoria Horfilla	Director, Grassroots United for Integral Development and Empowerment (GUIDE), Inc.
√	Lemuel Manalo	IDIS
√	Jessie Manuta	Interdev
√	Dam Vertido	Interdev
√	Sabelita Parba	Community Representatives
√	Arnold Vanderbroeck	Community Representatives
√	Edgar Ibuyan	Community Representatives
√	Edsil Gumalawe	Community Representatives
√	Elvio Nunez	Community Representatives
√	Erwin Kagape	Community Representatives
√	Jasper Lacida	Community Representatives
√	Joan Mayrin	Community Representatives
√	Ma. Agustina dela Cruz	Community Representatives
√	Mariel Montes	Community Representatives

√	Nelda Ticon	Community Representatives
√	Norzannah Orbe	Community Representatives
√	Reginal Pastoral	Community Representatives
√	Romat Vehicle	Community Representatives
√	Shane Maglasang	Community Representatives
√	Sharon Parescal	Community Representatives
Green-Collar Consulting Services (Preparer)		
√	Carmelita P. Martinez	Project Team Leader
√	Silverio V. Magallon, Jr.	Socio Expert
√	Melisa H. Aratia	Research Specialist
√	Michael Jhon M. Asis	Liason
√	Analiza P. Aguilar	Facilitator
Environmental Management Bureau 11		
√	MIralou Blanco	Sr. EMS/Chief EIAS, EMB 11
√	Maria Stella Corpuz	EIA Staff, EMB 11
Proponent		
√	Alejandro Sosa	Project Manager III, DPWH-UPMO-FCMC
√	ALAIN JOHN SOTTO	Chief, DPWH – ESROW/Flood Control Section
√	Kenichi KURAMOTO	OC Global, JICA
√	Jeric John Nuguid	Engineer 2, DPWH
√	Cheeryl Andresio	Research Assitant, OC Global
√	Ara Salcedo	DPWH 11

NARRATIVE SUMMARY OF PUBLIC SCOPING ACTIVITY

Program of Activity

Time	Program of Activity	Responsible Person
12:00 – 1:00 PM	Online Registration https://forms.gle/6EmezMU1cso12Jt89	Secretariat
1:00 – 1:15 PM	Opening Prayer National Anthem	Secretariat
1:15 – 1:30 PM	Welcome Remarks	**Gina R. Santos** Acting Division Chief, Plans and Programs Division, CPDO
1:30 – 1:40 PM	Introduction of Participants, Workshop Overview, Objectives and Expectation Setting	**Representative** EMB - XI
1:40 – 1:50 PM	Overview of the Scoping Guidelines and Mechanics	**Ms. Miralou Blanco** Chief, EIA Section, EMB - XI
1:50 – 2:50 PM	Brief Presentation of the Proposed Project	**Mr. Jeric Nuguid** UPMO
2:50 – 3:00 PM	Coffee Break/Snacks	
3:00 – 4:00 PM	Open Forum and Raising of Issues to be Addressed by the EIA Study	**Ms. Miralou Blanco** Chief, EIA Section, EMB - XI
4:00 – 4:30 PM	Synthesis/Summary of Issues and Agreements on Scoping	**Dr. Silverio V. Magallon, Jr.** Facilitator/ Socio Expert
4:30 – 5:00 PM	Closing Remarks and Next Steps in the EIA Process	**Ms. Miralou Blanco** Chief, EIA Section, EMB - XI

Welcome Remarks

The program started at 1:00 PM with an ecumenical prayer followed by the singing of the National Anthem as facilitated by Ms. Stella Corpuz, the EMB case handler for this project.

Maam Gina R. Santos, the Acting Division Chief for the Plans and Programs Division of the Davao City Planning Division Office, welcomes the participants of online public scoping.

Introduction of Participants

After that, Miss Corpuz acknowledges the participants. She informed the body that some of the participants were clustered in the Covered Court of Barangay Mandug.

Overview of Public Scoping Guidelines & the Mechanics

Also, Maam Blanco oriented the participants about the public consultation guidelines (dos and don'ts). She explains the purpose of conducting Public Scoping and the roles of EMB, the proponent, and other stakeholders involved in securing an ECC. Maam Blaco encourages everyone to listen and actively participate in the consultation process.

Brief Presentation of the Proposed Project

Engr. Jeric Nuguid of DPWH-UPMO presented to the public the project details. He explained to them the rationale and importance of the proposed flood control project in the context of Davao City. Engr. Nuguid also presented the components and potential outcomes of the project.

Open Forum

After presenting the project details, the participants were given a chance to raise some issues and concerns. Ms. Blanco facilitated the open forum with the assistance of Dr. Magallon. The results of almost two hours of productive discussions are presented in Table 1.

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
1.	The cut-off works and bridges would entail costs to the govt.	Mr. Philip Dizon	The project is considered to lessen the flow of water in the river. Therefore, based on JICA experts, the project is feasible. Retarding ponds will be established to control water flow and volume.	Engr. Jeric Nuguid, UPMO
2.	The shape of the River Front buffers the velocity of the water going to Ma-a. Once diverted, there will be a sudden flash of water to Ma-a and the riverside, causing people to drown. Muslim brothers in downstream areas are also against the proposed project.		This project is similar to Monkayo. Cut-off works were done in Monkayo to solve the constriction of water flow. Based on the simulation, water from upstream will be temporarily stored in the retarding ponds, thereby reducing the magnitude of the river flow going downstream.	Engr. Allan Dela Pena, DPWH XI
3.	How to access the Flood Control Master Plan?	Mags Maglana	The master plan is not yet the final master plan. We can share the interim report.	Engr. Jeric Nuguid, UPMO
4.	Is there a retarding pond in Ma-a? What is the capacity in terms of size, volume, etc.?	Shane Maglasang, Bgry Ma-a	There is no retarding pond in Ma-a, only cut-off works, and river dredging	Engr. Allan Dela Pena, DPWH XI
			Complementary projects will be implemented in the year 2045 onwards.	Engr. Allan Dela Pena, DPWH XI
5.	Location of the proposed retarding ponds	Romulo Nicdao	Proposed location was presented	Engr. Allan Dela Pena, DPWH XI
6.	What is the schedule of the dredging project (if included in the master plan)? Is there a study on the maintenance schedule?	Emmanuel Cifra, San Lorenzo Ruiz Socio-Economic Development Foundation, Inc.	The consultants will determine the schedule of dredging depending on the width and depth. What is essential is the maintenance of the flood control mechanisms. Non-structural measures were proposed by controlling erosion upstream and reducing sediment transport during floods. This is not only the concern of DPWH but also by other agencies.	Engr. Allan Dela Pena, DPWH XI
			JICA consultants are studying the dredging frequency, including excavation and other technical analyses.	Jeric Nuguid, UPMO

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
7.	Expound the efficacy of retarding pond	Victoria Horfilla	RP will store the water upstream to prevent flooding downstream	Jeric Nuguid, UPMO
	Were you able to measure the volume of water that will flow in Ma-a areas? How does it be addressed by the RP? Will you be putting ponds on the portions of the river where you intend to straighten them?		We have 3 RP upstream, 4.7M cm^3, 2.2M cm^3, 0.67 M cm^3… 7.57M cm^3 total capacity. The locations of the retarding ponds were determined by studying the characteristics of the Davao River	Atty. Alain Sotto, DPWH XI
	We had the Vinta before, was it considered in the plan?		Not all water will be contained in the retarding ponds. To prevent flooding, other activities are cut-off works and dredging.	Engr. Allan Dela Pena, DPWH XI
			Japan consultant used Typhoon Vinta incidence as the basis for the simulation. In addition, the 100-year flood was used to calculate the design capacity of flood control systems.	
8.	Public hearing and information campaign by barangay is vital to raise community awareness and acceptance of the proposed project	Miralou Blanco, EMB XI	Public consultations were conducted even during the conceptualization of this plan. DPWH will hold a series of public consultations in the future.	Engr. Allan Dela Pena, DPWH XI
9.	Old river beds will not be used as relocation sites, and these should be planted with trees and no structures. No relocation or community be allowed within the old river bed.	Danilo Gonzales	The team will consider your valuable comments and suggestions.	Jeric Nuguid, UPMO
10.	Straightening the meandering portion, is this a sensible plan?	Victoria Horfilla	It cannot be avoided. Ideally, if we want people not to be affected by the flood, situate them away from the river. We should not occupy the flood plain.	Engr. Allan Dela Pena, DPWH XI
			RP will arrest the water from upstream to avoid flooding downstream. So it is in the interim report. Justifications and reasons were explained there in the master plan.	Engr. Allan Dela Pena, DPWH XI
11.		Romulo Nicdao	No design yet during the time. These countermeasures came out later. These are	Engr. Allan Dela Pena, DPWH XI

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
	The concern of Mr. Dizon was not discussed during the two series of consultations.		recommendations made by the study team. These are the lowest cost with the benefit-cost ratio analysis based on cost.	
			That was an early stage of master plan development. We surveyed mountain areas affected by Typhoon Vinta. JICA considered that scenario; that is why they came up with these components.	Jeric Nuguid, UPMO
12.	Do we have series of public consultations to raise awareness before project implementation?	Norzannah Orbe	Yes, Sir. IEC should be done.	Jeric Nuguid, UPMO
			This is only the first stage. After this, there will be an EIA to be done, including the IEC plan. The plan will include details of different strategies for public consultations. Therefore, public participation in the entire process of EIA is a must.	Maam Miralou Blanco, EMB XI
13.	Is Retarding Pond be established in Barangay Callawa?	Jasper Lacida	One RP in Callawa near the Garay quarry, one in Mandug, and another in New Valencia. The map was presented.	Dam Vertido, Interdev
14.	The proponent should consider the following: - Meeting with Mr. Dizon, - Clustered public consultations by barangay - Constant river dredging	Romulo Nicdao	Well noted. DPWH, being the proponent of this project, is responsible for the consultation.	Miralou Blanco, EMB XI
			Well taken, Sir.	Jeric Nuguid, UPMO
			(Showed the map, designated RPs)	Atty. Alain Sotto, DPWH XI
15.	Clarification about the flow of water map What are the plans for the affected quarry concessioners? Is it possible to extend and create other cut-off works in 6.4 – 4.4km areas?	Rique Barral	It was explained on the map that only very few people and houses would be affected. We can ask our experts on the technical project design. Public participation is needed.	Jeric Nuguid, UPMO

No.	ISSUE/CONCERN	PARTIES CONCERNED (NAME/AGENCY/SECTOR)	RESOLUTIONS/AGREEMENT	PERSON WHO RESPONDED TO THE ISSUE/CONCERN RAISED
16.	River cutting will indeed be very costly. These will need additional mitigating measures after, such as pumping stations to pump/discharge water immediately to Davao Gulf (likely the same to Singapore's Marina Barrage pumping tech/mechanism at the river mouth). We might as well reallocate the budget and focus more on securing/developing a network of retarding ponds (restoration of wetlands as nature-based solutions). Retarding ponds are very efficient; they help capture-convey-infiltrate floods. What are other measures considered to mitigate the potential adverse effects of cut-off works? An example is the effects of the pumping station in Singapore. Is this projected?	Lemuel Lloyd Manalo, *Interfacing Development Interventions for Sustainability*	We will take note of your comments. JICA will take note of this. However, the technical analysis of the cut-off works is not yet completed.	Jeric Nuguid, UPMO
			There is no need for a pumping station because RP's design will use gravity. As of now, there is no mention of putting a pumping station in Davao River. Loss of wetlands is one of the causes of flooding in urban areas. The countermeasure of urban flooding is constructing artificial storage like box culverts.	Engr. Allan Dela Pena, DPWH XI
17.	What about in the inner part of Davao City? What is the status of the Pumping stations?	Romulo Nicdao	No proper maintenance. It is recommended to maintain the drainage facilities/canals to minimize flooding properly.	Engr. Allan Dela Pena, DPWH XI

Synthesis/Summary of Issues and Agreements on Scoping

After the open forum, Dr. Magallon summarized all issues and concerns raised by the participants using the EMB-prescribed template. He also informed the crowd that a documentation report should be submitted to EMB 11 along with the request for technical scoping.

PROPOSED DESIGN OF PUBLIC PARTICIPATION

Public participation is an integral part of environmental decision-making. It has been enshrined in international environmental law via the 1992 Rio Declaration and the 1998 Arschus Convention. Public participation has three dimensions: the right to participate in environmental decision–making processes, the right to information concerning the environment and activities affecting it, and the right of access to justice. In environmental enhancement, community participation is expected to enhance the democratic legitimacy of decisions, manage social conflict, lead to greater accountability and effectiveness in decision-making, and produce more accurate results in the planning process.

This project will have five spectrums (see Figure 1). The first spectrum is to **inform** the public with balanced and objective information to assist them in understanding the issues, concerns, problems, alternatives, opportunities, and solutions. The spectrum of the consultation follows this to obtain public feedback on analysis, alternatives, and decisions. The third is to **involve** or work directly with the public throughout the process to ensure public concerns and aspirations are consistently understood and considered. The fourth spectrum is to **collaborate** or partner with the public in each aspect of the decision, including developing alternatives and identifying preferred solutions. Last is the spectrum of **empowerment** that places decision-making in the public's hands. Each spectrum will be applied in specific activities or processes undertaken in the proposed project.

INCREASING IMPACT ON THE DECISION					
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the issues, concerns, problems, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision, including developing alternatives and identifying the preferred solution.	To place final decision-making in the hands of the public.
PHASE	Awareness (IEC) Phase	Scoping Phase			Decision-Making Phase
ACTIVITIES	Conduct of IEC and Pre-Perception Survey	Conduct of Public and Technical Scoping	Conduct of Perception Survey and other Baselining Activities	Creation of Multi-partite Monitoring Team	Public Hearing and Decision Making of EMB Review Committee (Accept or Reject)

Figure 1: Proposed Design for Public Participation

ANNEX 1: ATTENDANCE SHEET

A. On-Site Attendance

REPUBLIC OF THE PHILIPPINES
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU

PUBLIC SCOPING
ATTENDANCE SHEET

Project: Priority Projects for Flood Control in Davao River, Davao City Proponent: DPWH Flood Control Management Cluster (UPMO-FCMC) Venue: Online (https://meet.google.com/rfn-gqgo-ssn)	Project Location: Davao City, Davao River Basin Date: 7 December 2021

Name	Gender M	Gender F	Office/Organization Represented	Designation	Home Address (Purok, Barangay)	Email Address	Contact Number	Signature
1 Marilou Amarillo		✓	women	Member	Purok Lapay Brgy.	Mandug	09959450898	[signature]
2 [illegible] Villacura		✓	LEBENDBUD	SEC	DDF Village	[illegible]	09[illegible]	[signature]
3 Marcos Endrina			LAPEDRB CU	Chairman	Balon Tugatto DC		09078641949	[signature]
4 [illegible] P. Lisondra			Women	Member	Brgy Mandug		0930 400 7075	[signature]
5 Yolanda [illegible]			Women	Member	Brgy Mandug		09630653852	[signature]
6 [illegible]	✓		Brgy. Official	Kagawad	Brgy. Mandug		09[illegible]	[signature]
7 REY V. OTOTAN	✓		BRGY. CAPTAIN	BRGY. CAPTAIN	COOG, MANDUG D.C.	ototanrey@gmail.com	0946760525	[signature]
8 DODONG OCON	✓		BDC-Mandug	member BDC	DDF Village Mandug	exodee94@gmail.com	09234814788	[signature]
9 [illegible] V. [illegible]	✓		JRDC Marketing	OIC	Sitio Lapay, Mandug, DC	[illegible]	09[illegible]	[signature]
10 [illegible] Cantrano	✓		BRGY. MANDUG	BDRRMC	DDF VILL. MANDUG		09[illegible]	[signature]

REPUBLIC OF THE PHILIPPINES
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU

PUBLIC SCOPING
ATTENDANCE SHEET

Project: Priority Projects for Flood Control in Davao River, Davao City Proponent: DPWH Flood Control Management Cluster (UPMO-FCMC)	Project Location: Davao City, Davao River Basin
Venue: Online (https://meet.google.com/rfn-qaqq-isn)	Date: 7 December 2021

Name	Gender M	Gender F	Office/ Organization Represented	Designation	Home Address (Purok, Barangay)	Email Address	Contact Number	Signature
1 Denis Agsoy	·		Vista Valencia	Driver	Sto. Lumay Purok 7		09512462150	
2 Rosemarie P. Palencho		✓	Quarry Mandug	SPA	Mandug		09498130129	
3 Aniñon, Melisa		✓	GCS					
4 Aguilar, Analisa		✓	GCS					
5 ALMA FOX		✓	WOMEN	PRESIDENT	ZRU		09279708402	
6 MICHELLE C. PONGIGAN		✓	STAFF		DDF			
7 MARY MAY PORFERAS		✓	STAFF		LAS ARENAS			
8 KHEIZA MAE M. ABELLANA		✓	STAFF		MANDUG PROPER			
9 Louie Juan Ahov		✓	Staff		Danao			
10								

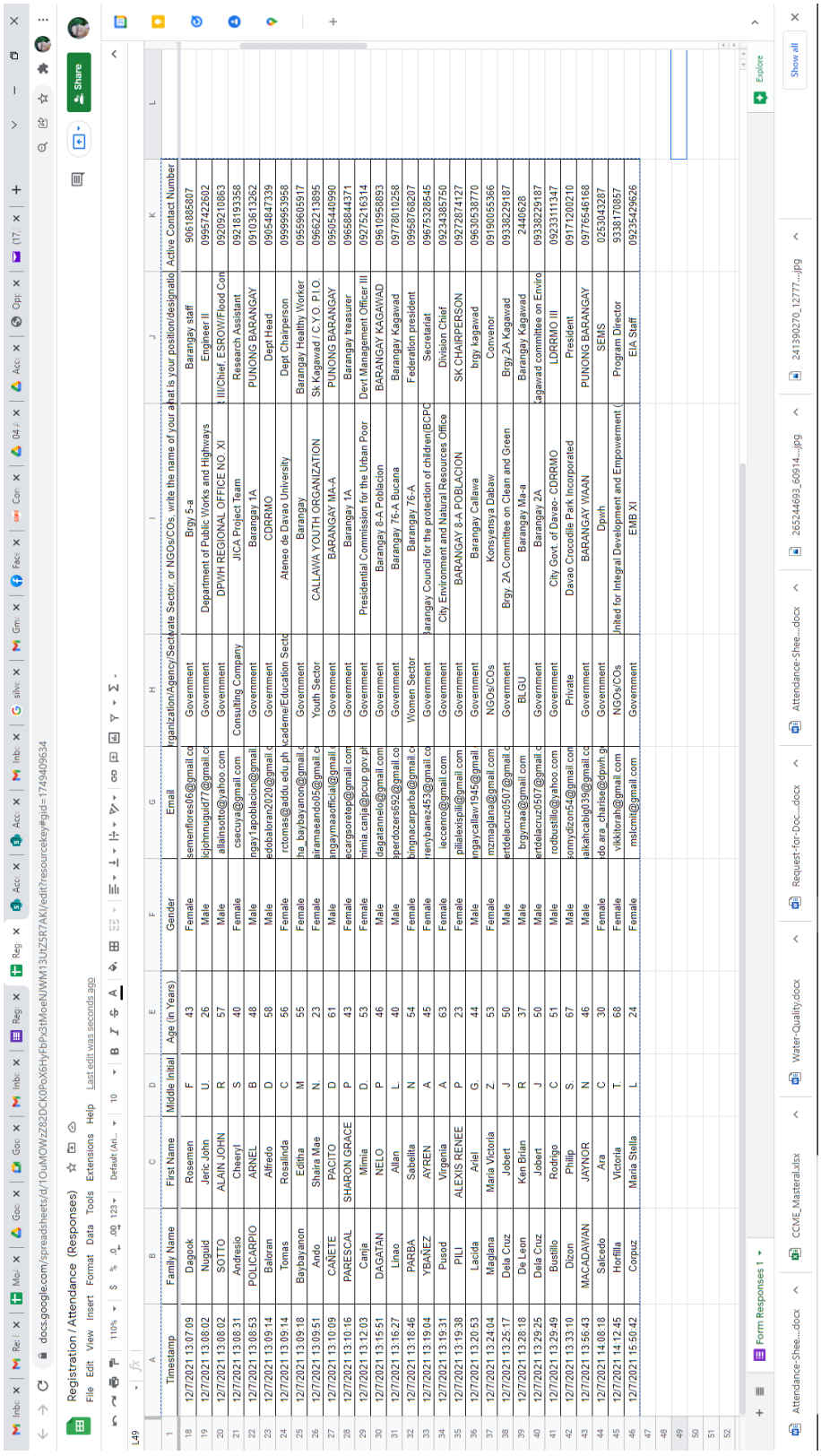
REPUBLIC OF THE PHILIPPINES
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU

PUBLIC SCOPING ATTENDANCE SHEET

Project: Priority Projects for Flood Control in Davao River, Davao City	**Project Location:** Davao City, Davao River Basin
Proponent: DPWH Flood Control Management Cluster (UPMO-FCMC)	
Venue: Online (https://meet.google.com/rfn-qaqq-isn)	**Date:** 7 December 2021

Name	Gender M	Gender F	Office/ Organization Represented	Designation	Home Address (Purok, Barangay)	Email Address	Contact Number	Signature
1 [illegible]		✓	Shirley Dimple C. Lajo	Liaison	Mandug Davao City	[illegible]	[illegible]	[signature]
2 [illegible]	✓		[illegible]	B.D.O	Lapuy, Mandug D.C.		[illegible]	[signature]
3 [illegible]		✓	New Valencia	Brgy Kagawad	P-7 Wingan New Valencia		[illegible]	[signature]
4 Ramon [illegible]	✓			Senior Citizen	P-7 Wingan New Valencia			[signature]
5 [illegible]		✓		BCW	P-7 Wingan New Valencia		[illegible]	[signature]
6 Gregorio Laput Jr				Brgy Kagawad	P-4-Brgy New Valencia		[illegible]	[signature]
7 Maria Nilda A. Rigodon		✓	BDC Mandug	Member	DDF Village, Mandug	[illegible]	[illegible]	[signature]
8 Eduardo Yaranon	✓		Brgy Mandug	Brgy. Kagawad	DDF Village, Mandug	eyaranon_3@yahoo.com	[illegible]	[signature]
9 Maria Luiz A Monial		✓	Brgy Mandug-Council	Brgy Kagawad	DDF Village, Mandug, DC	[illegible]	[illegible]	[signature]
10 Emma A Alcono		✓	Brgy Mandug	Sitio Leader Lapuy	Lapuy, Mandug D.C.		[illegible]	[signature]

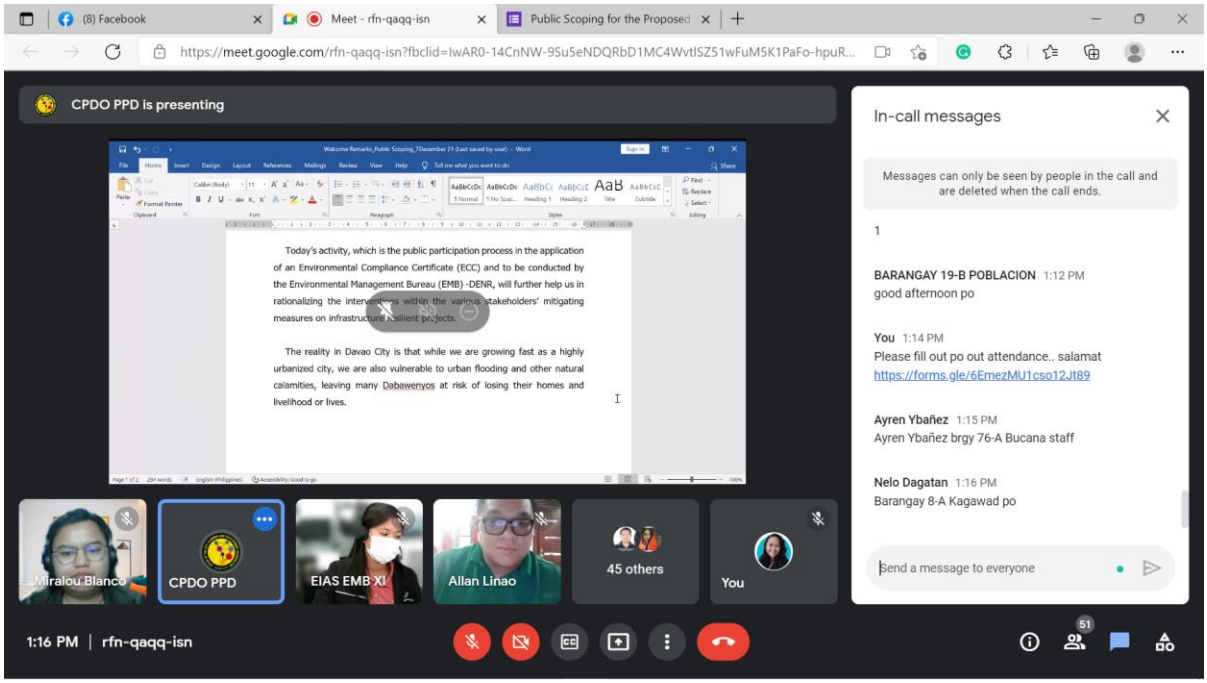
B. Online Attendance

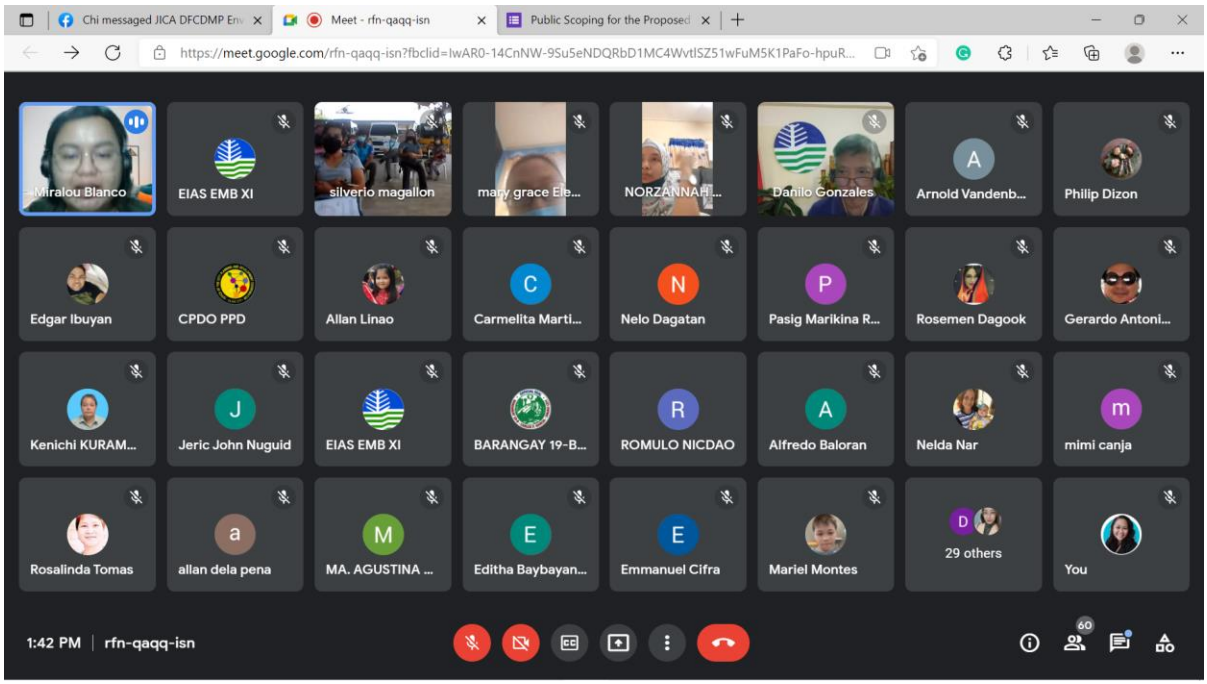


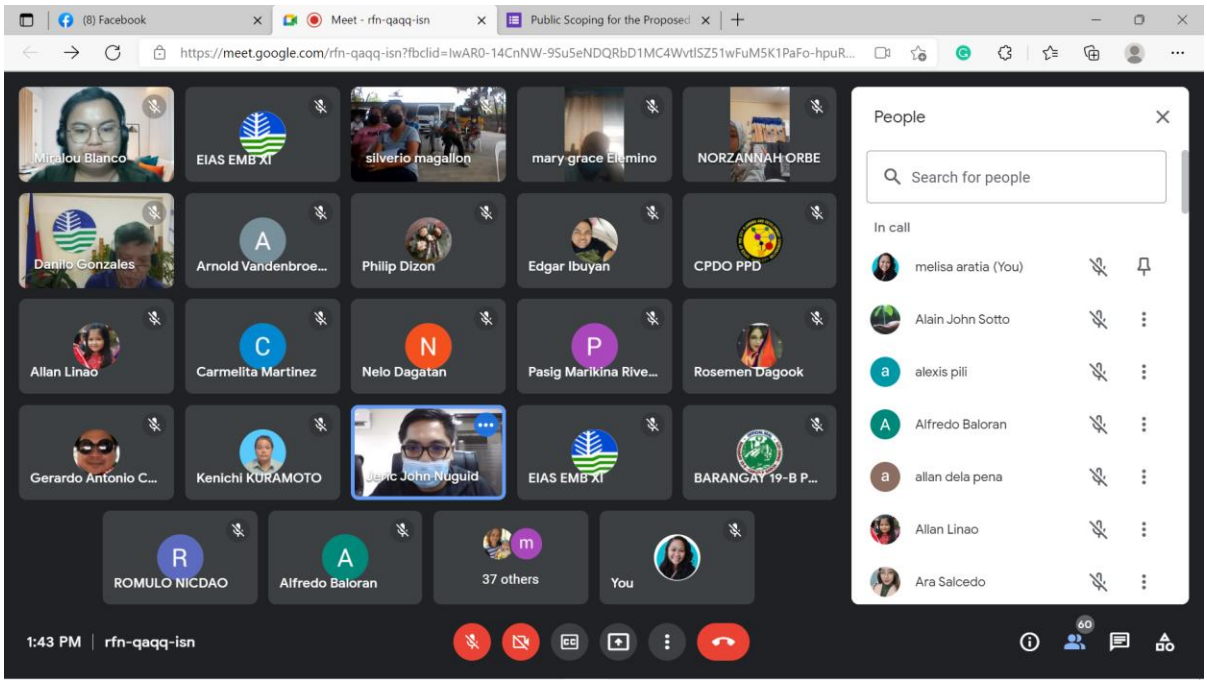
ANNEX 2: PHOTO DOCUMENTATION

A. On-site Participants at Barangay Mandug Covered Court

B. Participants in the Online Public Scoping



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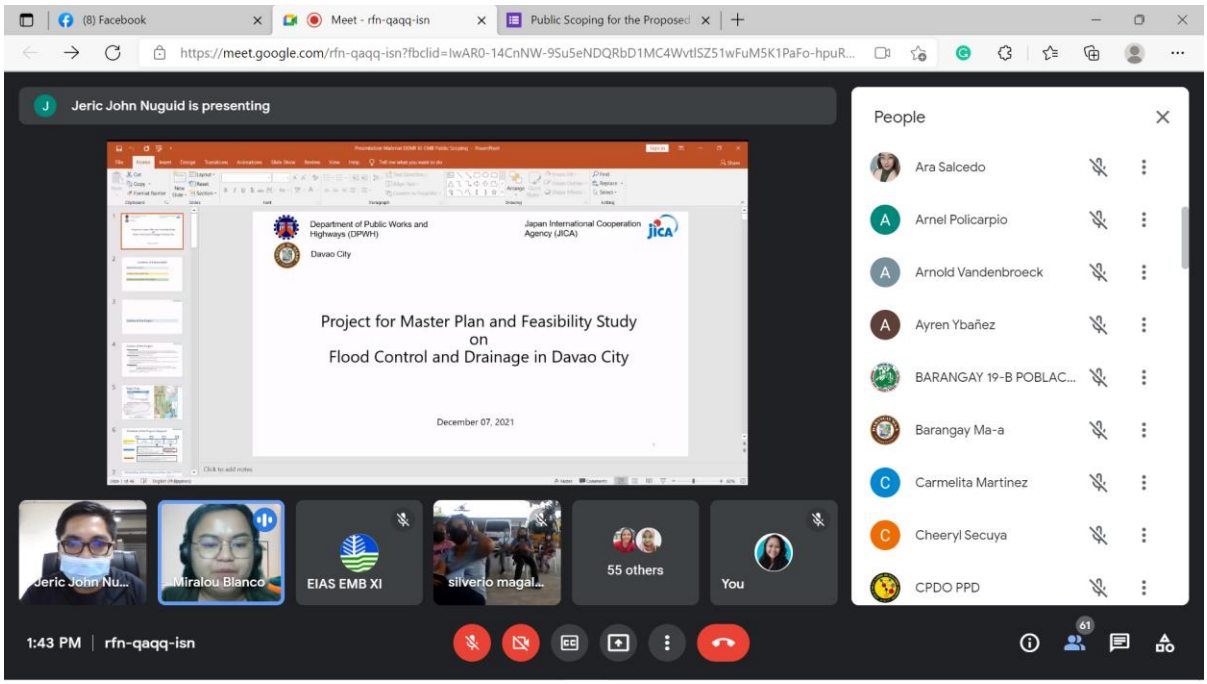
Meet - rfn-qaqq-isn
Public Scoping for the Proposed
https://meet.google.com/rfn-qaqq-isn?fbclid=IwAR0-14CnNW-9Su5eNDQRbD1MC4WvtlSZ51wFuM5K1PaFo-hpuR...
Miralou Blanco
EIAS EMB XI
silverio magallon
mary grace Elemino
NORZANNAH ORBE
Danilo Gonzales
Arnold Vandenbroe...
Philip Dizon
Edgar Ibuyan
CPDO PPD
Allan Linao
Carmelita Martinez
Nelo Dagatan
Pasig Marikina Rive...
Rosemen Dagook
Gerardo Antonio C...
Kenichi KURAMOTO
Jeric John Nuguid
EIAS EMB XI
BARANGAY 19-B P...
ROMULO NICDAO
Alfredo Baloran
37 others
You
People
Search for people
In call
melisa aratia (You)
Alain John Sotto
alexis pili
Alfredo Baloran
allan dela pena
Allan Linao
Ara Salcedo
1:43 PM | rfn-qaqq-isn


(8) Facebook
Meet - rfn-qaqq-isn
Public Scoping for the Proposed
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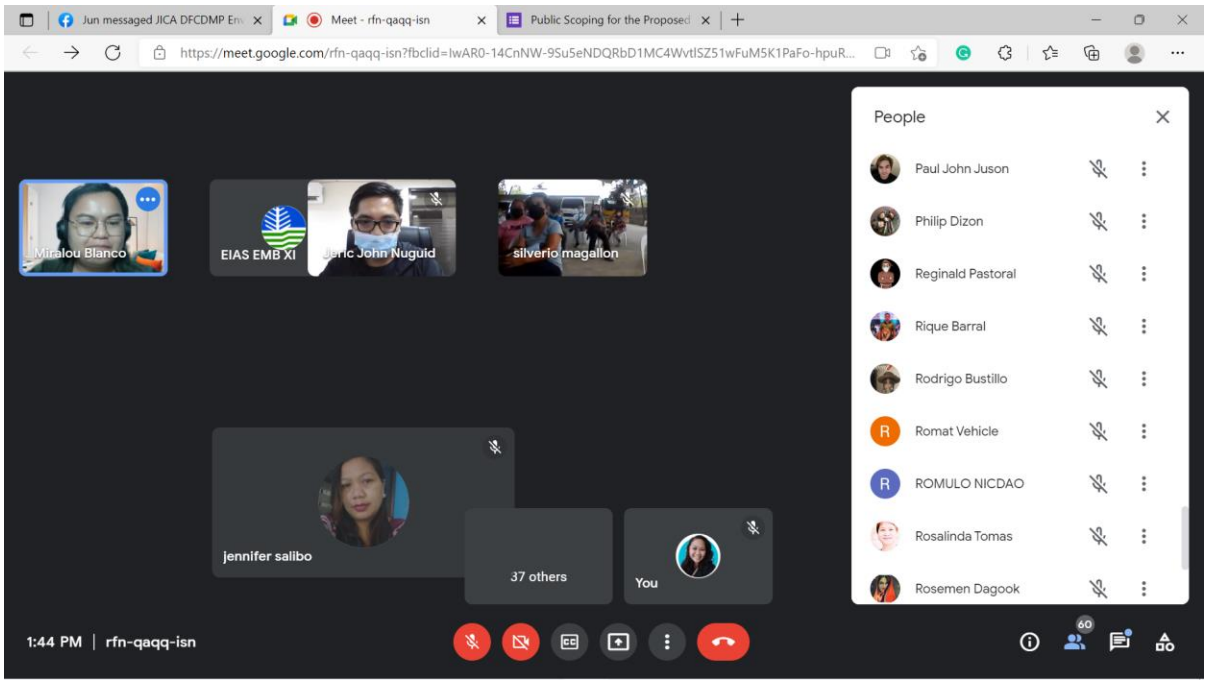
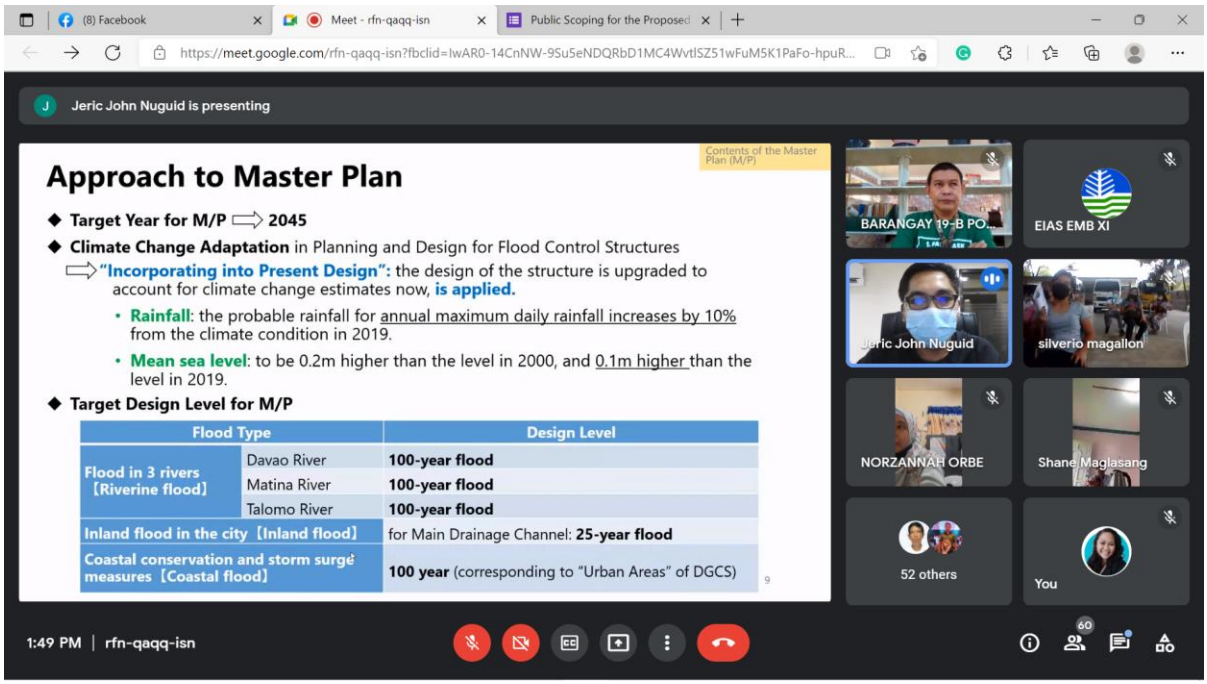
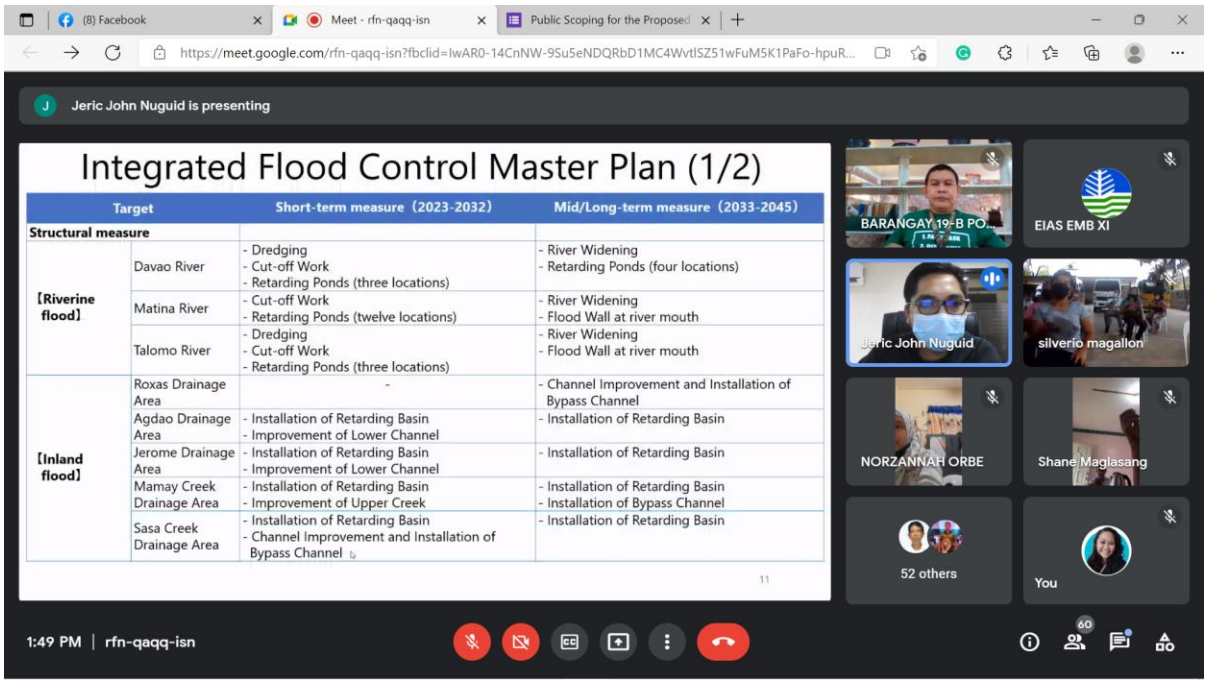
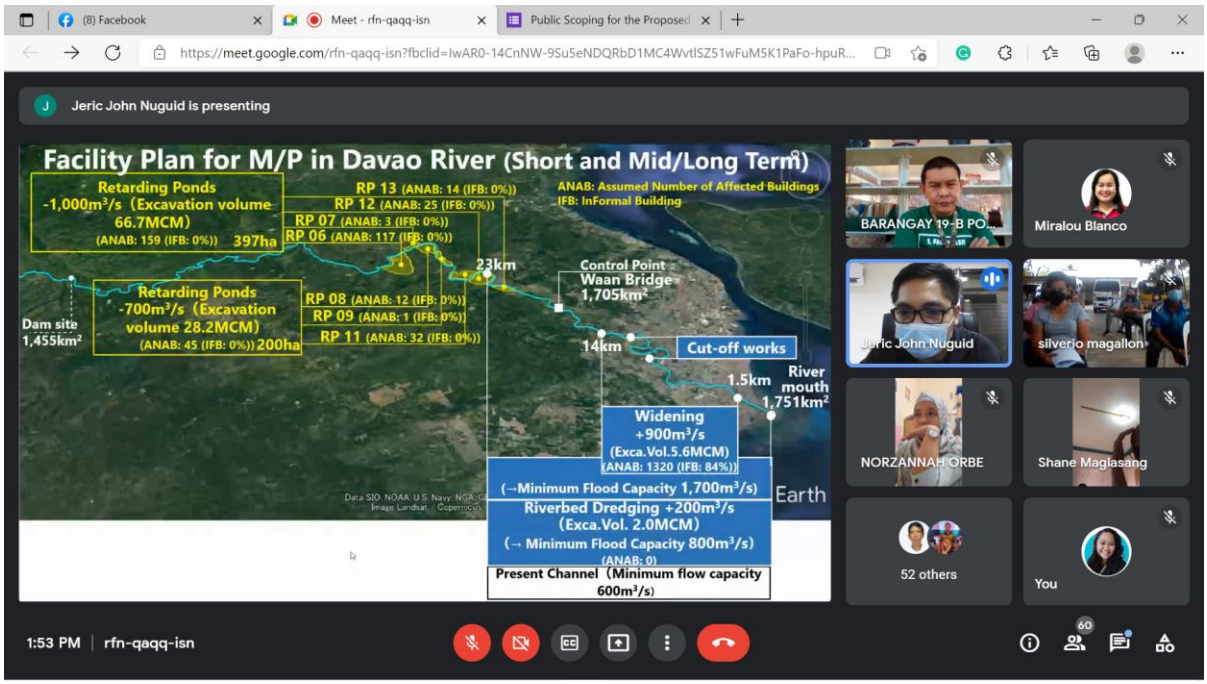
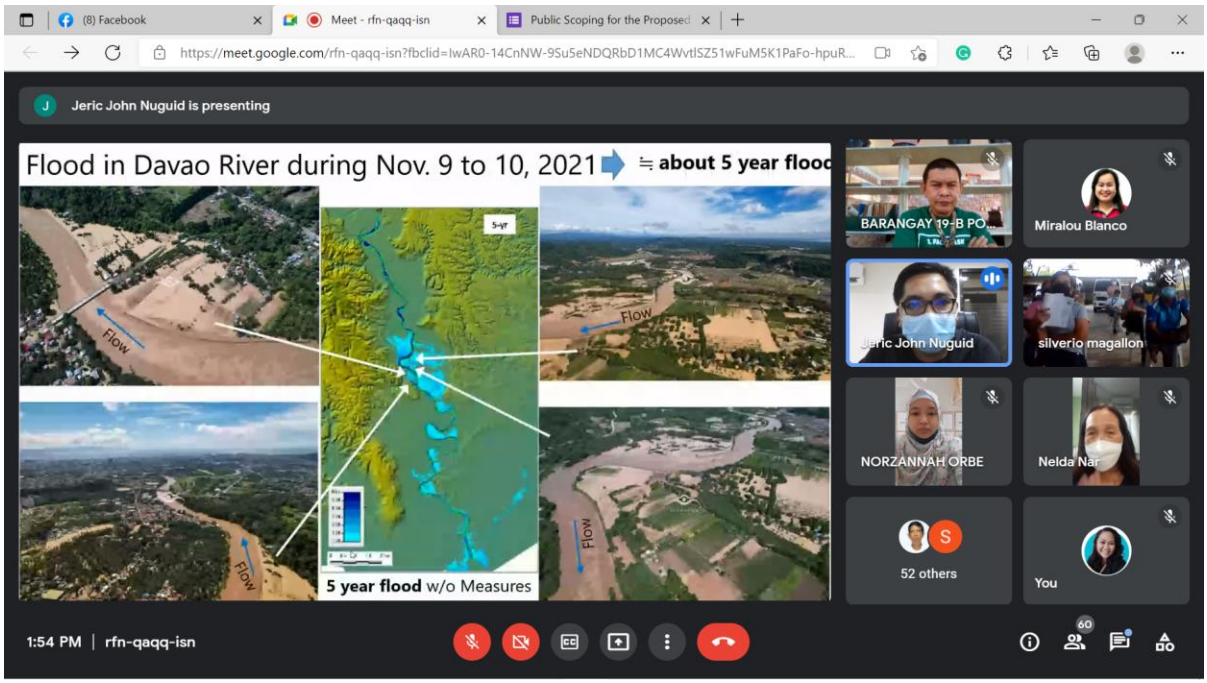
Jeric John Nuguid is presenting
Department of Public Works and Highways (DPWH)
Davao City
Japan International Cooperation Agency (JICA)
Project for Master Plan and Feasibility Study
on
Flood Control and Drainage in Davao City
December 07, 2021
Jeric John Nu...
Miralou Blanco
EIAS EMB XI
silverio magal...
55 others
You
People
Ara Salcedo
Arnel Policarpio
Arnold Vandenbroeck
Ayren Ybañez
BARANGAY 19-B POBLAC...
Barangay Ma-a
Carmelita Martinez
Cheeryl Secuya
CPDO PPD
1:43 PM | rfn-qaqq-isn

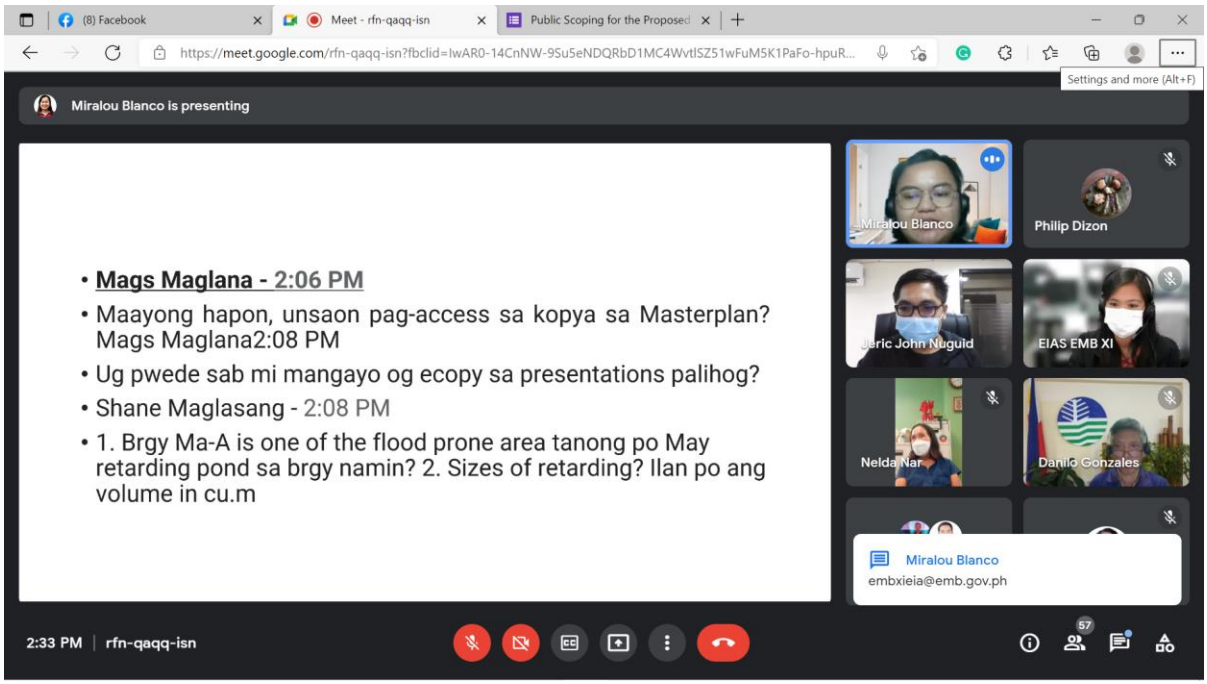

Meet - rfn-qaqq-isn
Public Scoping for the Proposed
https://meet.google.com/rfn-qaqq-isn?fbclid=IwAR0-14CnNW-9Su5eNDQRbD1MC4WvtlSZ51wFuM5K1PaFo-hpuR...
People
Paul John Juson
Philip Dizon
Reginald Pastoral
Rique Barral
Rodrigo Bustillo
Romat Vehicle
ROMULO NICDAO
Rosalinda Tomas
Rosemen Dagook
Miralou Blanco
EIAS EMB XI
Jeric John Nuguid
silverio magallon
jennifer salibo
37 others
You
1:44 PM | rfn-qaqq-isn

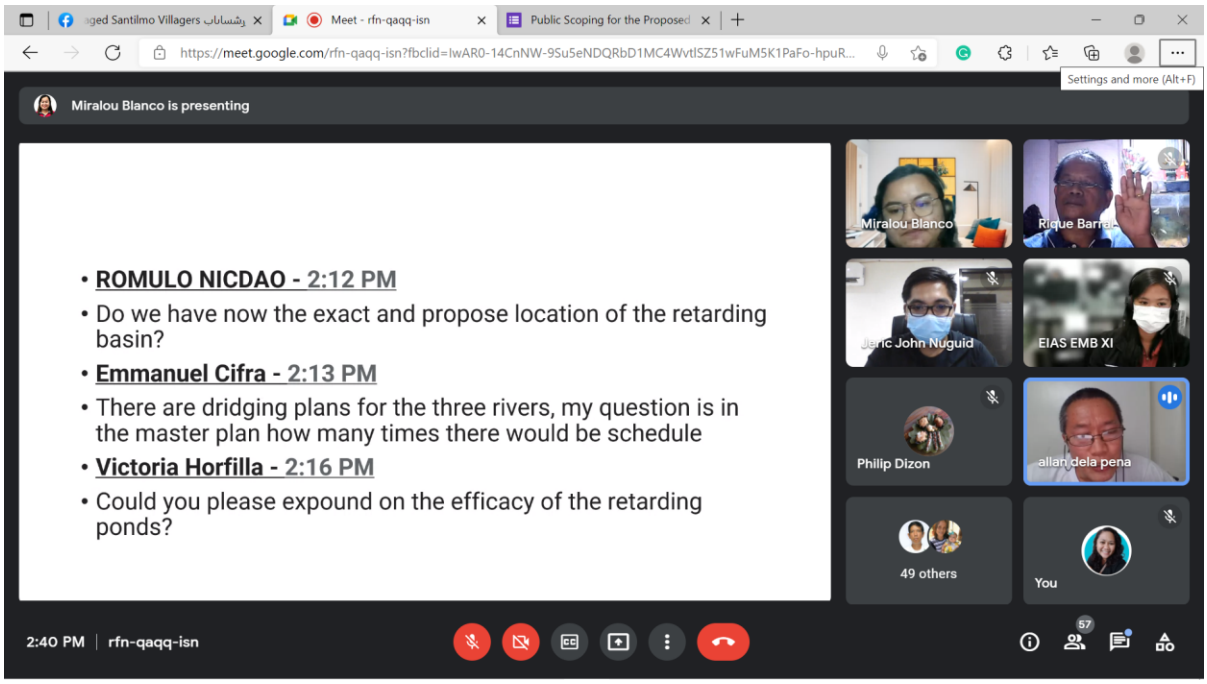

Meet - rfn-qaqq-isn
Public Scoping for the Proposed
https://meet.google.com/rfn-qaqq-isn?fbclid=IwAR0-14CnNW-9Su5eNDQRbD1MC4WvtlSZ51wFuM5K1PaFo-hpuR...
Jeric John Nuguid is presenting
Contents of the Master Plan (M/P)
Approach to Master Plan
◆ Target Year for M/P ⇨ 2045
◆ Climate Change Adaptation in Planning and Design for Flood Control Structures
⇨ "Incorporating into Present Design": the design of the structure is upgraded to account for climate change estimates now, is applied.
• Rainfall: the probable rainfall for annual maximum daily rainfall increases by 10% from the climate condition in 2019.
• Mean sea level: to be 0.2m higher than the level in 2000, and 0.1m higher than the level in 2019.
◆ Target Design Level for M/P
Flood Type
Design Level
Flood in 3 rivers 【Riverine flood】
Davao River
100-year flood
Matina River
100-year flood
Talomo River
100-year flood
Inland flood in the city 【Inland flood】
for Main Drainage Channel: 25-year flood
Coastal conservation and storm surge measures 【Coastal flood】
100 year (corresponding to "Urban Areas" of DGCS)
BARANGAY 19-B PO...
EIAS EMB XI
Jeric John Nuguid
silverio magallon
NORZANNAH ORBE
Shane Maglasang
52 others
You
1:49 PM | rfn-qaqq-isn

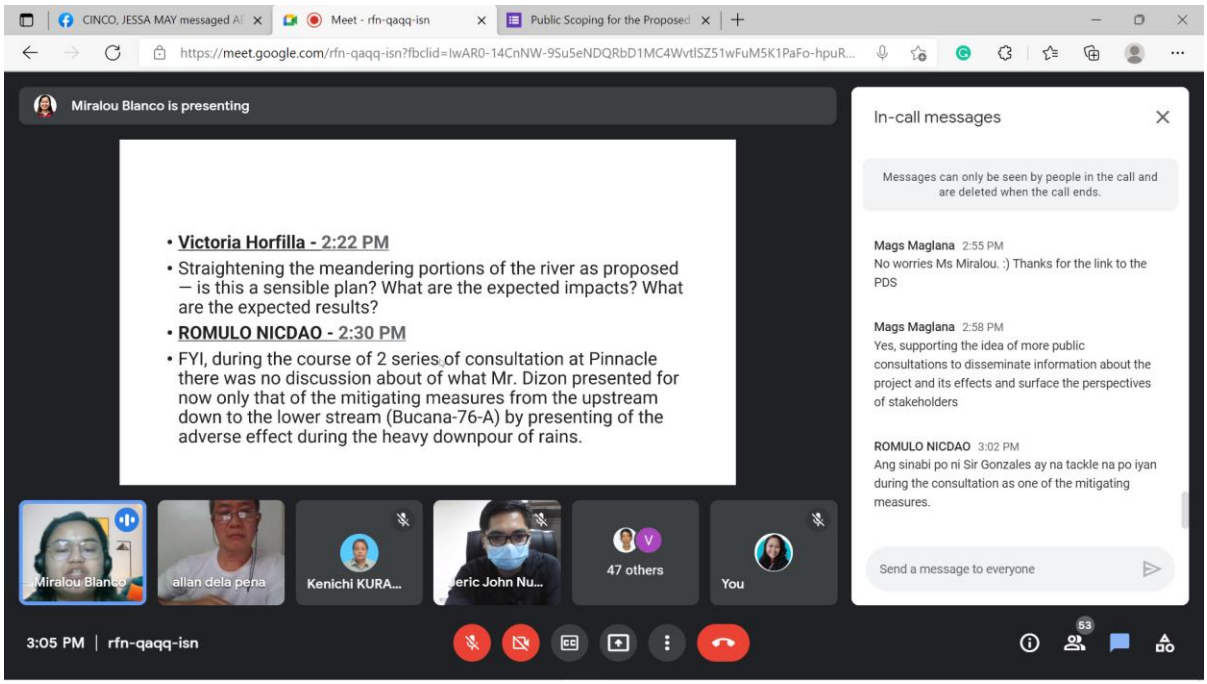

Jeric John Nuguid is presenting
Integrated Flood Control Master Plan (1/2)
Target
Short-term measure (2023-2032)
Mid/Long-term measure (2033-2045)
Structural measure
【Riverine flood】
Davao River
- Dredging
- Cut-off Work
- Retarding Ponds (three locations)
- River Widening
- Retarding Ponds (four locations)
Matina River
- Cut-off Work
- Retarding Ponds (twelve locations)
- River Widening
- Flood Wall at river mouth
Talomo River
- Dredging
- Cut-off Work
- Retarding Ponds (three locations)
- River Widening
- Flood Wall at river mouth
【Inland flood】
Roxas Drainage Area
-
- Channel Improvement and Installation of Bypass Channel
Agdao Drainage Area
- Installation of Retarding Basin
- Improvement of Lower Channel
- Installation of Retarding Basin
Jerome Drainage Area
- Installation of Retarding Basin
- Improvement of Lower Channel
- Installation of Retarding Basin
Mamay Creek Drainage Area
- Installation of Retarding Basin
- Improvement of Upper Creek
- Installation of Retarding Basin
- Installation of Bypass Channel
Sasa Creek Drainage Area
- Installation of Retarding Basin
- Channel Improvement and Installation of Bypass Channel
- Installation of Retarding Basin
11
BARANGAY 19-B PO...
EIAS EMB XI
Jeric John Nuguid
silverio magallon
NORZANNAH ORBE
Shane Maglasang
52 others
You
1:49 PM | rfn-qaqq-isn

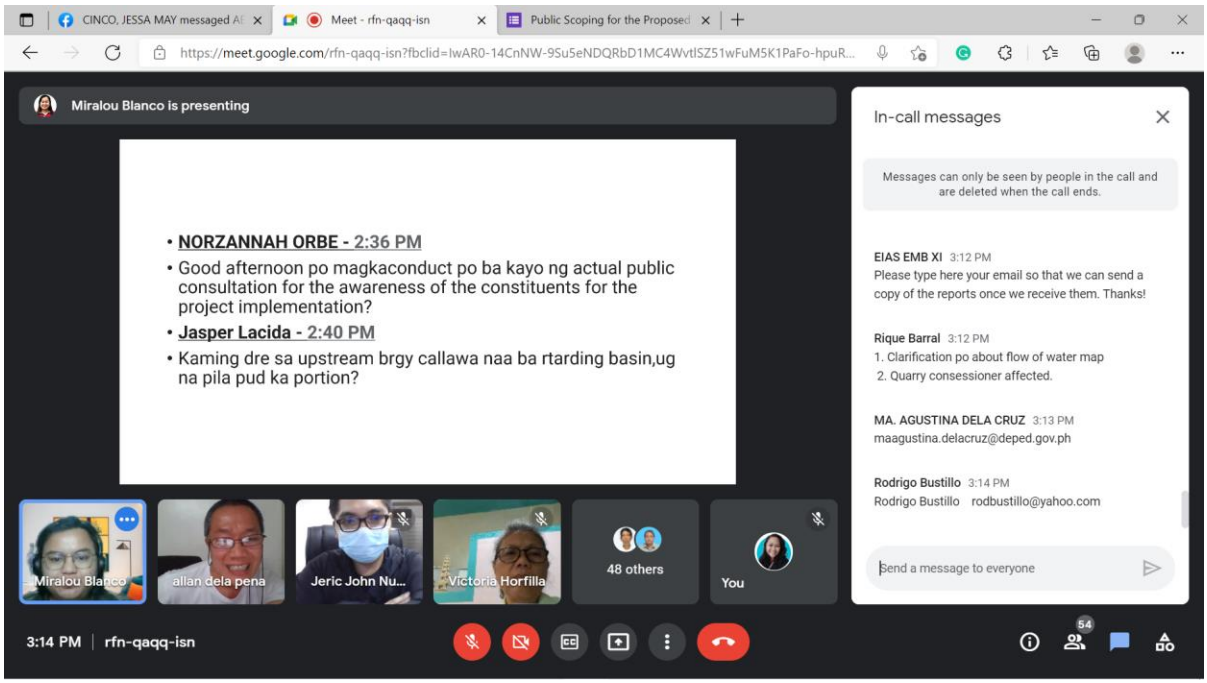

Jeric John Nuguid is presenting
Facility Plan for M/P in Davao River (Short and Mid/Long Term)
Retarding Ponds
-1,000m³/s (Excavation volume 66.7MCM)
(ANAB: 159 (IFB: 0%)) 397ha
RP 13 (ANAB: 14 (IFB: 0%))
RP 12 (ANAB: 25 (IFB: 0%))
RP 07 (ANAB: 3 (IFB: 0%))
RP 06 (ANAB: 117 (IFB: 0%))
ANAB: Assumed Number of Affected Buildings
IFB: InFormal Building
23km
Control Point
Waan Bridge
1,705km²
Retarding Ponds
-700m³/s (Excavation volume 28.2MCM)
(ANAB: 45 (IFB: 0%)) 200ha
RP 08 (ANAB: 12 (IFB: 0%))
RP 09 (ANAB: 1 (IFB: 0%))
RP 11 (ANAB: 32 (IFB: 0%))
Dam site
1,455km²
14km
Cut-off works
1.5km
River mouth
1,751km²
Widening
+900m³/s
(Exca.Vol.5.6MCM)
(ANAB: 1320 (IFB: 84%))
(→Minimum Flood Capacity 1,700m³/s)
Riverbed Dredging +200m³/s
(Exca.Vol. 2.0MCM)
(→ Minimum Flood Capacity 800m³/s)
(ANAB: 0)
Present Channel (Minimum flow capacity 600m³/s)
Earth
BARANGAY 19-B PO...
Miralou Blanco
Jeric John Nuguid
silverio magallon
NORZANNAH ORBE
Shane Maglasang
52 others
You
1:53 PM | rfn-qaqq-isn

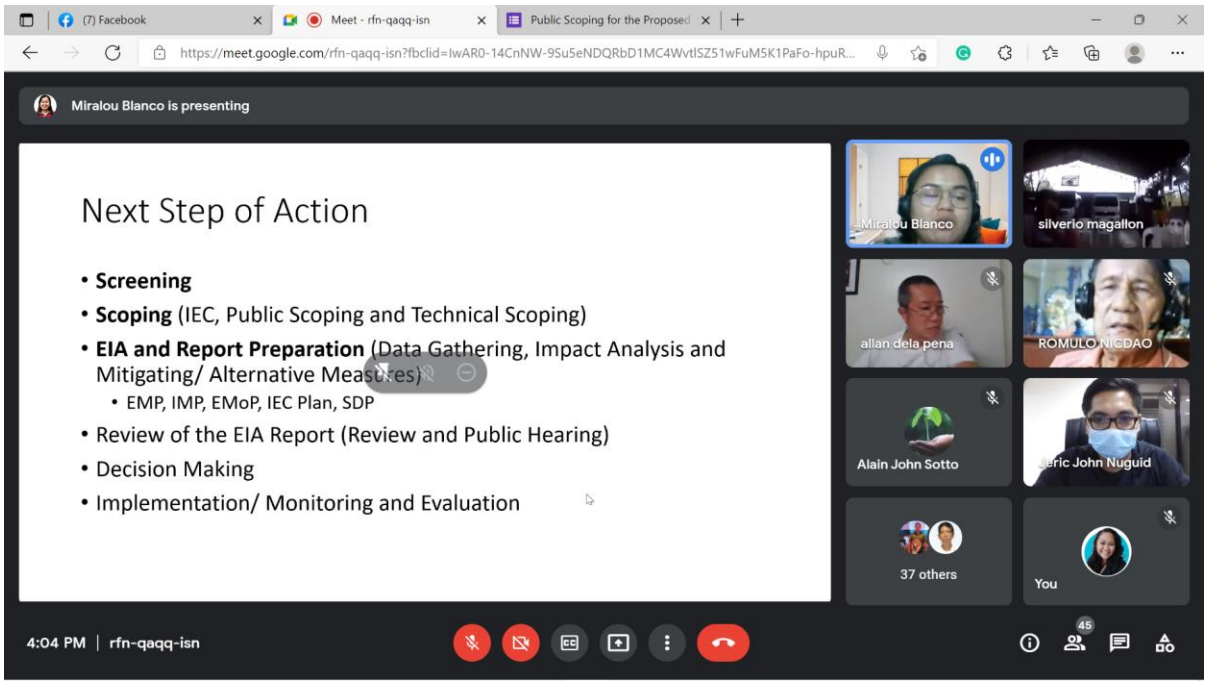

Jeric John Nuguid is presenting
Flood in Davao River during Nov. 9 to 10, 2021
about 5 year flooc
Flow
5 year flood w/o Measures
BARANGAY 19-B PO...
Miralou Blanco
Jeric John Nuguid
silverio magallon
NORZANNAH ORBE
Nelda Nar
52 others
You
1:54 PM | rfn-qaqq-isn

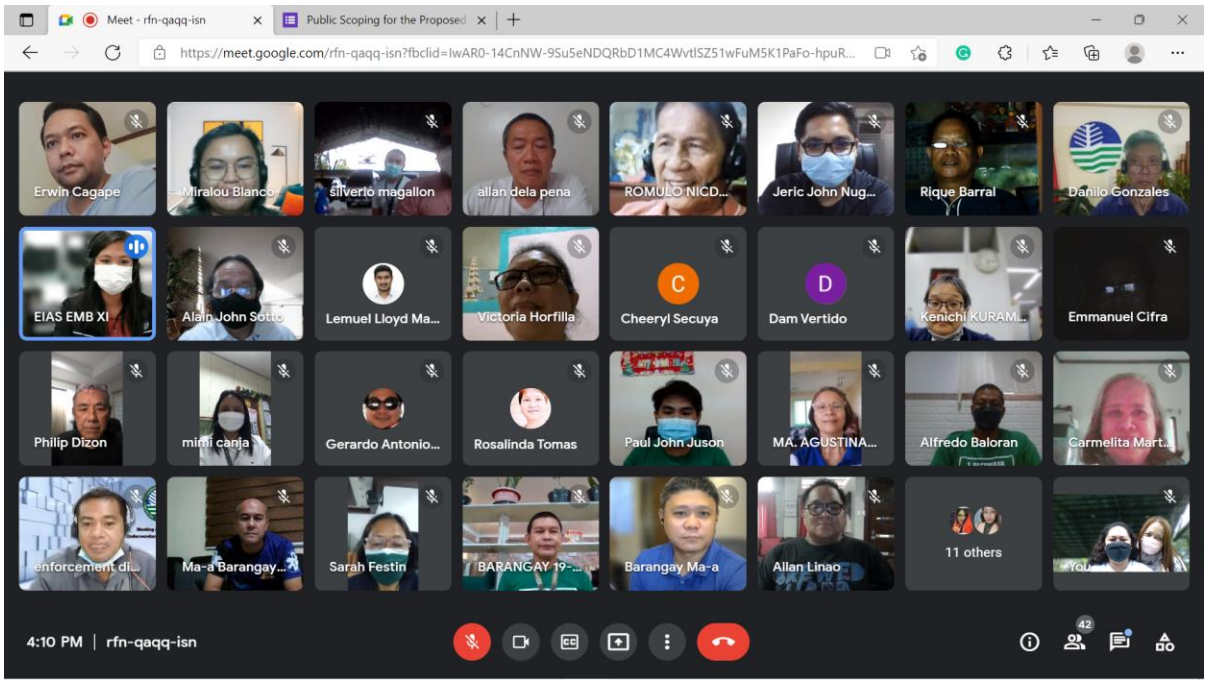

Miralou Blanco is presenting
Mags Maglana - 2:06 PM
Maayong hapon, unsaon pag-access sa kopya sa Masterplan? Mags Maglana2:08 PM
Ug pwede sab mi mangayo og ecopy sa presentations palihog?
Shane Maglasang - 2:08 PM
1. Brgy Ma-A is one of the flood prone area tanong po May retarding pond sa brgy namin? 2. Sizes of retarding? Ilan po ang volume in cu.m
Miralou Blanco
Philip Dizon
Jeric John Nuguid
EIAS EMB XI
Nelda Nar
Danilo Gonzales
Miralou Blanco
embxieia@emb.gov.ph
2:33 PM | rfn-qaqq-isn

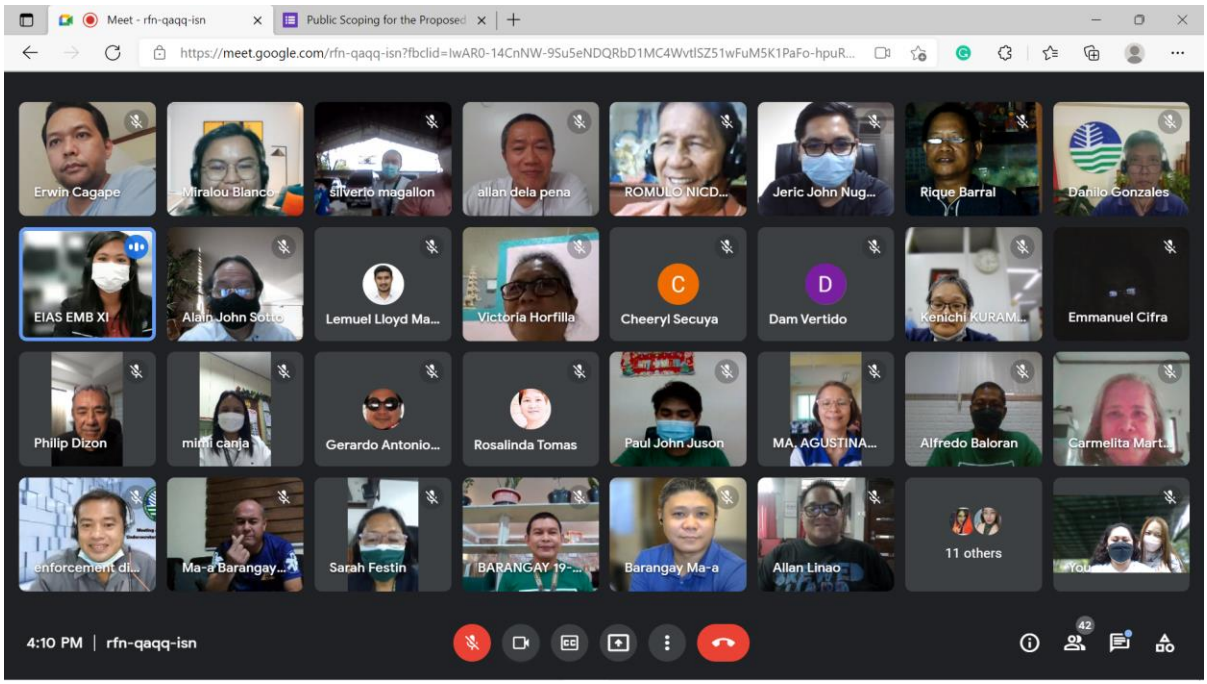

Meet - rfn-qaqq-isn
Public Scoping for the Proposed
https://meet.google.com/rfn-qaqq-isn?fbclid=IwAR0-14CnNW-9Su5eNDQRbD1MC4WvtlSZ51wFuM5K1PaFo-hpuR...
Settings and more (Alt+F)
Miralou Blanco is presenting
• ROMULO NICDAO - 2:12 PM
• Do we have now the exact and propose location of the retarding basin?
• Emmanuel Cifra - 2:13 PM
• There are dridging plans for the three rivers, my question is in the master plan how many times there would be schedule
• Victoria Horfilla - 2:16 PM
• Could you please expound on the efficacy of the retarding ponds?
Miralou Blanco
Rique Barra...
Jeric John Nuguid
EIAS EMB XI
Philip Dizon
allan dela pena
49 others
You
2:40 PM | rfn-qaqq-isn


Meet - rfn-qaqq-isn
Public Scoping for the Proposed
https://meet.google.com/rfn-qaqq-isn?fbclid=IwAR0-14CnNW-9Su5eNDQRbD1MC4WvtlSZ51wFuM5K1PaFo-hpuR...
Miralou Blanco is presenting
• Victoria Horfilla - 2:22 PM
• Straightening the meandering portions of the river as proposed — is this a sensible plan? What are the expected impacts? What are the expected results?
• ROMULO NICDAO - 2:30 PM
• FYI, during the course of 2 series of consultation at Pinnacle there was no discussion about of what Mr. Dizon presented for now only that of the mitigating measures from the upstream down to the lower stream (Bucana-76-A) by presenting of the adverse effect during the heavy downpour of rains.
Miralou Blanco
allan dela pena
Kenichi KURA...
47 others
You
In-call messages
Messages can only be seen by people in the call and are deleted when the call ends.
Mags Maglana 2:55 PM
No worries Ms Miralou. :) Thanks for the link to the PDS
Mags Maglana 2:58 PM
Yes, supporting the idea of more public consultations to disseminate information about the project and its effects and surface the perspectives of stakeholders
ROMULO NICDAO 3:02 PM
Ang sinabi po ni Sir Gonzales ay na tackle na po iyan during the consultation as one of the mitigating measures.
Send a message to everyone
3:05 PM | rfn-qaqq-isn


Miralou Blanco is presenting
• NORZANNAH ORBE - 2:36 PM
• Good afternoon po magkaconduct po ba kayo ng actual public consultation for the awareness of the constituents for the project implementation?
• Jasper Lacida - 2:40 PM
• Kaming dre sa upstream brgy callawa naa ba rtarding basin,ug na pila pud ka portion?
In-call messages
Messages can only be seen by people in the call and are deleted when the call ends.
EIAS EMB XI 3:12 PM
Please type here your email so that we can send a copy of the reports once we receive them. Thanks!
Rique Barral 3:12 PM
1. Clarification po about flow of water map
2. Quarry consessioner affected.
MA. AGUSTINA DELA CRUZ 3:13 PM
maagustina.delacruz@deped.gov.ph
Rodrigo Bustillo 3:14 PM
Rodrigo Bustillo rodbustillo@yahoo.com
Send a message to everyone
Miralou Blanco
allan dela pena
Jeric John Nu...
Victoria Horfilla
48 others
You
3:14 PM | rfn-qaqq-isn


Miralou Blanco is presenting
Next Step of Action
• Screening
• Scoping (IEC, Public Scoping and Technical Scoping)
• EIA and Report Preparation (Data Gathering, Impact Analysis and Mitigating/ Alternative Measures)
• EMP, IMP, EMoP, IEC Plan, SDP
• Review of the EIA Report (Review and Public Hearing)
• Decision Making
• Implementation/ Monitoring and Evaluation
Miralou Blanco
silverio magallon
allan dela pena
ROMULO NICDAO
Alain John Sotto
Jeric John Nuguid
37 others
You
4:04 PM | rfn-qaqq-isn


Meet - rfn-qaqq-isn
Public Scoping for the Proposed
https://meet.google.com/rfn-qaqq-isn?fbclid=IwAR0-14CnNW-9Su5eNDQRbD1MC4WvtlSZ51wFuM5K1PaFo-hpuR...
Erwin Cagape
Miralou Blanco
silverio magallon
allan dela pena
ROMULO NICD...
Jeric John Nug...
Rique Barral
Danilo Gonzales
EIAS EMB XI
Alain John Sotto
Lemuel Lloyd Ma...
Victoria Horfilla
Cheeryl Secuya
Dam Vertido
Kenichi KURAM...
Emmanuel Cifra
Philip Dizon
mimi canja
Gerardo Antonio...
Rosalinda Tomas
Paul John Juson
MA. AGUSTINA...
Alfredo Baloran
Carmelita Mart...
enforcement di...
Ma-a Barangay...
Sarah Festin
BARANGAY 19-...
Barangay Ma-a
Allan Linao
11 others
You
4:10 PM | rfn-qaqq-isn
42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Erwin Cagape
Miralou Blanco
silverio magallon
allan dela pena
ROMULO NICD...
Jeric John Nug...
Rique Barral
Danilo Gonzales
EIAS EMB XI
Alain John Sotto
Lemuel Lloyd Ma...
Victoria Horfilla
Cheeryl Secuya
Dam Vertido
Kenichi KURAM...
Emmanuel Cifra
Philip Dizon
mimi canja
Gerardo Antonio...
Rosalinda Tomas
Paul John Juson
MA. AGUSTINA...
Alfredo Baloran
Carmelita Mart...
enforcement di...
Ma-a Barangay...
Sarah Festin
BARANGAY 19-...
Barangay Ma-a
Allan Linao
11 others
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42

ANNEX E – BASELINE STUDY SUPPORT

Annex E.1 - Ambient Air Quality and Noise Level Monitoring

BSI
Environmental Management Service Provider

To: MS. CARMELITA MARTINEZ
Email: greencollarservices@yahoo.com
rayanjoyofmel@yahoo.com

Company: GREEN COLLAR CONSULTING SERVICES
Date: October 28, 2021

From: MR. JOHN MARK S. SISON
Page 1 of: 3

cc: -
BSI Project No: PJ 21 490

Special Instructions: ☐ Confidential ☐ Urgent ☒ Please reply ☒ For your information ☐ For follow-up

If you do not receive all pages or transmission is illegible, please contact the originator to re-send. Should the email be sent to a wrong address, please notify BSI immediately and destroy this copy. Thank you.

Subject: Initial Report on Ambient Air Quality And Noise Level Monitoring

Dear Ms. Martinez,

Please find below the initial results of the ambient air quality and noise level monitoring conducted on September 20-23, 2021 at your facilities in Davao City.

Measured Ambient Air Concentrations of PM_{10} & $PM_{2.5}$ for 24-Hr Monitoring

Sta. No.	Location	Date and Time of Sampling	PM_{10} (µg/Ncm)	$PM_{2.5}$ (µg/Ncm)
A1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	September 20-21, 2021 / 1330H-1330H	< 0.07	< 0.07
A2	Contractor Office, Sitio Luman Purok 6, Brgy. New Valencia Davao	September 21-22, 2021 / 1435H-1435H	< 0.07	< 0.07
A3	Cayot Residence, Bilusa, Bucana Bry. 76-A	September 22-23, 2021 / 1555H-1555H	4.75	< 0.07
DENR NAAQGV for Criteria Pollutants based on 24-hour averaging time			**150**	**35**

Note: For the non-detect values, the detection limit in µg was divided by the total normal volume of air sampled.

Measured Ambient Air Concentrations of SO_2, & NO_2 for 24-Hr Monitoring

Station	Location	Date / Time of Sampling	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)
A1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	September 20-21, 2021 / 1330H-1330H	3.35	0.18
A2	Contractor Office, Sitio Luman Purok 6, Brgy. New Valencia Davao	September 21-22, 2021 / 1435H-1435H	3.24	0.19
A3	Cayot Residence, Bilusa, Bucana Brgy. 76-A	September 22-23, 2021 / 1555H-1555H	4.72	0.16
DENR National Ambient Air Quality Guideline Values for Criteria Pollutants based on 24 hours averaging time			**180**	**150**

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Measured 8-hour Concentrations of CO for 24-Hour Monitoring

Station	Location	Date / Time of Sampling	8-Hour Monitoring Period	CO* (ppm)
A1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	September 20-21, 2021	1330H-2130H	< 1.0
			2130H-0530H	< 1.0
			0530H-1330H	< 1.0
A2	Contractor Office, Sitio Luman Purok 6, Brgy. New Valencia Davao	September 21-22, 2021	1435H-2235H	< 1.0
			2235H-0635H	< 1.0
			0635H-1435H	< 1.0
A3	Cayot Residence, Bilusa, Bucana Brgy. 76-A	September 22-23, 2021	1555H-2355H	< 1.0
			2355H-0755H	< 1.0
			0755H-1555H	< 1.0
DENR NAAQGV for Criteria Pollutants based on 8 hours averaging time				**9**

Minimum detection limit of CO gas analyzer : 1.0 ppm
**Average of 8 hourly concentrations.*

24 – Hour Ambient Noise Level Monitoring Results

Sta. No.	Location	Date and Time of Sampling	Period	Median Noise Level* (dBA)	NPCC Standard (dBA)
N1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	September 21, 2021 / 0740H-0750H	Morning	51	50
		September 21, 2021 / 1250H-1300H	Daytime	54	55
		September 20, 2021 / 1855H-1905H	Evening	51	50
		September 20, 2021 / 2210H-2220H	Nighttime	49	45
N-2	Contractor Office, Sitio Luman Purok 6, Brgy. New Valencia Davao	September 22, 2021 / 0710H-0720H	Morning	51	50
		September 21, 2021 / 1440H-1450H	Daytime	62	55
		September 21, 2021 / 1950H-2050H	Evening	53	50
		September 21, 2021 / 2125H-2225H	Nighttime	48	45
N3	Cayot Residence, Bilusa, Bucana Brgy. 76-A	September 23, 2021 / 0700H-0710H	Morning	56	50
		September 23, 2021 / 1045H-1055H	Daytime	62	55
		September 22, 2021 / 2005H-2015H	Evening	58	50
		September 22, 2021 / 2230H-2240H	Nighttime	51	45

Notes: The three stations are categorized under Class A areas (a section or contiguous area which is primarily used for residential purposes)
**Median of seven highest recorded noise levels*

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24-Hr Observed Sources of Noise

Sta. No.	Location	Period	Sources of Noise
N1	Near Ma-a River at Crocodile Park, Brgy. Ma-a Davao City	Morning	Animal calls (i.e. birds, insects and roosters)
		Daytime	On-going construction nearby, back hoe operation & chirping birds
		Evening	Animal calls (i.e. frogs and insects)
		Nighttime	Animal calls (i.e. frogs and insects)
N2	Contractor Office, Sitio Luman Purok 6, Brgy. New Valencia Davao	Morning	Community area and animal calls (i.e. birds and roosters)
		Daytime	On-going construction nearby, heavy equipment operation & passing vehicles
		Evening	Community area and animal calls (i.e. frogs and insects)
		Nighttime	Animal calls (i.e. frogs and insects)
N3	Cayot Residence, Bilusa, Bucana Brgy. 76-A	Morning	Fishing boat, playing music from community area and crowing rooster
		Daytime	Community area, playing music and children playing
		Evening	Fishing boat and playing music from community area
		Nighttime	Animal calls (i.e. frogs and insects)

The final report will be prepared as soon as we receive a scanned copy of this document with your signature. If we are unable to receive a response from you within three (3) working days upon receipt of this initial report, we will start preparing the final report.

If you have any queries, please do not hesitate to contact us.

Thank you and best regards.

JOHN MARK S. SISON
Jr. Environmental Specialist

Noted:

ALBERT S. TAGUBARAS
Technical Department Manager

Conforme:

GREEN COLLAR CONSULTING SERVICES

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San Juan, Metro Manila, Philippines
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BSI
Environmental Management Service Provider

25 November 2021 Ref. No.: FR-21-490-6-56

MS. CARMELITA MARTINEZ
Company Representative
GREEN COLLAR CONSULTING SERVICES
Rd 1, Doña Vicenta Village,
Bajada, Davao City

Subject: ***Vibration Peak Velocity Measurement Report***

Dear Ms. Martinez:

This report presents the results of vibration peak velocity measurements conducted on October 23 to 24, 2021 at one (1) designated station in Sitio Luman, Brgy. New Valencia, Davao City. The vibration acceleration measurements were conducted by the team led by Mr. Jonathan G. Ompoy of BSI.

A. OBJECTIVE OF THE MONITORING

The purpose of the monitoring was to determine the vibration peak velocity levels at one (1) station designated by Green Collar Consulting Services in Sitio Luman, Brgy. New Valencia, Davao City. The Department of Environment and Conservation (NSW)'s Criteria for Exposure to Vibration was included for reference only and not for any regulatory compliance purposes.

B. SAMPLING PROCEDURE

Vibration acceleration was measured by the use of a direct-reading vibration meter. The vibration meter is equipped with a vibration sensor and a magnetic base and gives a display of vibration peak velocity. It is expressed in terms of the frequency-weighted velocity in units of *millimetres per second* (mm/s). Twenty-four (24) hours monitoring was conducted over hourly peak vibration velocity reading recorded per minute. The average of the peak vibration velocity readings were computed.

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C. SUMMARY OF RESULTS

One (1) designated station in Sitio Luman, Brgy. New Valencia, Davao City was monitored for vibration peak velocity. The results, station, and the corresponding Global Positioning System (GPS) coordinates of the stations are shown below in *Table 1,* while the sampling observations and activities were summarized in *Tables 2 and 3*. A location map of the stations and the calibration certificate of the vibration meter are also attached with this report.

Table 1. Vibration Peak Velocity Monitoring Results

Station	Location/ GPS	Date / Time		Vibration Peak Velocity * (mm/s)	
				Continuous	*Impulsive*
Criteria for exposure to vibration [c]			***Daytime***	***0.56[a] 2.2[b]***	***17.0[a] 36.0[b]***
			Nighttime	***0.40[a] 2.2[b]***	***5.6[a] 36.0[b]***
V24-1	Sitio Luman, Brgy. New Valencia, Davao City 7°10'56.68"N | 125°33'34.13"E	October 23- 24, 2021 / 0830H-0830H	Daytime (0830H-2130H; 0730H-0830H)	7.5	
			Nighttime (2230H-0630H)	0.4	

Notes: [a]Residences; [b]Workshops
[c]Table C1.1, Department of Environment and Conservation
**Average of hourly peak vibration velocity readings*
Daytime is 0700H to 2200H and nighttime is 2200H to 0700H

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Table 2. Sampling Observations and Photo Documentation

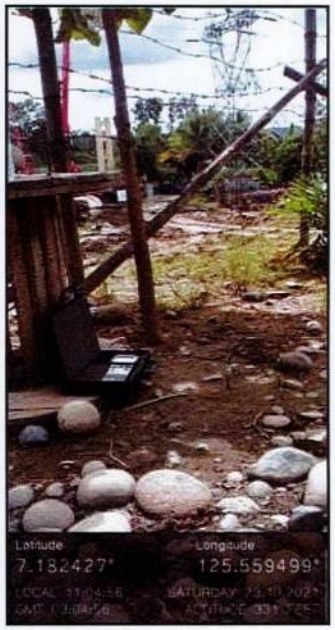
Station	Sampling Observation	Photo Documentation
V24-1 Sitio Luman, Brgy. New Valencia, Davao City	The station was situated in unpaved rocky ground. It is about 10-20 meters away from the construction site. Vegetation were present near the sampling station. Activities observed in the area were ongoing construction activities, heavy equipment operations, operating generator set and passing vehicles (i.e. light and heavy vehicles and motorcycle). Such activities attributed to the high average hourly vibration peak velocity especially during daytime period.	 

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Table 3. Observed Activities

Station	Location	Time	Observation
V24-1	Sitio Luman, Brgy. New Valencia, Davao City	0830H START	--
		0930H	Passing vehicles (i.e. heavy vehicles), heavy equipment operations & operating generator set
		1030H	Passing vehicles (i.e. motorcycles), operating generator set & ongoing construction
		1130H	Passing vehicles (i.e. light & heavy vehicles)
		1230H	Passing vehicles (i.e. heavy vehicles)
		1330H	Passing vehicles (i.e. heavy vehicles) & heavy equipment operations
		1430H	Heavy equipment operations
		1530H	Passing vehicles (i.e. heavy vehicles) & heavy equipment operations
		1630H	Passing vehicles (i.e. heavy vehicles), minimal operation
		1730H	Passing vehicles (i.e. motorcycles)
		1830H	Passing vehicles (i.e. motorcycles)
		1930H	Passing vehicles (i.e. motorcycles)
		2030H	--
		2130H	Passing vehicle (i.e. one (1) motorcycle)
		2230H	--
		2330H	--
		0030H	--
		0130H	--
		0230H	--
		0330H	--
		0430H	--
		0530H	Passing vehicle (i.e. one (1) motorcycle)
		0630H	Passing vehicle (i.e. one (1) motorcycle)
		0730H	Passing vehicles (i.e. two (2) motorcycle)
		0830H END	Passing vehicle (i.e. truck)

If you have any inquiries, please do not hesitate to contact us.

Thank you and regards.

Very truly yours,

per **EMMANUEL R. ALTAREJOS**
Executive Vice President

ERA/mss

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Department of Environment and Natural Resources (DENR)
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Switchtek
Measurement Systems

A Division of Switchtek Construction Corporation
4th Floor Northridge Plaza, Annex A, 12 Congressional Ave.,
Bahay Toro,Quezon City, 1106, Philippines
Tel Nos: 3453-7694 ; 8928-2869 ; 8928-7769 Fax No.: 8426-7593
email Address: admin@switchtek.com.ph
www.switchtek.com.ph

Certificate No.:	500.01-5309-1.21	Calibration of	Vibration Meter		
Identification:	BERKMAN SYSTEMS INCORPORATED				
Job:	P1	Test and Verification			
Fin.acc:	32	Certificate of Calibration			
Done......:	April 26, 2021	Initials...:	CAC		
Categories		Men	Hours	Total cost	Type
Cal Officer		2	8.0	-	Certificate

CERTIFICATE OF CALIBRATION - VIBRATION METER

This report of calibration shall document that the instrument herein was examined and tested in compliance with ISO/IEC 17025 against NIST traceable reference standards and its co-equal standards.

Issued to: BERKMAN SYSTEMS INCORPORATED
Address: Suite 208 VAG Bldg., Ortigas Avenue, Greenhills, San Juan, Metro Manila, Philippines

UNIT UNDER TEST (UUT):

Instrument:	Vibration Meter
Brand:	LUTRON
Model No:	VB-8213
Serial No:	R.026276
Acceleration range:	0.5 to 199.9 mm/s
Velocity range:	0.5 to 199.9 m/s2
ID code:	E-1A-4-1
Calibration Date:	April 24. 2021
Calibration Due:	April 23, 2022

CALIBRATOR INFORMATION:

Instrument:	Vibration analyzer
Brand:	Lutron
Model No:	VB-8201HA
Serial No.:	Q612498
Calibration Due:	May 2021
Calibrated Against:	UKAS, ISO 2954:1975

Environmental Condition:

Condition:	DRY/BASIC/NEUTRAL	Ambient Temp. (Deg C):	23.3 ±2
Relative Humidity:	56.3 ±5%, 1010 hPa		

Calibration Method:

By comparison technique, the unit under test was tested and calibrated in reference with a calibrated vibration meter at fixed point placed in vibration source. Procedures of test conform to the requirements of NIST & UKAS. Data were gathered and tabulated.

During calibration, the unit was found to have a standard error of ± 0.00 mm/sec with a confidence of not less than 95%. Uncertainty of measurement is ± 0.57 mm/sec. Calculations were taken using Standard Deviation Formula.

Results:

APPLIED SIGNAL (mm/sec.)	UNIT UNDER TEST RESPONSE (mm/sec.)	ERROR IN READING (mm/sec.)	STANDARD DEVIATION	REMARKS
0.00	0.0	0.0000	0.0000	The user should determine the suitability of the instrument for its intended use.
5.70	5.7	0.0000	0.0000	
10.90	10.9	0.0000	0.0000	
21.80	21.8	0.0000	0.0000	
49.90	49.9	0.0000	0.0000	

Remarks:

All data pertain only to the unit described obtained at the time of test. This certificate is not valid w/out seal and signature. Unauthorized reproduction is prohibited.

Calibrated By: C.A. CASADO
Date: April 24, 2021

Certified By: A.R. CAINDOC
Date: April 26, 2021

UNIVERSITY OF THE IMMACULATE CONCEPTION
SCIENCE RESOURCE CENTER

UIC-SRC Form No. 7
Revision No. 01
10.01.2018

TEST REPORT

NAME OF CUSTOMER: GREEN COLLAR SERVICES (c/o MEL MARTINEZ)
ADDRESS: DOÑA VICENTA VILL., BAJADA, DAVAO CITY
SAMPLE: WATER (04)
DATE SAMPLED : 10/13/2021

CONTROL NO: 21-2053C
DATE REPORTED: 11/09/2021
DATE ANALYSIS STARTED: 10/13/2021
DATE SAMPLE RECEIVED: 10/13/2021

RESULTS OF ANALYSIS:

Lab. No.		W21-4380	W21-4381	W21-4382	W21-4383
Description	Fresh Water	SS4- Bucana	SS3- Ma-a	SS2- Waan	SS4- Mandug
pH @ 25.0°C		7.2	7.6	7.6	7.8
Temperature, °C		27.3	26.9	28.4	27.5
Turbidity, NTU		70	237	146	206
Dissolved Oxygen, mg/L		7.4	8.1	8.5	8.1
Biochemical Oxygen Demand (5-day, 20°C), mg/L		2	1	<1	<1
Total Suspended Solids (dried at 105°C), mg/L		70	221	84	211
Oil and Grease, mg/L		<1	<1	<1	2
Nitrite, mg/L		<0.007	<0.007	<0.007	0.015
Phosphate, mg/L		0.64	0.92	0.74	0.86
Chloride, mg/L		535	7.49	6.61	6.28
Arsenic, mg/L		0.006	0.005	0.005	0.007
Cadmium, mg/L		<0.003	<0.003	<0.003	<0.003
Chromium (hexavalent), mg/L		<0.010	<0.010	0.018	0.019
Lead, mg/L		<0.01	<0.01	<0.01	<0.01
Mercury, mg/L		<0.002	<0.002	<0.002	<0.002

Nothing follows

REMARKS: 1. Results relate only to samples as submitted and tested.
2. Methods used are in accordance with the Standard Methods for the Examination of Water & Wastewater, 23rd ed.
NTU Nephelometric Turbidity Unit
3. Estimation of Measurement Uncertainty (MU) may be available upon request.
4. This test report may not be reproduced unless in full.

ANALYZED BY:

KARL JAN D. ALOCADA
PRC License No. 3288
Junior Analyst I

SHEENA MARIE B. CRUZ
PRC License No. 13309
Junior Analyst I

RUSSELL CAESAR P. ENOC
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Junior Analyst I

EVELYN D. AUSAN
PRC License No. 1232
Senior Analyst I

CERTIFIED BY:

LUDIVINA M. PORTICOS, *MBA, MS*
PRC License No. 6237
Director

msoffice\water\srr2021-2053

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10.01.2018

TEST REPORT

NAME OF CUSTOMER:	GREEN COLLAR SERVICES (c/o MEL MARTINEZ)	**CONTROL NO:**	21-2053M
ADDRESS:	DOÑA VICENTA VILL., BAJADA, DAVAO CITY	**DATE REPORTED:**	10/16/2021
SAMPLE:	WATER (04)	**DATE ANALYSIS STARTED:**	10/13/2021
DATE SAMPLED :	10/13/2021	**DATE SAMPLE RECEIVED:**	10/13/2021

RESULTS OF ANALYSIS:

Lab. No.	Description	Fecal Coliform, MPN/100mL
	Fresh Water	
W21-4380	SS4- Bucana	23
W21-4381	SS3- Ma-a	<1.8
W21-4382	SS2- Waan	<1.8
W21-4383	SS4- Mandug	49
		Nothing follows

REMARKS: 1. Results relate only to samples as submitted and tested.
2. Method used is in accordance with the Standard Methods for the Examination of Water & Wastewater, 23rd ed.
MPN Most Probable Number
3. Estimation of Measurement Uncertainty (MU) may be available upon request.
4. This test report may not be reproduced unless in full.

ANALYZED BY:

NELYN MAE T. CADOTDOT
PRC License No. 59878
Junior Analyst I

CERTIFIED BY:

LUDIVINA M. PORTICOS, *MBA, MS*
PRC License No. 6237
Director

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Annex E.3 - Sediment Quality Test Results

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TEST REPORT

NAME OF CUSTOMER: GREEN COLLAR SERVICES (c/o MEL MARTINEZ)
ADDRESS: OBRERO, DAVAO CITY
SAMPLE: SOIL (04)

CONTROL NO: 21-1960C
DATE REPORTED: 10/20/2021
DATE SAMPLE RECEIVED: 09/29/2021

RESULTS OF ANALYSIS (DRY BASIS):

Lab. No.	S21-115	S21-116	S21-117	S21-118
Description	S 1	S 2	S 3	S 4
Arsenic (leachable), µg/g	0.122	0.143	0.238	0.285
Cadmium, µg/g	0.79	0.78	0.81	0.87
Chromium, µg/g	78.69	90.32	83.10	98.81
Lead, µg/g	9.94	8.47	9.68	10.56
Mercury, µg/g	0.02	0.02	<0.02	0.02
Sulfur, µg/g	41.51	29.23	74.80	376

Nothing follows

REMARKS: 1. Results relate only to samples as submitted and tested.
2. Methods used are in accordance with the Manual on Standard Analytical Procedures of the Mines & GeoSciences Bureau Laboratories.
Method used for leachable arsenic: Prepared by leaching 10 g soil with 250 mL milliQ water overnight; followed by colorimetric determination in accordance with the Standard Methods for the Examination of Water & Wastewater, 23rd ed.
Dried at 60°C for 3.5 days.
3. Estimation of Measurement Uncertainty (MU) may be available upon request.
4. This test report may not be reproduced unless in full.

ANALYZED BY:

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GIRLIE MAE P. ZABALA
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Junior Analyst I

EVELYN D. AUSAN
PRC License No. 1232
Senior Analyst I

CERTIFIED BY:

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Annex E.4 - WQMA Water Quality Data of Davao River

Source of data on Davao River 2012-2019 Results: Davao River Water Quality Management Area c/o EMB-XI

All 17 Davao River stations are classified as Class B.

Table 1. BOD levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012	2.9	2.5	2.1	2.1	5
2013	4.5	2.1	2.2	2.0	
2014	5.5	1.2	1.2	1.0	
2015	1.1	0.9	1.0	1.1	
2016	1.6	1.2	1.1	1.0	
2017	3.7	1.9	2.9	2.9	
2018	2.2	0.7	0.8	0.7	
2019	1.7	1.2	1.0	1.0	
AVERAGE	**2.9**	**1.5**	**1.5**	**1.5**	
Nov. 2021	2	1	<1	<1	

*Per DAO 2016-008

Table 2. Chloride levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012					250
2013					
2014					
2015					
2016	1,272	8.0	7.0	6.5	
2017	824	6.0	7.0	6.8	
2018	581	10.0	9.0	8.9	
2019	1,510	8.0	8.0	7.5	
AVERAGE	**1,047**	**8.0**	**7.8**	**7.4**	
Nov. 2021	535	7.49	6.61	6.28	

*Per DAO 2016-008 No available data

Values in red exceed the specified water quality guideline. Note that Bucana station is at the mouth of Davao River (where river water mixes with seawater).

Table 3. Dissolved oxygen levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012	6.6	7.2	7.3	7.3	NLT 5
2013	5.9	7.2	7.3	7.3	
2014	6.0	7.6	7.8	7.8	
2015	6.1	7.1	8.0	8.2	
2016	5.6	7.1	7.8	8.0	
2017	6.8	7.3	7.5	7.5	
2018	6.3	7.5	7.6	7.6	
2019	6.5	7.4	7.8	8.0	
AVERAGE	**6.2**	**7.3**	**7.6**	**7.7**	
Nov. 2021	7.4	8.1	8.5	8.1	

*Per DAO 2016-008

Table 4 . Fecal coliform levels (MPN/100 mL) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012	84,672	35,697	10,231	11,561	200
2013	314,684	14,484	11,125	14,577	
2014	253,508	8,316	4,721	3,593	
2015	1,292,447	68,910	28,360	25,343	
2016	1,110,572	31,281	42,148	21,665	
2017	192,640	51,831	27,401	42,709	
2018	24,303	3,385	719	740	
2019	141,997	16,439	6,017	4,895	
AVERAGE	426,853	28,793	16,340	15,635	
Nov. 2021	23	<1.8	<1.8	49	

Most Probable MPN Number

*Per DAO 2021-19

Values in red exceed the specified water quality guideline.

Table 5 . pH levels in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012	8.0	8.1	8.2	8.2	6.5-8.5
2013	7.9	8.2	8.2	8.2	
2014	7.7	8.1	8.2	8.2	
2015	8.1	8.3	8.4	8.4	
2016	8.0	8.4	8.5	8.5	
2017	8.2	8.2	8.3	8.4	
2018	8.2	8.4	8.5	8.5	
2019	8.1	8.3	8.3	8.4	
AVERAGE	**8.0**	**8.3**	**8.3**	**8.4**	
Nov. 2021	7.2	7.6	7.6	7.8	

*Per DAO 2016-008

Table 6 . Phosphate levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012	0.57		0.29	0.30	1.5
2014	1.01		0.80	0.90	
2015	0.31	0.40	0.28	0.30	
2016	0.42	0.85	0.79	0.70	
2017	1.84	5.29	4.40	4.90	
2018	0.36	0.26	0.36	0.30	
2019	1.08	1.59	2.11	1.91	
AVERAGE	**0.80**	**1.68**	**1.29**	**1.33**	
Nov. 2021	0.64	0.92	0.74	0.86	

*Per DAO 2021-19 No available data

Table 7 . Temperature levels (°C) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012	27.8	26.8	26.5	27.0	**26-30**
2013	28.2	27.2	26.8	27.0	
2014	27.5	26.8	27.1	27.0	
2015	29.1	29.1	29.9	30.0	
2016	29.0	29.0	29.0	29.0	
2017	28.0	27.0	28.0	27.0	
2018	29.0	29.0	29.0	29.0	
2019	28.4	27.9	28.6	28.0	
AVERAGE	**28.4**	**27.9**	**28.1**	**28.0**	
Nov. 2021	27.3	26.9	28.4	27.5	

*Per DAO 2016-008

Table 8 . Total suspended solids levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit *
	Bucana	Ma-a	Waan	Mandug	
2012	841	1,183	1,146	1,068	65
2013	552	602	685	528	
2014	237	313	405	317	
2015	264	457	453	443	
2016	93	123	196	149	
2017	362	950	686	824	
2018	75	120	156	117	
2019	664	515	509	435	
AVERAGE	386	533	530	485	
Nov. 2021	70	221	84	211	

*Per DAO 2016-008

Values in red exceed the specified water quality guideline.

Table 9 . Cadmium levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit *
	Bucan a	Ma-a	Waan	Mandu g	
2012					
2013	0.002			0.001	
2014	0.003	0.006	0.007	0.006	
2015	0.008				
2016	0.006	0.004	0.003	0.004	
2018	0.006	0.003	0.003	0.003	**0.003**
2019	0.009	0.003	<0.003	0.003	
AVERAGE	**0.006**	**0.004**	**0.004**	**0.003**	
Nov. 2021	<0.003	<0.003	<0.003	<0.003	

No available data

*Per DAO 2016-008

Values in red exceed the specified water quality guideline.

Table 10 . Lead levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	Ma-a	Waan	Mandug	
2012					
2013	0.01			0.01	
2014					
2015					
2016	<0.01	<0.01	<0.01	0.01	
2017	<0.01	<0.01	<0.01	<0.01	**0.01**
2018	<0.01	<0.01	<0.01	<0.01	
2019	<0.01	<0.01	<0.01	<0.01	
AVERAGE	**<0.01**	**<0.01**	**<0.01**	**<0.01**	
Nov. 2021	<0.01	<0.01	<0.01	<0.01	

*Per DAO 2016-008

No available data

Table 10 . Mercury levels (mg/L) in previous years at four sampling stations of Davao River

Year	Sampling station				Limit*
	Bucana	**Ma-a**	**Waan**	**Mandug**	
2012 2013 2014 2015 2016 2017	<0.001	0.002	0.002	0.003	**0.002**
2018	<0.002	<0.002	<0.002	0.002	
2019	<0.002	<0.002	<0.002	<0.002	
AVERAGE	**0.0011**	**0.0016**	**0.0016**	**0.0021**	
Nov. 2021	<0.002	<0.002	<0.002	<0.002	

*Per DAO 2016-008 No available data

NOTE: There are no available data for arsenic, chromium and oil & grease for 2012-2019

ANNEX F – PROJECT ENVIRONMENTAL MONITORING AND AUDIT PRIORITIZATION SHCEME (PEMAPS)

ANNEX 2-7d

PROJECT ENVIRONMENTAL MONITORING AND AUDIT PRIORITIZATION SCHEME (PEMAPS) QUESTIONNAIRE

Project Name:	Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Project Location:	Barangays Bucana, 1, 2, 3, 5, 19, Ma-a, TWa-an, igatto, Mandug, New Carmen, New Valencia, Callawa
ECC Reference No.:	
Proponent:	DPWH UPMO-FCMC
Pollution Control Officer:	
Tel. No./Fax No./E-mail:	+632 534 3813/ +632 534 3752
Project Type:	Environmental Enhancement
Project Status:	New

I. PROJECT CONSIDERATIONS

1.1 Size and Type

1.1.1 Size based on number of employees

Specify number of employees: could not be ascertain

1.1.2 Type:

- ECP (in either ECA or Non-ECA) ☐
- Non-ECP but in ECA ☑
- Non-ECP and Non-ECA ☐

1.2 Waste Generation and Management

1.2.1 Enumerate Waste Type and Specify Quantity of Wastes generated in your facility. (Identify /Enumerate)

Category	Waste	Type		Quantity
		Hazardous	Non-Hazardous	

Specify number: 0

3.6.2 Others (other Govt. Agencies, Private Institutions)

Specify number: 0

(To be filled up by EMB Personnel)

RECOMMENDATION/S:

Assessed By:

Noted By:

Specify number: 0

3.4.4 Distance to nearest ECA (select one and mark)

- 0 to less than 0.5km ☑
- 0.5 to 1 km ☐
- Greater than 1 km ☐

IV. ENVIRONMENTAL PERFORMANCE (FOR EXISTING PROJECTS FOR EXPANSION)

3.5 Compliance (pls. take note that this will be double-checked with PCD files)

Law	Violation (check if any)	Type (pls. specify number of times committed) STANDARD				Type of Admin Violation	Additional Remarks/Status of Compliance
		Emission/Effluent/ Discharge	Ambient	Human Impact	Admin/ ECC		
RA 8749	☐						
RA 9275	☐						
RA 6969	☐						
PD 1586	☐						
RA 9003	☐						

3.6 Number of Valid Complaints

3.6.1 Citizen and NGOs

Industrial	☐
Agricultural	☑

3.4 Land

3.4.1 Indicate current/actual land uses within 0.5 km radius: (may select more than one of the criteria below)

Residential	☑
Commercial/Institutional	☑
Industrial	☐
Agricultural/Recreational	☑
Protected Area	☐

3.4.2 Potential/proposed land uses within 0.5 km (may select more than one of the criteria below)

Residential	☑
Commercial/Institutional	☑
Industrial	☐
Agricultural/Recreational	☐
Protected Area	☐

3.4.3 Number of affected Environmentally Critical Areas within 1 km:

SD	☐
3.2.4.2 Economic value of water use	(may select more than one of the criteria below)
Fishery	☑
Tourist zone or park	☐
Recreational	☑
Industrial	☐

3.3 Ground Water

3.3.1 Distance to nearest recharge area	(select one and mark)
0 to less than 0.5 km	☐
0.5 to 1 km	☐
Greater than 1 km	☑
3.3.2 Distance to nearest well used	(select one and mark)
0 to less than 0.5 km	☐
0.5 to 1 km	☐
Greater than 1 km	☑
3.3.3 Groundwater use within the nearest well	(may select more than one of the criteria below)
Drinking	☐

AA	☐
A	☑
B	☑
C	☐
D	☐

3.2.3.2 Size of fresh water body:

Specify size:	no data

3.2.3.3 Economic value of water use (may select more than one of the criteria below)

Drinking	☐
Domestic	☐
Recreational	☐
Fishery	☐
Industrial	☐
Agricultural	☑

3.2.4 Salt water

3.2.4.1 Classification of salt water (select one and mark)

SA	☐
SB	☐
SC	☑

Depth of groundwater table (meter)	(select one and mark)
0 to less than 3	☐
3 to 10	☑
Greater than 10	☐

III. RECEIVING MEDIA/RECEPTORS

3.1 Air (Distance to nearest community) (select one and mark)

0 to less than 0.5 km	☐
0.5 to 1 km	☑
Greater than 1 km	☐

3.2 Receiving Surface Water Body

3.2.1 Distance to receiving surface water: (select one and mark)

0 to less than 0.5 km	☑
0.5 to 1 km	☐
Greater than 1 km	☐

3.2.2 Size of population using receiving surface water

Specify number: no data

3.2.3 Fresh Water

3.2.3.1 Classification of fresh water: (select one and mark)

	PCS N	
Liquid	Primary 2 - chamber septic tanks (temporary)	for domestic waste
	Secondary settling pond (temporary)	
	Tertiary	
Solid	disposal in accordance with dredging plan	

II. PATHWAYS

2.1 Prevailing wind towards barrio or city? (mark the corresponding point) Yes ☐ No ☑

2.2 Rainfall (impacts surface & groundwater pathways)

2.2.1 Average annual net rainfall:

Specify amount: 990 mm

2.2.2 Maximum 24-hour rainfall:

Specify amount: 75 mm

2.3 Terrain (select one and mark) Flat ☑ Steep ☐

2.4 Is the facility located in a flood-prone area? (select one and mark) Yes ☑ No ☐

2.5 Ground Water: none

Air	Waste 1 NOx, SOX, PM10, PM 2.5	hazardous		(units: MT/yr) can not be quantified
	Waste 2			
	Waste N			
Liquid	Domestic wastewater		non-hazardous	(units: m^3/yr) can not be quantified
	run off containing oil spills	hazardous		can not be quantified
Solid	Dredged materials		non-hazardous	(units: tons/yr) 2.0 MCM
	Excavated materials (cut-off works		non hazardous	1.7 MCM
	Excavated soil RPs		non hazardous	15.5 MCM

1.3 Pollution Control System (PCS)

1.3.1 Enumerate PCS or Waste Management Method Used in your facility. (Identify /Enumerate)

Category	PCS/Waste Management Method Used	Remarks
Air	PCS 1 Muffler	for vehicle and other heavy equipment
	PCS 2	

ANNEX G – ZONING CERTIFICATE AND PROOF OF OWNERSHIP

Annex G.1 - Zoning Certificate

REPUBLIC OF THE PHILIPPINES
CITY OF DAVAO
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that per City Ordinance No. 0546-13, Series of 2013, the area being applied for a proposed Retarding Pond Number 8 located at Brgy. New Valencia, Tugbok District, this City, as per attached GIS Map plotting, the zone classification of the area falls within Floodway Mitigation Sub-zone (FPZ) with Very High Susceptibility to Flood.

Further, a proposed Retarding Pond may be allowed within the said zone classification.

This certification is being issued upon the request of ***RAMON A. ARRIOLA III-*** *Project Director, UPMO-FCMC/DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS* for Environmental Compliance Certificate (ECC) application purposes.

Issued this 13th day of July 2022, City of Davao, Philippines.

ROY RYAN II A. RIGOR
Assistant City Planning & Dev't Coordinator
Acting Zoning Administrator

Zoning/cris/Cert 2022/July

Rm. 2, Davao City Hall, City Hall Drive, Davao City, 8000 | (082) 241-1000 loc. 239 | cpdo@davaocity.gov.ph

City Government of Davao
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR
Map Showing the Properties at Retarding Pond 8
Barangay: NEW VALENCIA
District: TUGBOK
ZONING MAP
For CPDO use only.
NOTE: Proposed Alignment of MINDANAO RAILWAY, BY-PASS HIGHWAY and COASTAL ROAD are subject to change.
Note: Approximate Location plotted based on TECHNICAL DESCRIPTION as described in TCT's submitted
P-9018 (Lot 2)
T-307161 (Lot 4)
T-307158 (Lot 1)
FPZ
Very High Susceptibility to Flood
FOR CPDO USE ONLY
To avoid any conflict in the interpretation of this map and/or protect the same from any technical alteration, this map is considered unofficial. hence all information contained herein shall all be subject to verification from the OCPDC.
LOCATION MAP
THE SITE
ZONE CLASSIFICATION (2013-2022):
Major Urban:
Low Density Residential (R1)
Medium Density Residential (R2)
High Density Residential (R3)
Socialized Housing (SHZ)
Minor Commercial (C1)
Major Commercial (C2)
Light Industrial (I1)
Medium Industrial(I2)
Heavy Industrial (I3)
General:
Agricultural (AG)
- Prime Agricultural Land (APR)
- Agri-non Tillage Land (ANT)
- Marginal Agricultural Land (AMR)
Conservation (CZ)
Forest (FZ)
Agro-Industrial (Agi)
Rural Settlement Area (RSA)
Environment Management:
Floodway Mitgation (FPZ)
Landslide Mitgation (LPZ)
Urban Ecological Enhancement (UEE)
Inland Water Zone (WU):
- Major River
- Creek
- Shoreline
- Fish Pond
Institution (Ins)
Special Institution (Sins)
Infrastructure/Utilities (IU)
Planned Unit Development (PUD)
Tourism Development (TDZ)
Open Space(OSE)
EasementBuffer (BU)
Parks and Recreation (PR)
Special Use (SU)
Waste Management, Treatment, Utilization and Disposal (WMTUD)
Water Resource Zone (WRZ)
Coastal Water:
Aquaculture Area (WAqu)
Eco-Tourism & Research (WEco)
Fish Sanctuary (WFSH)
Fishing Area (WFSA)
Mangrove Rehabilitation Area (WMRA)
Marine Protected Area (WMPA)
Multiple Use Zone (WMUZ)
Recreation Area (WRec)
Proposed Road
Proposed Davao River DS buffer
Active Fault (PHIVOLCS)
Proposed Mindanao Railway Alignment
Mindanao Railway (Buffer)
Proposed By-Pass
Proposed Coastal Road

REPUBLIC OF THE PHILIPPINES
CITY OF DAVAO
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that per City Ordinance No. 0546-13, Series of 2013, the area being applied for a proposed Retarding Pond Number 9 located at Brgy. Mandug, Buhangin District, this City, as per attached GIS Map plotting, the zone classification of the area falls within Floodway Mitigation Sub-zone (FPZ) with Very High Susceptibility to Flood.

Further, a proposed Retarding Pond may be allowed within the said zone classification.

This certification is being issued upon the request of ***RAMON A. ARRIOLA III-*** *Project Director, UPMO-FCMC/DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS* for Environmental Compliance Certificate (ECC) application purposes.

Issued this 13th day of July 2022, City of Davao, Philippines.

ROY RYAN II A. RIGOR
Assistant City Planning & Dev't Coordinator
Acting Zoning Administrator

Zoning/cris/Cert 2022/July

Rm. 2, Davao City Hall, City Hall Drive, Davao City, 8000 | (082) 241-1000 loc. 239 | cpdo@davaocity.gov.ph

NOTE: Proposed Alignment of MINDANAO RAILWAY, BY-PASS HIGHWAY and COASTAL ROAD are subject to change.
Note: Approximate Location plotted based on TECHNICAL DESCRIPTION as described in TCT's submitted
CL-4117 (Lot 10)
P-17431 (Lot 6)
FPZ
ANT
APR
Very High Susceptibility to Flood
High Susceptibility to Landslide
Fatima ES
FOR CPDO USE ONLY
ZONING MAP
For CPDO use only
To avoid any conflict in the interpretation of this map and/or protect the same from any technical alteration, this map is considered unofficial hence all information contained herein shall all be subject to verification from the OCPDC
THE SITE
LOCATION MAP
ZONE CLASSIFICATION (2013-2022):
Major Urban:
Low Density Residential (R1)
Medium Density Residential (R2)
High Density Residential (R3)
Socialized Housing (SHZ)
Minor Commercial (C1)
Major Commercial (C2)
Light Industrial (I1)
Medium Industrial(I2)
Heavy Industrial (I3)
General:
Agricultural (AG)
- Prime Agricultural Land (APR)
- Agri-on Tillage Land (ANT)
- Marginal Agricultural Land (AMR)
Conservation (CZ)
Forest (FZ)
Agro-Industrial (Agi)
Rural Settlement Area (RSA)
Environment Management:
Floodway Mitigation (FPZ)
Landslide Mitigation (LPZ)
Urban Ecological Enhancement (UEE)
Inland Water Zone (WU):
- Major River
- Creeks
- Shoreline
- Fish Pond
Institution (Ins)
Special Institution (Sins)
Infrastructure/Utilities (IU)
Planned Unit Development (PUD)
Tourism Development (TDZ)
Open Space(OSE)
EasementBuffer (BU)
Parks and Recreation (PR)
Special Use (SU)
Waste Management, Treatment, Utilization and Disposal (WMTUD)
Water Resource Zone (WRZ)
Coastal Water:
Aquaculture Area (WAqu)
Eco-Tourism & Research (WEco)
Fish Sanctuary (WFSH)
Fishing Area (WFSA)
Mangrove Rehabilitation Area (WMRA)
Marine Protected Area (WMPA)
Multiple Use Zone (WMUZ)
Recreation Area (WRec)
Proposed Road
Proposed Davao River DS buffer
Active Fault (PHVOLCS)
Proposed Mindanao Railway Alignment
Mindanao Railway (Buffer)
Proposed By-Pass
Proposed Coastal Road
City Government of Davao
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR
Map Showing the Properties at Retarding Pond 9
Barangay: MANDUG
District: BUHA NGIN

REPUBLIC OF THE PHILIPPINES
CITY OF DAVAO
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that per City Ordinance No. 0546-13, Series of 2013, the area being applied for a proposed Retarding Pond Number 11 located at Brgy. Mandug, Buhangin District, this City, as per attached GIS Map plotting, the zone classification of the area falls within Floodway Mitigation Sub-zone (FPZ) and Prime Agricultural Land Sub-zone (APR) with Very High Susceptibility to Flood.

Further, a proposed Retarding Pond may be allowed within the said zone classification.

This certification is being issued upon the request of ***RAMON A. ARRIOLA III-*** *Project Director, UPMO-FCMC/DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS* for Environmental Compliance Certificate (ECC) application purposes.

Issued this 13th day of July 2022, City of Davao, Philippines.

ROY RYAN II A. RIGOR
Assistant City Planning & Dev't Coordinator
Acting Zoning Administrator

Zoning/cris/Cert 2022/July

Rm. 2, Davao City Hall, City Hall Drive, Davao City, 8000 | (082) 241-1000 loc. 239 | cpdo@davaocity.gov.ph

NOTE: Proposed Alignment of MINDANAO RAILWAY, BY-PASS HIGHWAY and COASTAL ROAD are subject to change.
Note: Approximate Location plotted based on TECHNICAL DESCRIPTION as described in TCT's submitted
ANT
High Susceptibility to Landslide
APR
FPZ
T-314203 (Lot 3-C)
T-315822 (Lot 2-A)
T-315821 (Lot 2-B)
T-314206 (Lot 2-C)
T-315817 (Lot 1-A)
T-315814 (Lot 1-B)
T-314357 (Lot 1-C)
T-315813 (Lot 3-A)
T-314361 (Lot 4-A)
T-315820 (Lot 4-B)
T-315815 (Lot 4-C)
T-314358 (Lot 5-A)
T-315819 (Lot 5-B)
T-315818 (Lot 5-C)
T-315812 (Lot 6-C)
T-314364 (Lot 6-A)
T-315816 (Lot 6-B)
T-312812 (Lot 1021)
Very High Susceptibility to Flood
FOR CPDO USE ONLY
To avoid any conflict in the interpretation of this map and/or protect the same from any technical alteration, this map is considered unofficial hence all information contained herein shall all be subject to verification from the OCPDC
ZONING MAP
For CPDO use only
LOCATION MAP
THE SITE
ZONE CLASSIFICATION (2013-2022):
Major Urban:
Low Density Residential (R1)
Medium Density Residential (R2)
High Density Residential (R3)
Socialized Housing (SHZ)
Minor Commercial (C1)
Major Commercial (C2)
Light Industrial (I1)
Medium Industrial(I2)
Heavy Industrial (I3)
General:
Agricultural (AG)
- Prime Agricultural Land (APR)
- Agri-non Tillage Land (ANT)
- Marginal Agricultural Land (AMR)
Conservation (CZ)
Forest (FZ)
Agro-Industrial (Agi)
Rural Settlement Area (RSA)
Environment Management:
Floodway Mitigation (FPZ)
Landslide Mitigation (LPZ)
Urban Ecological Enhancement (UEE)
Inland Water Zone (WU):
- Major River
- Creeks
- Shoreline
- Fish Pond
Institution (Ins)
Special Institution (Sins)
Infrastructure/Utilities (IU)
Planned Unit Development (PUD)
Tourism Development (TDZ)
Open Space(OSE)
Easement/Buffer (BU)
Parks and Recreation (PR)
Special Use (SU)
Waste Management, Treatment, Utilization and Disposal (WMTUD)
Water Resource Zone (WRZ)
Coastal Water:
Aquaculture Area (WAqu)
Eco-Tourism & Research (WEco)
Fish Sanctuary (WFSH)
Fishing Area (WFSA)
Mangrove Rehabilitation Area (WMRA)
Marine Protected Area (WMPA)
Multiple Use Zone (WMUZ)
Recreation Area (WRec)
Proposed Road
Proposed Davao River DS buffer
Active Fault (PHIVOLCS)
Proposed Mindanao Railway Alignment
Mindanao Railway (Buffer)
Proposed By-Pass
Proposed Coastal Road
City Government of Davao
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR
Map Showing the Properties at Retarding Pond 11
Barangay: MANDUG
District: BUHANGIN

REPUBLIC OF THE PHILIPPINES
CITY OF DAVAO
OFFICE OF THE CITY PLANNING AND DEVELOPMENT COORDINATOR

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that per City Ordinance No. 0546-13, Series of 2013, the area being applied for a proposed Cut-off Works located at Brgy. Ma-a, Talomo District, this City, as per attached GIS Map plotting, the zone classification of the area falls within Medium Density Residential Sub-zone (R-2), High Density Residential Sub-zone (R-3), Planned Unit Development Zone (PUD) Open Space Easement Zone (OSE) and Floodway Mitigation Sub-zone (FPZ) with Very High Susceptibility to Flood.

Further, a proposed Cut-off Works may be allowed within the said zone classification.

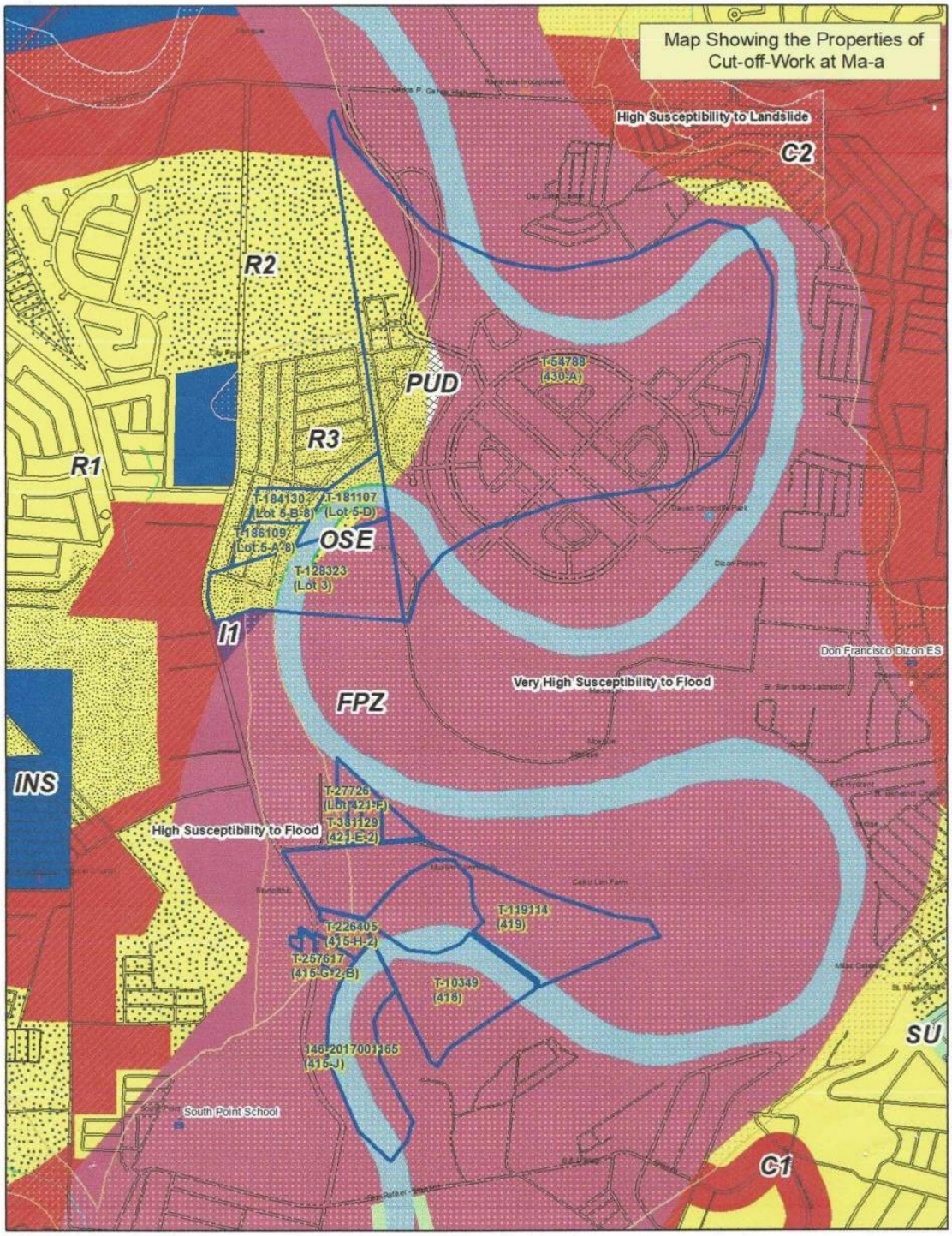
This certification is being issued upon the request of ***RAMON A. ARRIOLA III-*** *Project Director, UPMO-FCMC/DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS* for Environmental Compliance Certificate (ECC) application purposes.

Issued this 13th day of July 2022, City of Davao, Philippines.

ROY RYAN II A. RIGOR
Assistant City Planning & Dev't Coordinator
Acting Zoning Administrator

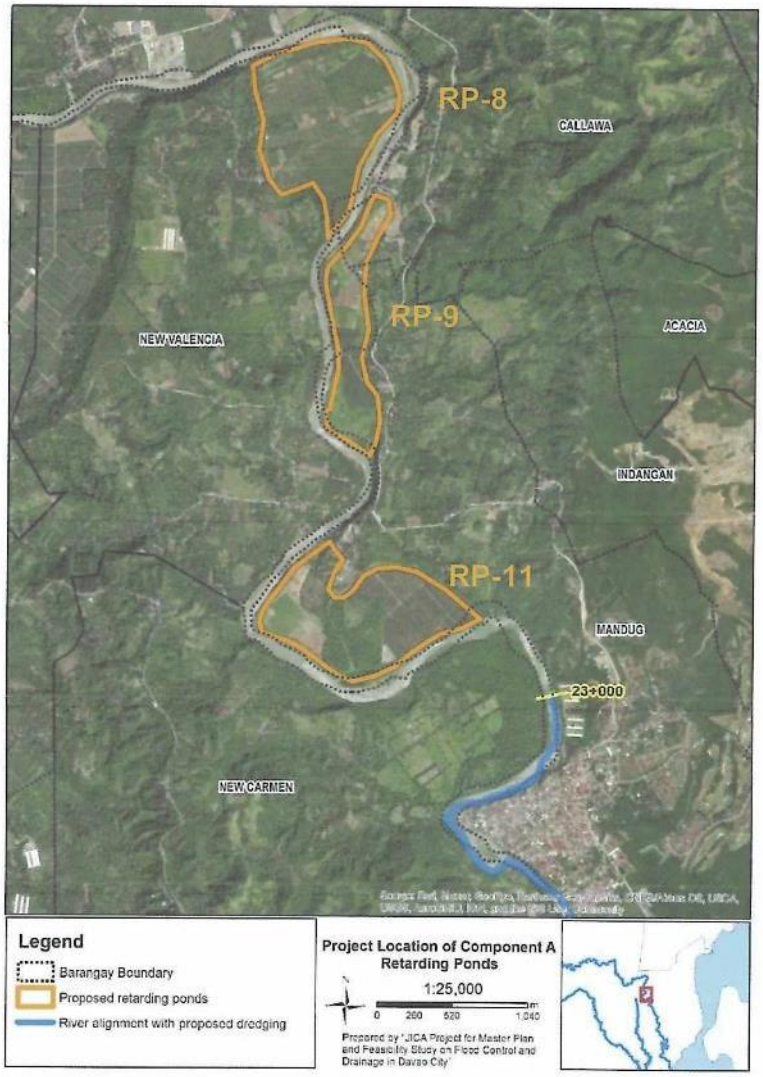
Zoning/Cert 2022/July/cris

Rm. 2, Davao City Hall, City Hall Drive, Davao City, 8000 | (082) 241-1000 loc. 239 | cpdo@davaocity.gov.ph


Map Showing the Properties of
Cut-off-Work at Ma-a
High Susceptibility to Landslide
C2
R2
PUD
R3
R1
T-54788
(430-A)
T-184130
(Lot 5-B-8)
T-181107
(Lot 5-D)
T-186109
(Lot 5-A-8)
OSE
T-128323
(Lot 3)
I1
Don Francisco Dizon ES
Very High Susceptibility to Flood
FPZ
INS
T-27726
(Lot 421-F)
T-381129
(421-E-2)
High Susceptibility to Flood
T-119114
(419)
T-226405
(415-H-2)
T-257617
(415-G-2-B)
T-10349
(416)
SU
146-2017001165
(415-J)
South Point School
C1

Annex G.2 - Proposed Sites

Project Location Map (Retarding Ponds)



Recommended by

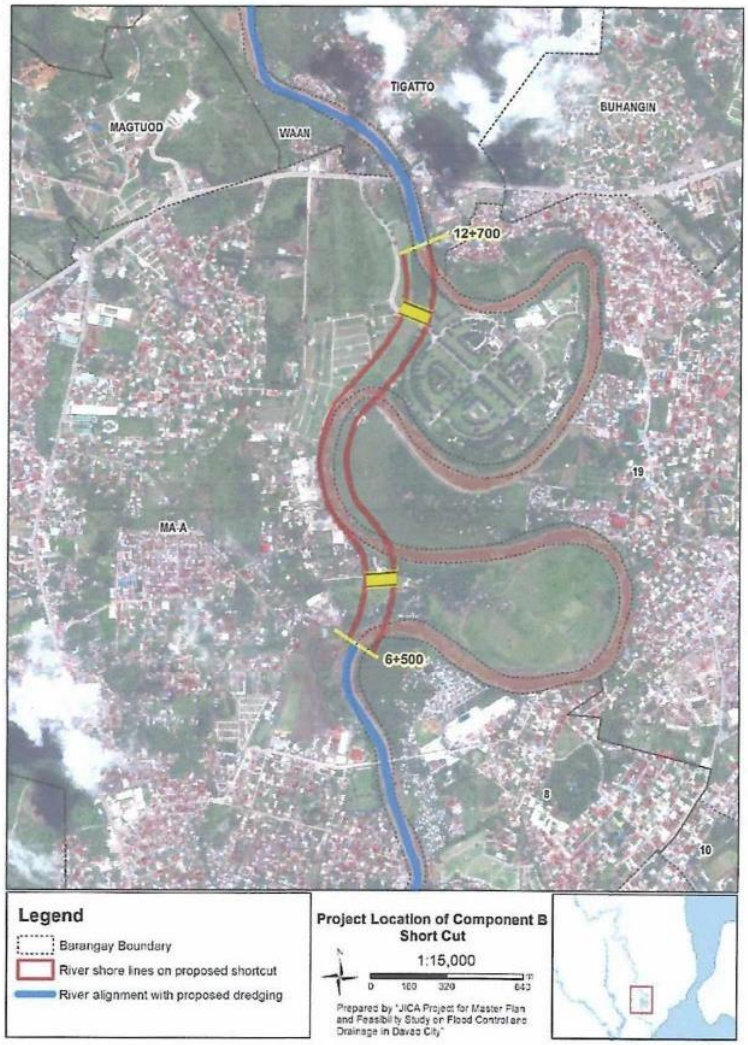
森田 健治

Kenji Morita
Team Leader of the JICA Consultant Team

Concurred by

Ramon A. Arriola III
Project Director
Unified Project Monitoring Office –
Flood Control Management Cluster

Project Location Map (Cut-off-works and Bridges)



Recommended by

森田 健治

Kenji Morita
Team Leader of the JICA Consultant Team

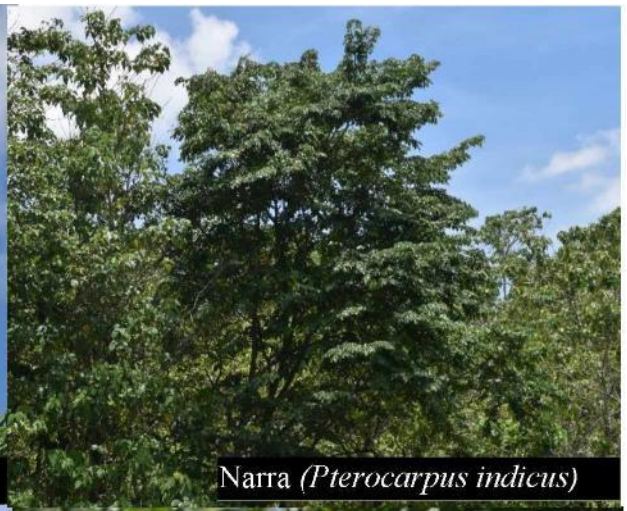
Concurred by

Ramon A. Arriola III
Project Director
Unified Project Monitoring Office – Flood Control Management Cluster

ANNEX H – OTHER PHOTOS

Annex H.1 - Endemic Flora Species Sighted in the proposed project area


Molave *(Vitex parvilfora)*


Narra *(Pterocarpus indicus)*


Ylang-ylang *(Cananga Odorata)*


Kahoi Dalaga *(Mussaenda frondosa)*


Barobo *(Diplodiscus paniculatus Turc.)*


Antipolo (Artocarpus blancoi)
Rimas (Artocarpus communis)
Niyog-niyogan (Ficus pseudopalma)
Is-is (Ficus odorata)
Katmon (Dillenia philippinensis)
Anubing (Artocarpus cumingiana)


Buri (Corypha utan)
Manila Palm (Adonidia merrillii)
Anahaw (Saribus rotundifolius)
Tree Fern (Cyathea contaminans)
Tagbak (Kolowratia elegans)

Annex H.2 - Endangered and threatened Flora Species Sighted in the proposed project area based on DAO 2017-11

Category B- Endangered

Category C- Vulnerable

Category D- Other

Annex H.3 - Photos of endemic fauna species sighted in the project area

Philippine Bulbul
Hypsipetes philippinus
Least Concern
(DAO 2019-09)

Philippine Magpie-robin
Copsychus mindanensis
Least Concern
(DAO 2019-09)

White-eared Brown Dove
Phapitreron leucotis
Least Concern
(DAO 2019-09)

Greater musky Fruit Bat
Ptenochirus jagori
Least Concern
(DAO 2019-09)

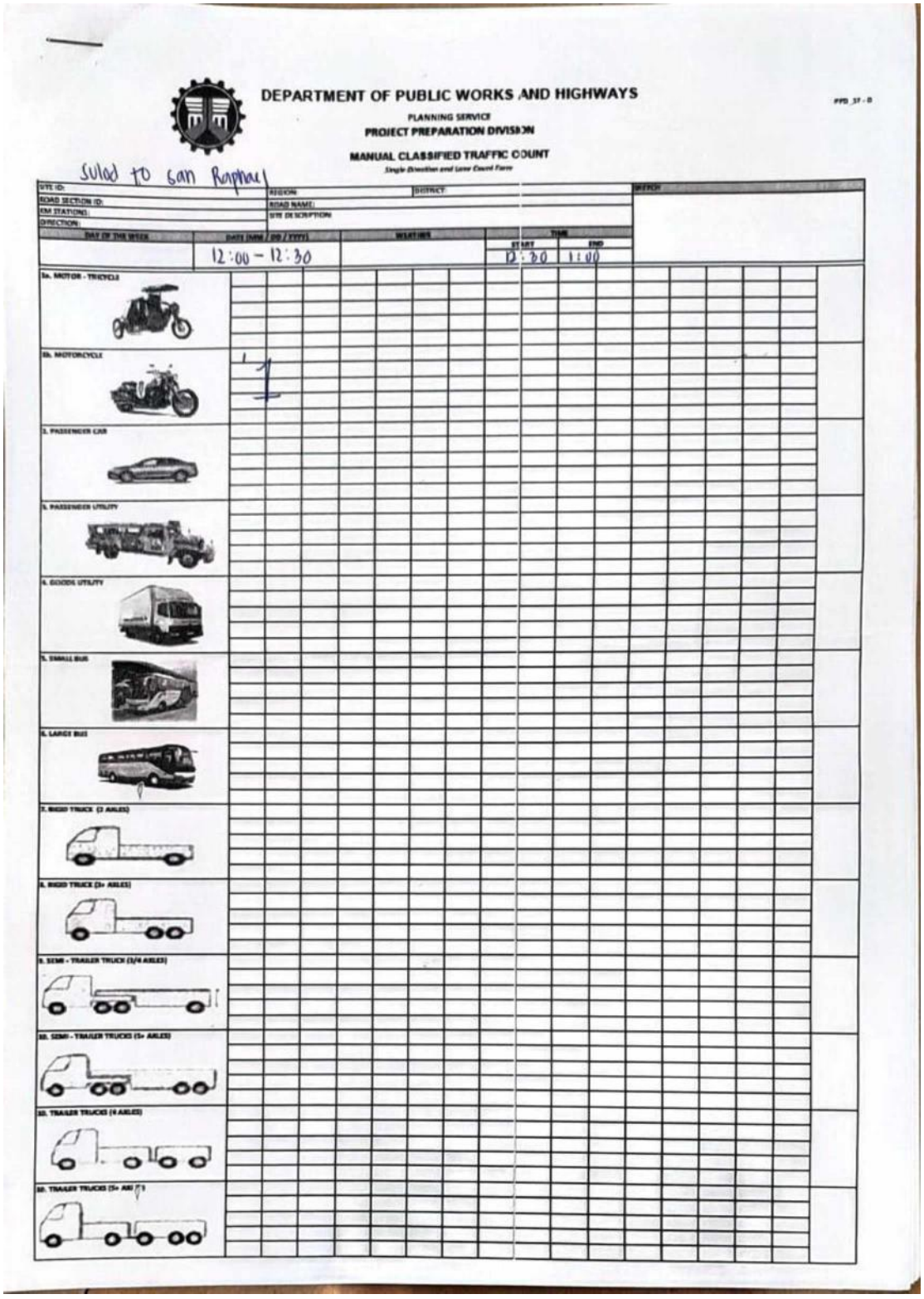
Lesser musky Fruit Bat
Ptenochirus minor
Least Concern
(DAO 2019-09)

Philippine Dawn Bat
Eonycteris robusta
Near Threatened
(DAO 2019-09)

Philippine Fanged Frog
Limnonectes magnus
Near Threatened
(DAO 2019-09)

ANNEX I – TRAFFIC SURVEY

Annex I.1 - DPWH Format for Manual Classified Traffic Count



DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

PLANNING SERVICE

PROJECT PREPARATION DIVISION

MANUAL CLASSIFIED TRAFFIC COUNT

Single Direction and Lane Count Form

Sulod to San Raphael

12:00 – 12:30

12:30 1:00

Figure 9. Location of Traffic Station 1 for 24-Hour Manual Counting (ITC 01)

Figure 10. Location of Traffic Station 2 for 24-Hour Manual Counting (ITC 02)

Figure 11. Trained and experienced observers for manual counting at Traffic Station 1 (ITC 01)

Figure 12. Trained and experienced observers for manual counting at Traffic Station 2 (ITC 02)

ANNEX J – CAUSES OF MORTALITY AND MORBIDITY

MORTALITY CASES, 2022

TOP LEADING CAUSES OF MORTALITY FROM BUHANGIN				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
UNDETERMINED NATURAL CAUSE		52	61	113
Diseases of the heart	I00 - I09; I20-I51	29	27	56
CEREBROVASCULAR ACCIDENT		36	17	53
Diabetes Mellitus	E10-E14	15	19	34
Pneumonia	J18.90-J18.99	17	14	31
Hypertensive diseases	I10-I15	13	11	24
Chronic kidney disease	N03	9	12	21
Cancer all forms	C01- C99	9	10	19
Septicemia	A41.9	10	6	16
Breast Cancer	C50	0	10	10

TOP LEADING CAUSES OF MORTALITY FROM DISTRICT A				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
UNDETERMINED NATURAL CAUSE	UNC	14	26	40
Pneumonia	J18.90-J18.99	15	11	26
Diabetes Mellitus	E10-E14	11	7	18
CEREBROVASCULAR ACCIDENT	CVA	8	8	16
Diseases of the heart	I00 - I09; I20-I51	9	7	16
Septicemia	A41.9	8	1	9
Cancer all forms	C01- C99	3	4	7
Chronic kidney disease	N03	5	2	7
Tuberculosis	A15-A19	3	1	4
Hypertensive diseases	I10-I15	2	1	3

TOP LEADING CAUSES OF MORTALITY FROM DISTRICT B				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
UNDETERMINED NATURAL CAUSE	UNC	7	11	18
Diabetes Mellitus	E10-E14	11	3	14
Pneumonia	J18.90-J18.99	9	5	14
CEREBROVASCULAR ACCIDENT	CVA	7	4	11
Diseases of the heart	I00 - I09; I20-I51	4	4	8
Septicemia	A41.9	4	2	6
Tuberculosis	A15-A19	5	0	5
Acute Myocardial Infarction	I21	2	1	3
Lung Cancer	C34	1	1	2
Breast Cancer	C50	0	2	2

TOP LEADING CAUSES OF MORTALITY FROM TALOMO NORTH				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
UNDETERMINED NATURAL CAUSE		28	33	61
Diabetes Mellitus	E10-E14	23	11	34
Diseases of the heart	I00 - I09; I20-I51	16	17	33
CEREBROVASCULAR ACCIDENT		19	7	26
Pneumonia	J18.90-J18.99	17	7	24
Chronic kidney disease	N03	10	3	13
Septicemia	A41.9	6	5	11
Tuberculosis	A15-A19	7	2	9
Urinary Tract Infection	N39	6	3	9
Cancer all forms	C01- C99	2	6	8

TOP LEADING CAUSES OF MORTALITY FROM TUGBOK				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
UNDETERMINED NATURAL CAUSE		47	44	91
CEREBROVASCULAR ACCIDENT		27	19	46
Diabetes Mellitus	E10-E14	16	19	35
Pneumonia	J18.90-J18.99	19	11	30
Chronic kidney disease	N03	8	12	20
Diseases of the heart	I00 - I09; I20-I51	10	9	19
Septicemia	A41.9	5	7	12
Hypertensive diseases	I10-I15	4	7	11
Cancer all forms	C01- C99	7	3	10
Tuberculosis	A15-A19	8	0	8

MORBIDITY CASES, 2022

TOP LEADING CAUSES OF MORBIDITY FROM BUHANGIN				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
Hypertensive diseases	I10-I15	131	170	301
Wound (All Forms)	T15	43	38	81
Cough	R05	42	32	74
Acute Upper Respiratory infection	J00 - J06	25	32	57
Acute Watery Diarrhea	A09.0 (watery)	17	28	45
Animal Bites	T14.1	12	20	32
Acute febrille illness	R50.9	13	14	27
General Symptoms and signs	R51-R69	13	14	27
Diabetes Mellitus	E10-E14	15	4	19
Chronic lower respiratory diseases (COPD, asthma, emphysma)	J40-J46	8	7	15

TOP LEADING CAUSES OF MORBIDITY FROM DISTRICT B				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
Urinary Tract Infection	N39	11	12	23
Infections of the Skin & Subcutaneous Tissue	L00-L99	12	10	22
Acute Upper Respiratory infection	J00 - J06	7	11	18
Hypertensive diseases	I10-I15	9	8	17
Injuries (all forms)	S00-S99	9	8	17
Single spontaneous delivery	O80	0	14	14
Pneumonia	J18.90-J18.99	6	7	13
Chronic lower respiratory diseases (COPD, asthma, emphysma)	J40-J46	6	6	12
Diabetes Mellitus	E10-E14	4	7	11
Hypertensive disorders in pregnancy	O10 - O16	0	11	11

TOP LEADING CAUSES OF MORBIDITY FROM TUGBOK				
Davao City, Year 2022				
Causes	ICD 10	TOTAL		BOTH SEX
		M	F	
Acute Upper Respiratory infection	J00 - J06	29	48	77
Injuries (all forms)	S00-S99	45	23	68
Hypertensive diseases	I10-I15	28	30	58
Acute Bronchitis/Bronchiolitis	J20-J21	19	22	41
Animal Bites	T14.1	6	22	28
Chronic lower respiratory diseases (COPD, asthma, emphysma)	J40-J46	14	11	25
Diabetes Mellitus	E10-E14	14	10	24
Urinary Tract Infection	N39	7	16	23
Pneumonia	J18.90-J18.99	12	9	21
Influenza-like Illness	J11.1	5	9	14

ANNEX K – APPLICABLE POLICIES AND ISSUANCES

MORTALITY CASES, 2022

Republic of the Philippines
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City, 1100
Trunkline (632) 929-66-26 • 929-6628 • 929-6635 • 929-4028 • 929-3618
426-0465 • 426-0001 • 426-0347 • 426-0480 • 426-0491
Voice-Over-Internet-Protocol (VOIP) Trunkline (632) 755-3330 • 755-3300

DENR Administrative Order
No. 2017 - 15

MAY 0 2 2017

SUBJECT: **GUIDELINES ON PUBLIC PARTICIPATION UNDER THE PHILIPPINE ENVIRONMENTAL IMPACT STATEMENT (EIS) SYSTEM**

Consistent with the State Policies and Principles of the Philippine Constitution on the right of the people to a balanced and healthful ecology and on encouraging non-governmental, community-based, or sectoral organizations that promote the welfare of the nation, the provisions of PD 1151 and PD 1586 on the implementation of the Philippine EIS System and the 1992 Declaration of United Nations Conference on Environment and Development (UNCED) emphasizing that environmental issues are best handled with the participation of all concerned citizens as well as with the thrust of the Department of Environment and Natural Resources (DENR) to promote social justice,the following guidelines on Public Participation are hereby promulgated.

ARTICLE I
BASIC POLICY AND PRINCIPLES, OBJECTIVES, SCOPE AND DEFINITION OF TERMS

Section 1. Basic Policy and Principles

It is hereby declared a policy that amidst the country's economic development initiatives, common good shall be promoted through public participation in the implementation of the Philippine EIS System. It shall employ the following basicprinciples.

a) Public Participation should be initiated early and sustained at the various stages of the EIAProcess.

b) Public Participation should be well planned and should involvethe stakeholders in the assessment, management and monitoring of environmental impacts

c) Timely public disclosure of all necessary relevant information especially to the stakeholders who shall be made to understand and appreciate the specific purpose and context of their participation for each stage of the process.

Section 2. Objectivesand Outcome

The objective of this Administrative Order is to improve and rationalize Public Participation under the Philippine EIS System byincorporating best practice principles and standardizing the procedures and requirements.

The intended outcome of this order is to achieve meaningful public participation under the Philippine EIS System at the various stages of the EIA Process through:

a) Anadequate, timely and effective information disclosure and feedback mechanism for:

- The gathering ofall relevant baseline data / information, issues and concerns that should be included in the EIA study
- The review ofthe contents of the EIS

4/27/2017

- The management and monitoring of environmental impacts of projects/undertakings

b) Consideration of the needs of the vulnerable and disadvantaged and of gender concerns.
c) Discussion of relevant views of the affected people and other stakeholders for incorporation into the decision-making, such as project alternatives/design, mitigation measures, the sharing of development benefits and opportunities and implementation issues.
d) Definedroles and empowered citizens in taking responsibility in environmental protection

Section 3. Scope of Public Participation Requirement

Public participation under the Philippine EIS system shall be required for the entire EIA Process from social preparation prior to scoping to impact management and monitoring during project implementation/abandonment.

Section 4. Definition of Terms

For purposes of this Guideline, the following definitions shall be applied:

Compliance Monitoring Report (CMR) – a semi-annual report submitted by the project proponent to EMB to report its self-monitoring of compliance with the requirements under the Philippine EIS System.

Compliance Monitoring and Validation Report (CMVR) – a semi-annual monitoring report form for MMTs for submission to EMB.

Environment- shall refer to the totality of the external conditions affecting life, development and survival of organisms including the surrounding air, water (both ground and surface), land, flora, fauna, humans and their interrelations.

Environmental Aspects – elements of an organization's activities, products or services that can interact with the environment.

Environmental Compliance Certificate (ECC) – is a document that may be issued after thorough review of the EIA Report. It certifies that the proposed project has complied with the requirements of the EIS System and that the proponent has committedto implement its approved Environmental Management Plan (EMP) to address the environmental impacts and to operate within the best environmental practice.

Environmental Impact Assessment (EIA) – a process that involves predicting, monitoring and evaluating the impacts of a project (including cumulative impacts) on the environment during construction, commissioning, operation and abandonment. It also includes designing appropriate preventive, mitigating and enhancement measures to address these consequences to protect the environment and the community's welfare.

Environmental Impact Assessment Review Committee (EIARC) - a body of independent technical experts and professionals of known probity from various fields organized by the EMB to evaluate the EIS and other related documents and to make appropriate recommendations regarding the issuance or non- issuance of an ECC.

Environmentally Critical Project (ECP) - project or program that has high potential for significant negative environmental impacts as defined under Presidential Proclamations 2146 (1981) and 803 (1996) and described under existing EMB guidelines and such other projects that may be declared by the President.

Environmental Impact Statement (EIS) – an EIA Report typethat is required to be submitted for ECC application for proposed ECPs and other project types that are expected to have a high degree of environmental impact significance.

Environmental Management Plan/Program (EMP) – is a section in the EIS that details the prevention, mitigation/management and monitoring measures to enhance

positive impacts and minimize negative impacts and risks of a proposed project or undertaking. It also includes contingency and compensation plan for environmental impacts and risks.

Environmental Monitoring Plan (EMoP) – a part of the EMP which indicates specific parameters to the monitored for identified environmental aspects and impacts, the sampling and measurement plan and the corresponding management scheme.

Environmental Monitoring Fund (EMF)– a fund that a proponent shall set up after an ECC is issued for its project or undertaking, to be used to support the activities of the multi-partite monitoring teamformed for ECPs. It shall be immediately accessible and easily disbursable.

Environmental Performance Report and Management Plan (EPRMP) - an EIA Report type that is required to be submitted for ECC application for single projects that are already operating. It includes a documentation of the actual cumulative environmental impacts, a report on the effectiveness of measures that are currently being implemented and additional management measures to enhance the effectiveness of the current measures or address additional impacts from proposed expansion/modification of the project/undertaking as necessary.

Focus group discussion (FGD)is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants gather to discuss and deliberate on a specific topic.It has normally a small number of participants, just enough to generate rich discussion.

Impact Management Plan (IMP) – a part of the EMPwhich indicates the prevention/mitigation measures for identified environmental aspects and impacts. It also indicates the responsible entity/ies, costs and guarantee/financial arrangements for the implementation of the prevention and/or mitigation measures

Key Informant Interview (KII) – is an interview of people selected for their firsthand knowledge about the topic of interest designed to allow free flow of ideas.

Multipartite Monitoring Team (MMT) - an independent entity whose membership represents primarily the stakeholders / public that is intended to assist the DENR in monitoring environmental impacts and compliance with the Philippine EIS System requirements and other environmental laws as a third party entity. The MMT scheme is intended to enhance participationand transparency at the post-ECC issuance stage of the EIA Process.

Programmatic Environmental Impact Statement (PEIS) - an EIA Report type that is required to be submitted for ECC application for proposed co-located projects intending to undergo programmatic compliance. It includes adocumentation of comprehensive studies on environmental baseline conditions of a contiguous area and an assessment of the carrying capacity of the area to absorb impacts from co-located projects such as those in industrial estates or economic zones (ecozones).

Programmatic Environmental Performance Report and Management Plan (PEPRMP) - an EIA Report type that is required to be submitted for ECC application for existing co-located projects with programmatic ECC and intending to expand or modify scope of project as described in the programmatic ECC. It includes a documentation of the actual cumulative environmental impacts, a report on the effectiveness of measures that are currently being implemented and additional management measures to enhance the effectiveness of the current measures or address additional impacts from proposed expansion/modification as necessary.

Procedural Review - phase in the ECC application review process to check for the completeness the required documents.

Project or Undertaking -any activity, regardless of scale or magnitude, which may have significant impact on the environment.

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DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
SENR051699

undertaken.(e.g. in mining projects, this can include the entire block proposed to be mined and areas outside the block where auxiliary facilities may be sited such as power plant, access roads, administrative building site, any coastal stockyard, pier/causeway, anchorage area, quarry area, crusher or batching plant, tailings storage facilities). This shall be the EIA Study Area.

5.2 At the minimum, the following groups shall be the audience of the IEC:

a) Local government units in areas where all project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken
b) Government agencies with related mandate on the type of project and its impacts.
c) Interest groups (NGOs/POs) preferably those with mission/s specifically related to the type and impacts of the proposed undertaking/project
d) households, business activities, industries that will be displaced
e) people whose socio-economic welfare and cultural heritage are projected to be affected by the project especially vulnerable sectors and indigenous populations
f) local institutions (schools, churches, hospital

Section 6.Information and Education Campaign (IEC)

6.1 Information and Education Campaign (IEC)shall be conducted in preparation for the public scoping by providing them with information about the project, the proponent and the scoping process.At the minimum, the following information shall be provided:

a) Purpose of EIA as stipulated in PD 1151 and 1586
b) Need for the project, its goals & objectives
c) Alternatives being considered by the project proponent on the following:
   - project type,components and size
   - process/technology (including toxic chemicals that will be used or produced and may be released to the environment)
   - resource utilization (water, energy, etc.)
d) Proposed location of project facilities / components and alternatives considered prior to the selection
e) Project Proponent (indicate incorporators, subsidiaries)
f) Projected timeframe of the project phases
g) Preliminarily identified environmental aspects for each alternative

6.2 The IEC shall be in English and/or in Filipino or in local language and shall be conducted through the following means:

a) Field visits to the project site/s, meetings with traditional and political leaders, informal dialogues with community members, community meetings or "talakayang barangay". At the minimum, key informant interviews (KIIs) shall be conducted.
b) Use of appropriate IEC materials such as film or video showing, printed media or local radio. Other forms of information dissemination that can be used include streamers, exhibits and leaflets/flyers.

6.3 During the IEC activities, further information may be gathered to enhance or update the description of the project location, project alternatives and the identification of environmental aspects.

Section 7. Requirements prior to the Public Scoping

Scoping determines the coverage, focus, depth and extent of the environmental assessment to be undertaken and the basis of review. As such, an effective IEC shall have been conductedat the minimum with the initially identified stakeholders prior to the Public Scoping. The following guideline describes the specific requirement prior to public scoping.

7.1 Request for public scoping shall be submitted for approval to the EMB Office with jurisdiction over the processing of the ECC applicationwithin three (3) months from

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DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

Proponent - any natural or juridical person intending to implement or implementing a project or undertaking

Public –refer to the people of the country, province, district, city, municipality, barangay/Sitio which the government serves.

Public Consultationinvolves the gathering of information, concerns, opinions and suggestions from the public through meetings, interviews, focused group discussions and other similar means.

Public Hearingunder the Philippine EIS System is a formal process that is initiated, planned and conducted by the EMB-DENR that is designed to promote dialogue or communication between and among the project proponent, the EMB-DENR, relevant agencies, LGUs and other stakeholders for the purpose of exchanging information and views on the environmental impacts assessment, management and monitoring for proposed projects as part of the review of the ECC Application.

Public Participation(PP) – is an element of a process that gives citizens, particularly stakeholders, the opportunity to influence major decisions that may affect their community and their environment. In the EIA Process, the goal of public participation is to enable citizens to take responsibility for environmental protection and management through active involvement in the process.

Scoping -the stage in the EIS System where information and project impact assessment requirements are established to provide the proponent and the stakeholders the scope of work and terms of reference for the EIS.

Significant Impacts – impacts which damage the environment to the point that the environmental resource loses its capacity to sustain life or to continue functioning within baseline levels and efficiency. It refers to impacts needing action through prevention, mitigation or other interventions to protect the environment from being harmed at levels that reduce its functionality for its users or dependent biota.

Social Preparation – a preliminary activity for information disclosure carried out before the scoping to prepare the stakeholders for meaningful participation in the EIA Process.

Stakeholders – persons (natural or juridical) who affect or are affected by the project or undertaking, such as, but not limited to, members of the local community, industry, local government units (LGUs), National Government Agencies (NGAs) and non-government organizations (NGOs) and people's organizations (POs).

Stakeholder Involvement–working directly with stakeholders to ensure that relevant concerns and aspirations are reflected in the alternatives developed during the EIA Process and ensure feedback on how inputs influenced decisions on project implementation

ARTICLE II
PUBLIC PARTICIPATION INDEFINING THE SCOPE AND
IN THE ACTUAL CONDUCT OF THE EIA STUDY

Stakeholder involvement shall be initiated early through information and education campaign (IEC) prior to scoping. In addition to the stakeholders, the general public may participate the public scoping. The following requirements and procedures for the integration of public participation (PP) in defining the scope and in the actual conduct of the EIA Study shall be implemented.

Section 5. Initial Stakeholder Identification

Initial stakeholder identification shall be done to identify target groups forthe IEC

5.1 The IEC shall be conducted in the project area and the area where all project facilities are proposed to be constructed/situated and where all operations are proposed to be

the following guidelines and requirements shall apply:

8.1 The public scoping shall be conducted in a public facilitywithin the project site, as a general rule or in the nearest appropriate place in cases where such cannot be conducted within the project site because of inaccessibility, security risk or other site condition concerns.

8.2 The public scoping shall be facilitated by the EMB-RO and at the minimum, shall have the following agenda:

a) Brief Presentation by the EMB-RO of the EIA Process focused on the Scoping process and the objective of the Public scoping

b) Presentationby the project proponentof the Project Description as outlined in item c) of Section 7.1in Filipino/local language and/or in English.

c) Open Forum(at least 2 hrs.)

d) Presentation of the summary of concerns raised during the open forumby the EMB RO representative

e) Proponent's responseregarding what concerns can be integrated in the EIA and how will these concerns be tackled including possible modes of participation of stakeholders in the actual conduct of the EIA. The EMB-RO representative shall act as mediator in this discussion.

f) EMB-RO shall close the public scoping by summarizing agreements and presenting succeeding steps.

8.3 The proponent shall prepare thePublic Scoping Report (PSR) which at the minimum contains the following:

a) attendance of stakeholders & the general public (description of stakeholder sectoral representation during the public scoping vis-à-vis the identified stakeholders based on Section 5)
b) Segregated comments, issues raised and suggestions based on the main modules of the EIA: Project Description, Land, Water, Air, People. The sector or persons who raised the comments, issues or suggestions along with the proponent's response shall be noted.
c) The proposed design of public participation and analysis of issues raised by stakeholders using appropriate methods (to be discussed during the technical scoping).

8.4 The PSR for Environmentally Critical Projects (ECPs) shall be submitted to the EMB CO for approval within ten (10) working days after the public scoping duly validated by the EMB RO. The PSR for non-ECPs that are required an EIS shall be submitted to EMB RO for approval within seven (7) working days after the public scoping. The EMB shall evaluate and decide on the completeness of the PSR within three (3) working days.

8.5 The technical scoping to be convened by EMB with the EIARC shall be conducted within seven (7) working days after the approval of the PSR. The discussions, issues and agreements during the public scoping shall be integrated into the proposed technical scope of the EIA to be deliberated on and approved during technical scoping. The attendance of the stakeholders during public scoping shall be assessed/evaluated during technical scoping.

8.6 An announcement shall be posted in the EMB Website on the completion of the scoping and the start of the EIA Study together with the public scoping report (PSR)

8.7 The EIS shall be submitted for procedural screening not later than a year after the approval of the scope of the EIS unless otherwise specified.

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the conduct of social preparation. The following shall be submittedalong with the letter of request:

a) Proof of conduct of IEC
   - Documentation of FGDs conducted, at the minimum, represented by stakeholder groups identified based on the guidelines in Section 5.
   - Documentation of IEC including a proof of receipt of IEC materials by LGU and other stakeholders

b) Initial perception survey results at the minimum indicating the baseline knowledge about the project, concerns/questions about the description of the project alternatives and concerns about the environmental impacts of the project using accepted methodology.

c) Project Description for Scoping (PDS) containing at the minimum, the following information:

   1) Need for the project, its goals & objectives,
   2) Alternatives being considered by the project proponent on the following:
      - project type, components and size
      - process/technology (including toxic chemicals that will be used or produced and may be released to the environment)
      - resource utilization (water, energy, etc.)
   3) Proposed location of project facilities/components and alternatives considered in the decision
   4) A Map (e.g. google) showing the project site/s and the proposed EIA Study Area.
   5) Aerial photos of the project site taken not more than 90 days fromsubmission, at the minimum, showing households, business activities and industries that will be displaced as well as well aslocal institutions (schools, churches, hospitals)
   6) Project Proponent (indicate incorporators, subsidiaries)
   7) Projected timeframe of the project phases
   8) Preliminarily identified environmental aspects for each alternative

d) Proposed list of invitees for the public scoping, at the minimumrepresenting the groups listed in Section 5.2.

e) Draft invitation letter (to be signed by EMB) and IEC materials in preparation for the public scoping.

f) Draft presentation of the project during public scoping

7.2 The EMB Office with jurisdiction over the processing of the ECC application shall evaluate the proofs of the conduct of IEC and ensure the completeness of the PDS and the list of invitees for the public scoping, among others.

7.3 The EMB shall decide on the approval of requeston the conduct of the public scoping within five (5) working days and shall post an announcement for the public in the EMB Website at least 10 days before the public scoping containing the following information *along with the e-copy of the PDS*:
- Importance of EIAparticularly the scoping process
- Date and venue of public scoping
- Instructions and deadline for the registration of intent to comment
- Instructions and deadline for submitting comments

The proponent shall simultaneously disseminatethese information in the Project Area. The PDS shall remain in the Website until the submission of the ECC application.

Section 8.Public Participation during Public Scoping

The proposed scope of the EIA Study shall be disclosed to the general public and

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Section 9.Stakeholder involvement in the EIA Study / Report Preparation by the Proponent

Relevant local and indigenous knowledge shall be integrated into the EIA Study through stakeholder involvement. However, prior to engaging the stakeholders, the objectives of their participation should be made clear to them and necessary support for them to participate meaningfully shall be provided. The following briefly describes how the public can participate in the EIA Study:

9.1 Stakeholders in the community may perform the role of research partners, community mobilizers, or as key informants in *baseline data gathering*. Their specific involvement can include the following:

- Participation in rapid appraisals for the identification of affected communities, for the general rating of the level of development in terms of economic status of each population categories (farmers, fisherfolks, laborers, etc.), for assessing the affected population's need or demand for the project, in assessing absorptive capacity and in the conduct of perception surveys
- As source of information on the biophysical environment and could provide environmental indicators for the assessment of changes/trends in their own environment (ex. occurrence of flooding, reduced river flows, decline in fishery production, etc.), presence or disappearance of wild animals or birds and other ethnobiological information
- Participation in community validation meetings or workshops to check the accuracy of the results obtained from the survey and to gather additional issues and concerns

9.2 Participatory methods such as consultations, focused group discussions, group meetings among others may be used. The participation of identified stakeholders shall be the priority but shall also be open to relevant concerns from the general public. The participatory method to be used should be adapted to the social organization of the impacted communities and should consider the following in determining specific format:

- The cultural, social, economic and political dimensions.Many communities have their own formal and informal rules for public access to resources, conflict resolution and governance. This shows respect for the affected community and may improve public confidence of the process and its outcomes. Options for involving Indigenous Peoples (IPs) shall be explored based on the existing conditions in the project location in view of the Free and Prior Informed Consent (FPIC) requirement of the National Council for Indigenous Peoples (NCIP).
- Language and representation issues as well as access to communication technology/media.

9.3 Information gathered from the public including stakeholder inputs in the assessment of project alternatives shall be properly documented and shall be integrated into the appropriate modules of the EIS.

Section 10. Updating of Stakeholder Identification and Stakeholder Analysis

Once the EIA is completed, stakeholder identification shall be updated based on the delineation of the Direct Impact Area (DIA) and the Indirect Impact Area (IIA) for the proposed undertaking's impacts on air, water, land and people.

10.1 The DIA shall be delineated based on the results of the assessment of the project's impact on air, water, land and people. The following examples are provided for illustration purposes and may be applicable to certain types of projects.

a) DIA for Air Quality Impacts
-Areas with projected Ground Level Concentration (GLCs) of emissions higher than the ambient standard based on air dispersion/transport modeling studies (worst case scenario).

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b) DIA for Water Quality & Quantity Impacts
- The extent of water body/ies areas where the water quality are projected to exceed the ambient standards based on relevant worst case scenario discharge modeling studies (sediment and pollutant discharges)
- Areas using the groundwater that could possibly be contaminated by project activities involving the use and disposal of toxic chemicals and hazardous waste or construction of underground facilities.
- Areas where there are existing users of the same source of natural resources (e.g. water) that the proposed project will be using.

c) DIA for impacts on Land
- Areas directly vulnerable to potential flooding or inundation that may be caused by the project
- Areas where there will be disturbance of habitat

d) DIA for impacts on People
- Directly affected areas based on the results of the socio-economic impact assessment studies conducted including ancestral domain of indigenous communities that may be affected, if any.

The concerned EIA Specialist shall be responsible in identifying relevant parameters for the identification of the DIA for the specific project.

10.2 The IIA on the other hand, shall be delineated for impacts on people and shall include those in the vicinity of the DIA who will either benefit or be affected indirectly by the project.

10.3 Individuals, sectors, groups or organizations living, working or owns a property within the DIA as classified in Section 5.2 are given priority as stakeholders to participate in the succeeding stages of the EIA process. They shall be represented as member of the Multipartite Monitoring Team (MMT) which may be created for the monitoring of project impacts.The general public who were not identified as stakeholdersare still welcome to participate during public hearings.

10.4 The analysis of actual stakeholder/public participation vis-à-vis the above guidelines shall be reported as part of the EIA Process documentation in the EIS. The stakeholder groups and representing individuals who participated shall be listed along with the objective, type, methods and timeframe of participation.

ARTICLE III

PUBLIC PARTICIPATION IN THE REVIEW OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

Public participation in the review and evaluation of the EIA Report shall be required for projects that require an EIS,PEIS, PEPRMP and EIS-based EPRMPfor ECC application per existing guidelines.

Section 11. Overview of Public Participation in the review of EIA Reports

11.1 The EIA Report shall contain a documentation of the public participation processes conducted prior to and during the ECC application. It shall likewise include discussion on how the stakeholders' and the public's views were considered in choosing from the project alternatives.

11.2 EIA Reports including a simplified summary shall be made available to the general public through the website, Effective information dissemination on the review of the EIA shall likewise be implemented especially in the DIA.

11.3 The identified stakeholders shall be invited to actively be involved in review through the following:
- participating in the public hearing/s
- providingrelevant written comments that the EIARC should consider in the review of the EIA Report through online feedback or submitting hard copy to

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EMB within the set timeframe.

11.4 The public participation process undertaken as well as its outputs shall be considered in the review of the EIA Report by the EIARC and in the review of the ECC application by the EMB.

11.5 After the public hearing, the draft EIS shall be revised incorporating the following key aspects of the public hearing documentation along with other concerns raised during EIARC Meeting/s:

a) -Attendance of stakeholders & the general public (description of stakeholder sectoral representation)
b) What and how the information was disseminated to various stakeholder groups and the chronology of activities conducted in compliance with the requirements.
c) Segregated comments, issues raised and suggestions based on the main modules of the EIA: Project Description, Land, Water, Air, People including issues raised on project alternatives. Sector or Representatives who raised the comments, issues or suggestions along with the proponent's/DENR's response
d) Summary of issues raised that are beyond the mandate of the EMB, identifying agencies with mandate on these issues

The Revised EIS shall be posted in the EMB Website for further public comments.

11.6 The documentation of the public participation highlighting the stakeholder involvement shall be included in the review process report (RPR) of EMB. It shall be posted in the EMB Website

Section 12. Public Information / Disclosure

12.1 To enable meaningful public participation in the review of the EIA Report, anEIS Summary for the Public (ESP)in English andin Filipino shall be submitted along with the other requirements for ECC Application. The ESPshall contain the following information:

a) Project Description including the following:
   - Project type, components and size
   - process/technology (including toxic chemicals that will be used or produced and may be released to the environment)
   - resource utilization (water, energy, etc.)

   It should include a discussion on the process and criteria in choosing from the alternatives including how the public / stakeholders influenced the selection
b) Proposed location with vicinity map (current) of the project facilities /components and the criteria and process of decision making in choosing from the alternatives
c) Project Proponent (indicate incorporators, subsidiaries)
d) Projected timeframe of the project implementation
e) Concise integrated summary of the major impacts and residual effects after mitigation
f) Identified stakeholders based on Section10
g) Project proponent's statement of commitment and capability to implement necessary measures to prevent adverse negative impacts
h) Information on where to get a copy of the EIS for further information

12.2 The Draft EIS for review and the ESP shall be posted in the EMB Websiteat least 20 days before the public hearing along with the Notice of Public Hearing. The website

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12.3 The project proponent at its own expense shall cause the publication of the Notice of Public Hearing upon approval by the EMB Office with jurisdiction over the processing of the ECC application. The Notice shall be published in a newspaper of general circulation once a week for two (2) consecutive weeks, the second publication of which shall be at least seven (7) days before the scheduled public hearing. At the minimum, the Notice should contain the following:

a) The objective of the Public Hearing
b) Need for the project, its goals & objectives
c) A brief description of the project components, size and proposed location
d) Project proponent
e) Date and venue of public hearing
f) Instructions and deadline for the registration of intent to attend the public hearing and/or give comment/sor position papers
g) Instructions and deadline for submitting comments or position papers
h) Contact person/s for further inquiries

12.4 Notices shall likewise be posted in conspicuous places in the municipality and barangay where the project is proposed to be located at least 15 days prior to the scheduled hearing and distribution of flyers shall be done especially in places where the reading of newspapers is not a common practice.

12.5 If there are identified primary stakeholders who have no access to written means of information, the project proponent shall, in addition, disseminateinformation through non-written means such as radio, public address system or other similar meansfor two (2) consecutive days at least seven (7) days before the public hearing.

12.6 The Revised EIS incorporating the key aspects of the public hearing documentation as described in Section 11.5shall be posted in the EMB Website for seven (7) days for further public comments. Comments submitted after this 7-day period shall no longer be considered in the review of the ECC application.

12.7 A copy of the ECC, the EMP (IMP &EMoP) and the documentation of the public participation shall be posted in the EMB Website. and shall contain the following:

a) Chronology of PP conducted
   - social preparation, scoping, public consultations, FGDs, KIIs and public hearings other means of public participation
b) the key issues raised and how this was responded to by the project proponent and considered in the review of the ECC application
   indicate the stage of the EIA process when these issues were raised
c) related issues that were raised but are beyond the mandate of the EMB-DENR

Section 13. Public Hearing

13.1 One (1) Public Hearing shall be conducted for projects requiring EIS, PEIS, PEPRMP and EIS-based EPRMP. For projects covering more than one (1) municipality, public hearing may be conducted per municipality. The following guidelines shall govern the conduct of the public hearing.

13.2 The EMB Office with jurisdiction over the processing of the ECC application shall plan, initiate and conduct Public Hearing.Sufficient information dissemination shall be ensured prior to the conduct of public hearing as prescribed in Section 12.

13.3 Efficient exchange of information and views between and among the project proponent, the EMB-DENR, relevant agencies, LGUs and other stakeholders on the environmental impacts assessment, management and monitoring for proposed projects applying for an ECC shall be ensured.

13.4 Identified stakeholders registered prior to the deadline specified in the Notice shall be invited to the public hearing and given priority in terms of time slot during the hearing. Other stakeholders and the public shall likewise be given opportunity to speak during the public hearing as long as they sign on the attendance sheet and identify themselves.

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13.5 The EMB Director or Regional Director shall designate a hearing officer with the following qualifications:

- Of known probity and independence
- Has familiarity with the Philippine EIS System and the rules and procedures in the conduct of public hearing
- Is skilled in dispute and conflict resolution

13.6 The following are the major functions of the Hearing Officer:

a) shall direct the proceedings of the public hearing towards the aim of eliciting feedback on the assessment, management and monitoring of environmental impacts of the specific project to support the substantive review by the EIARC of the EIS in relation to the ECC application.

b) shall ensure that the participants especially the identified stakeholders are given the opportunity to ventilate their positions/concerns and ensure that these concerns are adequately discussed during the hearing.

c) shall endeavor to identify options for possible resolution of issues and conflicts.

d) may be called upon by the EIARC to give a verbal report even prior to the submission of the formal report for purposes of facilitating the review process. The report shall be an assessment of issues discussed or events that transpired during the public hearing, and the findings or recommendation of the public hearing officer.

e) shall ensure orderly and systematic conduct of the hearing within the planned period of time.

f) prepare hearing officers reportwithin 10 days after the hearing.

13.7 The Public Hearing shall have the following standard Program:

a) Briefing and Orientation on the purpose of the public hearing and the Philippine EIS System
b) Rules on the conduct of the public hearing
c) Presentation on the description of the Project including alternatives
d) Presentation on the EIA Study process and results
e) Open Forum
f) Recapitulation of issues raised and the proponent's response
g) Next steps

The open forum shall be at least 3 hours to provide sufficient time for stakeholders to ventilate their views and concerns about the project. The presentation of the project and the EIA Study process and results shall be brief but complete. A copy of the presentation shall be submitted to EMB for approval prior along with the copy of the notice of public hearing.

13.8 The full documentation of the public hearing shall be prepared by the project proponent and validated by EMB. It should contain at least the following:

a) Attendance of stakeholders & the general public (description of stakeholder sectoral representation)
b) What and how the information was disseminated to various stakeholder groups
c) Segregated comments, issues raised and suggestions based on the main modules of the EIA: Project Description, Land, Water, Air, People. Sector or Representatives who raised the comments, issues or suggestions along with the proponent's/DENR's response.
d) Summary of issues raised that are beyond the mandate of the EMB, identifying agencies with mandate on these issues
e) Transcription of the Proceedings
f) Video documentation of the proceedings of the public hearing

(itemsa, to dshall be incorporated in the revised EIS)

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13.9 The timeframe from the publication of the Notice until the acceptance of the full documentation of Public Hearing shall not be included in the processing timeframe.

Section 14.Roles and Obligations in the Public Participation Process

In order to have the optimum benefit from public participation in the review and evaluation of ECC applications, the project proponent, the DENR-EMB and the stakeholders including the LGUs, NGOs, NGAs and POs shall perform their respective roles and obligationssummarizedas follows.

14.1 The project proponent shall ensure that all relevant concerns gathered from the public participation process are adequately addressed and reflected in the following documents to be submitted to EMB:
a) Public Scoping Report
b) Draft EIS
c) EIS Summary for the Public (ESP)
d) Revised EIS (to be submitted to EMB after the public hearing)

14.2 The stakeholders including the LGUs, NGOs, NGAs and POs shall participate in the process by providing all necessary and truthful information within the set deadlines and timeframe.

14.3 The EMB-DENR shall ensure that the procedures and requirements for public participation from scoping to public hearing are complied with.

14.4 The decision by the EMB-DENR on the ECC application shall consider relevant inputs from the public participation process along with the results of the assessment of impacts on the biophysical environment as evaluated by the Environmental Impact Assessment Review Committee (EIARC). The following criteria shall be used to assess the validity and relevance of an issue raised:

a) It is based on correct and updated information
b) It is directly relevant to the project being assessed
c) It is related to the assessment, management and monitoring of the environmental impacts of the proposed project subject of the ECC application.
d) It puts public interest over personal interest

ARTICLE IV
PUBLIC PARTICIPATION IN MONITORING OF IMPACTS OF PROJECTS WITH ECC

During the implementation of the project, compliance to the ECC and other commitments of the project proponent as reflected in the EIA Report especially the Environmental Management Plan (EMP) shall be ensured. Through the monitoring and evaluation activities under the Philippine EIS System, the EMB shall ensure that the actual environmental impacts are monitored and managed by ensuring the sustained effectiveness of the measures instituted. Public participation in this process shall be guided by the following provisions.

Section 15. Overview of Public Participation in the Monitoring of Impacts of Projects with ECC

The vigilance of the public especially stakeholders living or working near the project site shall be used as tool in effectively monitoring and managing environmental impacts of projects.

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whose DIA covers more than 2 municipalities). In cases where there is no PG-ENRO, MENRO/City ENRO, the Municipal/Provincial Planning and Development Officer (MPDO/PPDO)or the chairman of the environment committee of the Sangguniang Bayan may be designated as representative to the MMT.

- the Rural Health Unit (RHU) Chief and
- concerned Barangay Captain

All existing LGU representatives to the MMT shall be replaced by these officers or their representatives.

b. 1 representative from the LGU-accredited local NGOs with mission/s specifically related to environmental management and/or to the type and impacts of the proposed undertaking/project may be designated as representative to the MMT. In cases, where there is no such NGOs, it shall be open to other NGOs.

c. Maximum of 2 representatives from Locally recognized community leaders who can represent vulnerable sectors including indigenous populations, women and senior citizens and representatives from the academe may be included as member of the MMT in addition to the LGU-accredited NGO

d. Maximum of 3 representatives form government agencies with related mandate on the type of project and its impacts during project implementation shall be included in the MMT membership, if not yet included. Examples of these government agencies are DOE for Energy Projects, MGB for Mining Projects, and PCG, BFAR, BMB or FMB, depending on the location.DENR participation/membership shall be limited only in cases where there are specific concerns related function related to biodiversity and forestry as endorsed by the concerned Bureau Director.

The MMT shall not exceed ten (10) membersexcept in cases where the location of project facilities covers more than one (1) Barangay. In such cases, the additional member shall come from the additional Barangay/s and MENRO.

16.4 As a general rule, the representative from the MENRO/City ENRO, the PG-ENRO or the representative from the lead government agency (e.g. DOE for energy projects, DOT for Tourism Projects) shall serve as the MMT Chair. In cases where the said representatives do not accept the chairmanship, the members of the MMT elect among themselves and specify the procedures in its Manual of Operations (MOO).

16.5 The existing MMTs for ECPs shall reconstitute themselves accordingly. A Memorandum of Agreement (MOA) between the EMB-CO and Proponent shall be executed with conformity by the members identified based on Section 16.3 of this Order. Appropriate EGF provisions shall be integrated into the new MOA with the EMB CO Director as Chairperson of the EGF Committee. The pro-forma MOA shall be provided by EMB and shall be executed within one (1) year, otherwise, these MMTs shall be deemed automatically dissolved until such time that such requirement is submitted.

16.6 In the case of existing MMTs for Mining Projects, the EMB representatives shall likewise be removed as member of the MMT. The MMT shall regularly submit to EMB CMVR format report including report on compliance with the EPEP (based on EMB-approved EMP) and the EMB shall similarly conduct its monitoring activities independent of the MMT.

Section 17. Functions of the Multi-Partite Monitoring Team (MMT)

As an independent entity whose membership representsthe stakeholders / public, the MMT is expected to add credibility by being open and transparent inmonitoring environmental impacts and compliance with the Philippine EIS System requirements. The MMT shall have the following specific functions:

a) Conduct quarterly ocular site visit to validate the proponent's compliance with the

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ECC conditions and the Environmental Management and Monitoring Plan including the requirement to conduct self monitoring and submit corresponding reports regularly.

The MMT may observe sampling activities conducted by the project proponent.

b) Prepare and submit its report to EMB-CO and EMB-RO concerned using EMB-prescribed format at least semi-annually not later than July 30 for the first semester report and January 30 for the 2nd semester report

c) Institute an environmental emergency and complaints receiving and management mechanism which shall include systems for transmitting recommendations for necessary regulatory action to EMB in a timely manner to prevent adverse environmental impacts.

Section 18. MMT Formation and Operationalization

18.1 After the issuance of ECC for ECPs, the project proponent shall initiate the formation of the MMT based on the above policy updates in compliance to the relevant ECC condition. A Memorandum of Agreement (MOA) between EMB-CO and PROPONENT based on a pro-forma to be provided by EMB shall be executed with conformity of members of the MMT as identified based on Section 15.3 of this Order. The MOA signed by the proponent and the new members the project proponent shall submitted to EMB CO for final approval within the deadline specified in the ECC.

18.2 A MMT Manual of Operations (MOO) shall be formulated / updated based on these policy updates. The MOO shall guide the MMT in planning its activities, operationalizing its functions and managing its performance. It should contain at least the following:

- Membership: selection process, code of ethics, suspension/removal, resignation/replacement process
- Organization : structure, leadership, roles & responsibilities
- Fund Administration & Management
- Activities: meetings, monitoring activities, records keeping, public disclosure, operations & performance enhancement

An MMT without an updated MOO submitted within a year from the signing of the MOA by DENR shall be suspended until such time that the requirement is submitted and approved.

18.3 In the conduct of its quarterly site visit, the MMTs shall implement the usual procedures including a closing meeting where the MMT findings shall be discussed with the representative of the project proponent.

18.4 MMTs who do not submit the required reports, those who fail to submit its report before the deadlines or submits incomplete reports for one (1) year shall be suspended until such time that such requirements are complied with.

18.5 Individual MMT Members who violate the code of ethics shall be subject to suspension/removal/replacement by the chairman of MMTor any other disciplinary action as indicated in the MOO.

18.6 All other existing guidelines consistent with the provisions of this DAO shall still be in effect.

Section 19. Environmental Monitoring Fund (EMF)

19.1 The Proponent shall provide funds for the EMF, the amount of which shall be based on the annual work and financial plan (AWFP) to be approved by the EMB-CO. All EMFs established without an MMT shall be returned to the project proponent. No new EMFs shall be established without an MMT

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19.2 The EMF administration and management shall be prescribed in the MOO and should contain at the minimum, the following provisions:

- Eligible Expenses and Standards
- Preparation & Approval of Work and Financial Plan for the establishment of the amount of EMF
- Management of Fund
- Disbursement and Auditing Procedures

19.3 The mode of fund administration shall be decided upon by the project proponent in consultation with the MMT and should consider the MMT's independence. The Fund Administrator shall accept the fund administration and management responsibilities as reflected in the MOO and shall be liable for any misapplication or inappropriate disbursements allowed to be charged against the EMF.

19.4 The Fund Administrator shall open an account with a government accredited bank, with the elected Chairperson or Treasurer of the MMT as signatory **AND** the representative of the Fund Administrator as counter signatory.

19.5 The Proponent shall release the amount of funds based on the EMB-approved AWFPinitially, equivalent to the projected expenses for the first three quarters and succeeding releases shall be done semi-annually upon liquidating expenses and validating submission of the MMT Report to EMB for the previous reporting period. The proponent shall conduct regular audit of the EMF and apprise EMB on irregularities, if any.

19.6 MMT members especially those who will lose their opportunity to earn while participating in MMT activities shall receive anhonoraria of not more than PhP 2000.00 per quarter for their participation charged to the EMF. A contingency of not more than 50% of the total amount allotted for the honoraria and for logistical expenses for regular activities may be allotted emergency meetings, capability building and other related activities.

ARTICLE V
GRIEVANCE REDRESS MECHANISMS

As check and balance for the proper implementation of the requirements and procedures for a meaningful and systematic public participation through this administrative order, following guidelines shall apply to the following types of grievance:

Section 20. Non-inclusion among the identified stakeholders of the project

A letter addressed to EMB with jurisdiction over the processing of the ECC shall be submitted not later than the submission of the EIS for procedural screening stating the reason for inclusion as stakeholder based on the guidelines for stakeholder identification and specific concerns about the environmental impacts of the project. The EMB shall include the complainant among the invitees during the public hearing if found to be a legitimate stakeholder.

Section 21. Non-consideration of legitimate concerns about the assessment management and monitoring of environmental impact of the proposed project

A letter addressed to EMB with jurisdiction over the processing of the ECC shall be submitted not later than seven (7) days before the conduct of the public hearing stating the specific concerns about the environmental impacts of the project. The EMB office concerned shall include the concerns in the review process if found valid and may include the complainant among the invitees during the public hearing.

Section 22. Non-reporting by the MMT of actual adverse environmental impacts during project implementation

A letter addressed to EMB-RO copy-furnished the EMB CO shall be submitted as soon as possible. The EMB shall immediately respond to this by conducting an

investigation as soon as possible.

Section 23. Non-compliance with this guidelines by EMB

A letter complaint addressed to the EMB/DENR Office next level higher than the one being complained shall be submitted preferably during or soon after the specific stage of the process where procedures or requirements were allegedly not complied. The letter should cite specific provisions that were violated. The EMB shall respond or try to address this in the next stage of the EIA process, as appropriate.

ARTICLE VI
SUPPLEMENTAL RULES AND REGULATIONS

Supplemental rules and regulations may be issued by the EMB consistent with this administrative order.

ARTICLE VII
EFFECTIVITY AND TRANSITORY PROVISIONS

This Order shall take effect fifteen (15) days after its publication in any newspaper of general circulation.

All Articles shall apply to relevant projects that have not yet conducted public scoping as of the date of effectivity of the DAO. The applicability of the provisions for projects that are currently at the different stages of the EIA Process shall correspond to the relevant provision of the DAO for the specific stage where the project is currently in as of the effectivity of the DAO.

For existing mechanisms/systems for PPwhich needs restructuring/reconstitution including the existing MMTs, one (1) year transition period will be given for these to fully adopt the relevant provisions of this Administrative Order.

ARTICLE VIII
REPEALING CLAUSE

All rules and regulations found inconsistent herewithshall be superseded by this Administrative Order.

REGINA PAZ L. LOPEZ
Secretary

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DENR ADMINISTRATIVE ORDER
NO. 2020 - 07

SUBJECT : **RATIONALIZING DREDGING ACTIVITIES IN HEAVILY-SILTED RIVER CHANNELS PURSUANT TO THE DENR-DPWH-DILG-DOTR JOINT MEMORANDUM CIRCULAR NO. 1 SERIES OF 2019**

Pursuant to Section 2, Article XII of the 1987 Constitution, the Department's mandate under Executive Order No. 292 or the Administrative Code of the Philippines, and Section 5.4 of DENR-DPWH-DILG-DOTr Joint Memorandum Circular No. 2019-01, in order to protect and properly manage the disposition of sand as well as restore the natural state and water flow of the heavily-silted river channels within the country, the following guidelines are hereby prescribed:

I.

GENERAL PROVISIONS

Section 1. *Coverage*. This Order shall cover the implementation of the DENR River Restoration thru Dredging Activities as embodied in Section 5.4 of the DENR-DPWH-DILG-DOTr Joint Memorandum Circular No. 2019-01 in heavily-silted river channels within the country.

River restoration through dredging activities for the provinces of Zambales, Oriental Mindoro, and Negros Occidental are governed by DENR Administrative Order Nos. 2019-13, DAO 2019-14, and DAO 2020-01, respectively.

Section 2. *Scope of Operations.* In order to open up heavily-silted river channels, areas starting from the coastline of river deltas extending all the way upstream, in accordance with the DPWH Dredging Master Plan, shall be designated as exclusive River Dredging Zones (RDZ) by the Inter-agency Committee created under Item VII, Section 1 of this Administrative Order. Only dredging activities shall be allowed within the RDZ, quarrying is strictly prohibited.

Section 3. *Rationale and Objectives*

a) The flow of materials and sediment from the upland that flank down major river channels thereby causing its aggradation became the long-term direct culprit of massive flooding.

b) It is necessary to protect and properly manage the utilization of the sand and gravel in heavily-silted river channels to improve the water flow, ensure the integrity of the various protective dikes and infrastructures, thereby reduce risks to lives and properties.

c) In order to restore the natural state and water flow of heavily-silted river channels and improve its hydraulic capacity thereby eliminate flooding, large-scale dredging and desilting operations, based on a comprehensive dredging plan, must be implemented.

Section 4. *Declaration of Policies*

a) The exclusive authority of the province to issue permit to extract sand, gravel and other quarry resources, pursuant to the ordinance of the Sangguniang Panlalawigan, under Republic Act No. 7160 is covered by Section 5.1 of JMC 2019-01 or the Dredging with

Commercial Utilization of Dredged Materials in favor of a mining permit holder under the Industrial Sand and Gravel (ISAG) or Commercial Sand and Gravel (CSAG) quarry permit.

b) River Restoration through Dredging Activities under Section 5.4 of JMC 2019-01 does not cover an ISAG or CSAG regime since the activity to be undertaken is dredging and not quarrying. This will not preclude, however, the entitlement of the province to the share from the commercial disposal of the dredged material in addition to the undertaking of the permit holder to restore the river thru dredging.

c) Local Government Units are entitled to their equitable share derived from the utilization and development of the national wealth within their respective areas under the Section 138 of the Local Government Code of 1991.

d) The State is allowed by the Constitution to enter into agreements with private sector entities to bolster the national economy through the sustainable utilization of minerals.

e) Disposal of dredged or extracted materials under this Order shall be governed by the principle according to which the government expects a reasonable return for its utilization, while holders of dredging clearance expect a reasonable return for its dredging operations while restoring the river to its original state.

Section 5. *No Funding from the Government.* No funding from the government shall be made for the conduct of dredging activities by the private sector. Holders of Dredging Clearance shall provide the financing, technology, management and personnel necessary to implement dredging activities within the exclusive RDZ.

II.

QUALIFICATIONS OF LARGE-SCALE DREDGING OPERATORS

Section 1. *Who May Apply.* Any citizen of the Philippines or a SEC-registered corporation, partnership, or association established to engage in construction, and development and/or dredging operations, with technical and financial capability to undertake large-scale flood control dredging and desilting operation, may apply for a dredging clearance with the Department of Public Works and Highways (DPWH). To implement efficient and cost-effective large-scale dredging operations, individual corporations may pool their resources, organize themselves and apply as a consortium.

Section 2. *Financial Capacity*. Applicants must possess the financial capacity prescribed by the Inter-Agency Committee to undertake dredging operations.

Section 3. *Technical Competence*. In addition to the above requirements, only applicants capable of implementing large-scale dredging activities for flood mitigation or prevention purposes in the heavily-silted river channels, based on their technical knowledge and verifiable previous track record conducting such activities, as prescribed by the Inter-agency Committee, are qualified to undertake dredging operations.

Section 4. ***Other requirements***. In addition to the above-stated requirements, the proponent shall:

a) Deploy all their equipment within 30 days from the Notice to Proceed (NTP) to be issued by the Provincial Government and the equipment shall be under the name of the company, either chartered or leased, and capable of undertaking large scale dredging activity.

b) Post a Cash Bond in the amount to be determined by the Inter-Agency Committee, to be held in an account for the Provincial Government, to ensure compliance with this Order and other applicable environmental laws, rules and regulations.

c) Secure the required clearances from the appropriate government office including a certification of no pending case relating to compliance with existing environmental laws, rules and regulations, and an undertaking that it will never be involved in such.

d) Undertake protection of the rivers banks from erosion and provide necessary engineering intervention to support the vital infrastructures along the river, pursuant to the dredging clearance approved by the DPWH.

e) Secure the necessary permit from the Provincial Government and pay the required National and Local Tax as required by law.

III.

DENR RIVER RESTORATION THROUGH DREDGING ACTIVITIES

Section 1. Local Government Units (LGUs) that are interested in undertaking river restoration through dredging activities in specified heavily-silted river channels within their jurisdiction must submit a letter of intent addressed to the Office of the Secretary.

Section 2. ***Prior Determination of Mineral Contents.*** Upon determination of the RDZ, the Mines and Geosciences Bureau (MGB) shall conduct a survey of the non-metallic and metallic resources on the RDZ. Once a prior determination of the metallic and other valuable materials in economic quantities is established, the proponent shall, in addition to the payment of taxes, pay the corresponding fees prescribed by the MGB.

Section 3. ***Application for Issuance of Dredging Clearance.*** The application for the issuance of Dredging Clearance with the concerned Regional Office of DPWH must be accompanied by the endorsement of the Governor and shall be governed by this Order and other applicable DENR laws, rules and issuances.

Section 4. ***Prescribed Extraction Method.*** Holders of dredging clearance under this Order shall adopt the sequence and mode of extraction approved by the DPWH and implement the same in accordance with the duly approved work program in order to ensure a systematic and responsible extraction/utilization/disposition of sand and gravel from river channels.

Section 5. ***Prescribed Dredging Method.*** In order to restore the natural state and flow of the river and taking into consideration the essential role played by constant sand replenishment, all dredging activities shall be initially conducted at the deltas of heavily-silted river channels, for a period of six (6) months, with the objective of creating navigational channels and providing more depth for passage of dredging vessel/s to implement true flood control measures within the RDZ.

IV.

ENVIRONMENTAL MANAGEMENT

Section 1. ***Environmental Compliance.*** All holders of dredging clearance shall comply with the pertinent laws, rules and regulations on environmental protection, the allocation of funds for environment-related expenditures, environmental impact assessment, and setting up of the contingent liability and rehabilitation fund, among others.

Section 2. Programmatic Environmental Impact Assessment (PEIA) or Strategic Environmental Assessment (SEA) per River Channels. In order to ensure that the river restoration activities and the dredging master plan consider the necessary environmental measures, the EMB Regional Office shall conduct the Programmatic EIA or SEA for each river system in coordination with MGB, DPWH and the Provincial Government. The Provincial Government may be the proponent for the Programmatic EIA and SEA.

Section 3. ***Application for Issuance of ECC.*** Upon issuance of the dredging clearance by the DPWH to the dredging operator, all ECC applications for large-scale dredging in heavily-silted river channels shall be filed with the EMB Regional Office.

Section 4. *Extraction Limit.* In view of the large-scale river dredging operations involving the heavily-silted river channels within the RDZ and its high replenishment rate/s, the issuance of ECC shall not be subject to any extraction limit, provided that:

a) The extraction activities conform with the approved work program in accordance with the DPWH Dredging Master Plan;

b) Assessment of the river systems shall be done by the team composed of representatives from PENRO, CENRO and the MGB every two (2) years; and

c) The maximum allowable extraction conforms to the designated mitigating measures based on the environmental impact assessment.

V.

MEMORANDUM OF AGREEMENT WITH DENR

Section 1. *Authority to Dispose.* A holder of an approved Dredging Clearance shall enter into a Memorandum of Agreement (MOA) with the DENR – Regional Office wherein the holder is granted the authority to dispose materials extracted from the RDZ.

Section 2. *Accreditation as Trader.* All holders of dredging clearance issued by the DPWH or entities duly authorized or contracted by holders of dredging clearance to market and/or commercially dispose dredged or extracted materials should be accredited as traders/retailers/dealers. The Certificate of Accreditation shall be issued by the MGB Regional Office.

Section 3. *Transport Permit.* The MOA executed between the DENR Regional Office and the holder of the dredging clearance who has been accredited as a trader shall include the issuance of Ore Transport Permit (OTP) and/or Mineral Ore Export Permit (MOEP) by MGB Regional Office. *Provided*, that a written notice prior to shipment or transport of dredged and/or extracted suitable materials shall be submitted to the MGB Regional Office for the purpose of monitoring dredging activities in the RDZ.

Section 4. *Excise Tax.* The excise tax on locally extracted or produced non-metallic minerals and quarry resources will be based on the actual market value of the gross output thereof at the time of removal. The Excise Tax shall be timely and completely paid to the nearest Bureau of Internal Revenue Office in the province concerned.

Section 5. *Work Deviation.* Any deviation of more than 15% from the approved work program in any of the activities involved, without the prior concurrence of the DPWH in coordination with the DENR through the MGB Regional Office shall be sufficient ground for the suspension/cancellation of pertinent permits and clearances.

VI.

OPERATIONS PERMIT WITH THE LOCAL GOVERNMENT

Section 1. *Operations Permit.* No Operations Permit, Notice of Award and Notice to Proceed shall be issued by the Provincial Government pursuant to this Order, unless the applicant has secured a dredging clearance for flood control dredging and desilting activities in RDZ from the Regional Office of the DPWH based on the DPWH-issued Dredging Master Plan, a valid MOA with the DENR Regional Office , has been duly accredited as a trader, and has obtained ECC.

Section 2. *Monitoring and Supervision Fee.* A monitoring and supervision fee which shall not be less than five percent (5%) of the market value of the gross output of the materials extracted from the covered area within the RDZ, exclusive of all other taxes, shall be paid to the provincial government for purposes of monitoring and ensuring compliance with this Order and other related issuances.

Section 3. *Extraction Fee*. Suitable materials for commercial disposition shall be subject to extraction fee, to be collected by the Provincial Government, in accordance with the Local Government Code.

VII.

MONITORING AND ENFORCEMENT

Section 1. *Creation of Inter-Agency Committee.* An Inter-agency Committee shall be created, composed of the following:

a) Governor of the Province as Chairperson;
b) DENR Regional Executive Director as Vice-Chairperson;
c) DPWH Regional Director as Member;
d) MGB Regional Director as Member; and
e) EMB Regional Director as Member.

Section 2. *Powers and Functions of the Inter-Agency Committee.* The inter-agency committee shall have the following powers and functions:

a) Serve as oversight for the implementation of this Administrative Order and monitoring of the dredging operations;
b) Shall recommend the suspension and/or cancellation of permits and/or clearances; and
c) Shall propose policies and programs to rationalize the dredging operations.

VIII.

FINAL PROVISIONS

Section 1. *Subjectivity to Other Laws*. This Order shall be subject to the Constitution, and all pertinent laws, guidelines and issuances.

Section 2. *Repealing Clause*. All Orders, issuances, rules and regulations, or parts thereof which are inconsistent with this Order are hereby repealed or modified accordingly.

Section 3. *Separability*. The provisions of this Order are hereby declared to be separable. If any part or provision of this Order shall be declared invalid, the remaining portions or provisions shall not be affected thereby and shall be construed as if it did not contain the particular invalid term or provision.

Section 4. *Suppletory Clause*. In case of violation and/or non-compliance with the provisions of this Administrative Order, the pertinent penal provisions under R.A. 7942, Presidential Decree No. 1586 and other applicable laws, rules and regulation shall be applied suppletory hereto.

Section 5. *Effectivity*. This Administrative Order shall take effect fifteen (15) days following its complete publication in a newspaper of general circulation and registration with the Office of the Administrative Register.

Issued on FEB 27 2020, in Quezon City.

ROY A. CIMATU
Secretary

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
SENR058224

Republic of the Philippines
Department of Environment and Natural Resources
Visayas Avenue, Diliman, 1100 Quezon City
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929-7041 to 43; 929-6252; 929-1668
Website: http://www.denr.gov.ph E-mail: web@denrgov.ph

0 5 NOV 2012

MEMORANDUM ORDER
No. 2012- 02

SUBJECT : **UNIFORM REPLACEMENT RATIO FOR CUT OR RELOCATED TREES**

For uniformity of application of regulations pertaining to the replacement ratio for cut or relocated trees, the following specifications are hereby issued:

1. Tree cutting permits covered by exemptions under "similar activities" of Section No. 2, Item 2.2 of Executive Order No. 23 shall be governed by the Memorandum from the Executive Secretary dated 20 October 2011, or a replacement ratio of 1:100.

2. All tree cutting permits excluded in the said Memorandum dated 20 October 2011 shall be governed by the following:

   2.1 NO replacements shall be applied to planted trees within private lands and forest lands exclusively established for tree plantations/timber production purposes;

   2.2 For planted trees in private and forest lands not covered under item 2.1 tree replacement shall be **1:50** while naturally growing trees on the same areas, including those affected by development projects shall have **1:100** ratio in support of the National Greening Program (NGP) and climate change initiatives of the Government; and

   2.3 In order to facilitate the implementation of tree replacements, seedling donation and identification of common planting sites shall be encouraged for more impact, especially in urban areas. Planted trees removed shall be replaced preferably with indigenous tree species while naturally growing trees shall be strictly replaced with indigenous tree species. All donated seedlings shall be properly recorded and turned-over to the CENRO concerned with jurisdiction over the area while tree planting sites shall be delineated on the ground with the corresponding technical description and map using GPS for ease of monitoring and evaluation purposes.

3. All orders, circulars and/or instructions inconsistent herewith are hereby repealed and/or modified.

FOR GUIDANCE AND STRICT COMPLIANCE.

RAMON J.P. PAJE
Secretary

Let's Go Green

8ENR033870

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
Manila

097.13.DPWH
12-01-2014

DEC 01 2014

DEPARTMENT ORDER)
NO. 139)
Series of 2014 12.01.14)

SUBJECT: GUIDELINES ON RIVER DREDGING OPERATIONS FOR FLOOD CONTROL

Consistent with Section 23 of the amended IRR of the Water Code of the Philippines (PD 1067)[1] and the Mining Industry Coordinating Council Resolution No. 4 dated 30 May 2014, providing, among others, that in the case of river and/or delta dredging activities, the DPWH shall have direct control and supervision.

Hence, this Department Order shall set the guidelines on standardizing the implementation of all DPWH flood control dredging projects with exemption on the scope of remediation options for the treatment of contaminated dredged materials, in order to achieve the positive impact of a dredging project as to increasing the conveyance capacity of rivers as well as mitigating flood damages. Its specifications are as follows:

1. **Surveys**

   The survey works shall include actual on-site bathymetric, topographic and hydrographic surveys in accordance with the survey requirements as called for in the DPWH Design Guidelines Criteria and Standards for Public Works and Highways, Volume I, Part I. Survey and Investigation.

2. **Soil Investigation**

   Any riverbed excavation may cause changes in the river morphology. A reduction in sediment transport from the upstream affects the sediment balance resulting to bed elevation degradation and may cause aggradation in the other reaches, which will be critical in the protection of public structures such as bridges and river structures, hence, sediment yield and transport analysis is necessary. On the other hand, dredging works may introduce the risk for instability of the excavated side slopes and the slopes of existing banks, hence, slope stability analysis shall be undertaken.

   In order to be able to establish the representative riverbed material gradation as well as soil parameters at the banks, soil investigation shall be conducted. Soil investigation shall be in accordance with the requirements as called for in the DPWH Design Guidelines Criteria and Standards for Public Works and Highways, Volume I, Part I. Survey and Investigation for slope stability analysis while shallow borings (about 3.0 to 5.0 m) be undertaken along the riverbed at a minimum of every 200 m intervals for the necessary determination of the representative riverbed material gradation for sediment transport analysis.

[1] "Plans and specifications of structures and devices that affect the direction or level of materials in rivers, lakes and in maritime waters shall be approved by the DPWH, except for irrigation projects", Section 23 of PD 1067

3. Environmental Clearances

Environmental clearances, either a Certificate of Non-Coverage (CNC) or Environmental Compliance Certificate (ECC) for dredging projects shall be secured from the DENR - Environmental Management Bureau.

4. Design and Related Reports

a. The design report shall contain the following:

- Project Impact Analysis
- Purpose and necessity of the dredging project
- Methodology of the hydrologic, hydraulic, sediment yield and transport, scouring and slope stability analyses.
- Hydrologic analysis using HEC-HMS and other acceptable rainfall-runoff analysis
- Hydraulic analysis to determine the existing capacity of the river and water surface profile for with and without dredging works using HEC-RAS in accordance with the memorandum of the Secretary dated June 21, 2011 re: "Upgrades on Flood Control and Road Drainage Standards"
- Sediment yield and transport analysis
- Scouring analysis
- Slope stability analysis

b. Geotechnical investigation report
c. Quantity calculation report
d. Construction methodology report which includes, among others but not limited to the mitigating measures to minimize if not avoid turbidity, spillage and other environmental impacts of dredging works.
e. Identification and designation of disposal areas in accordance with DENR requirements

5. Plan

The plans for dredging works shall contain, but not limited to the following:

- Cover sheet
- Index of drawings
- Location map and vicinity map
- Plan showing location of dumpsite for dredge materials
- General notes, legends/abbreviation and symbols and technical specifications
- Geotechnical investigation
- Typical drawings
- Plan and longitudinal profile and
- Cross sections

6. Standard Requirements

a. The proposed dredging works shall comply with the existing rules and regulations of the Water Code of the Philippines and Section 79.a of DENR Administration Order (DAO) No. 2010-21 which states "No extraction, removal and/or disposition of materials shall be allowed within a distance of one (1) kilometer from the boundaries of reservoirs established for public water supply, archaeological and historical sites or of any public or private works or structures, unless prior clearance from the Government agency(ies) concerned or owner is obtained. No

extraction, removal and/or disposition of materials shall likewise be allowed in offshore areas within five hundred (500) meters distance from the coast to two hundred (200) meters from the mean low tide."

b. The proposed dredging works shall likewise comply with Section 19.b of RA 7942 (Philippine Mining Act of 1995) and Section 15.b.2. of DENR Administration Order (DAO) No. 2010-21, pertaining to one of the areas close to mining applications, which states "near or under public or private buildings, cemeteries, archaeological and historical sites, bridges, highways, waterways, railroads, dams or other infrastructure projects or public or private works including plantations or valuable crops except upon written consent of the Government agency or private entity concerned".

c. The proposed dredging works shall be in accordance with the approved plan and specifications. Note that top edge of dredging works shall not be closer than 10 meters from existing riverbanks and/or river structures such as dikes, revetment, spur dikes and other river training structures.

d. The necessary permits shall be secured from/and paid to the proper Government Agency/(ies).

e. In case where a dredging proponent is concerned, any damage to the existing private and public utilities adjacent to the proposed dredging works, including the loss of lives, if any that may result shall be the sole responsibility of the dredging proponent. Such damages to the existing private and public utilities shall be reconstructed/repaired to its original form in accordance with the DPWH standards and specifications at the expense of the proponent.

f. The DPWH through its regional offices shall supervise and monitor the dredging activities.

g. "As-Built" plan shall be prepared upon the completion of the dredging project.

Any violation thereof, particularly on the aforementioned provisions of the Standard Requirements should be reported to the LGU or DENR concerned for their appropriate action or possible revocation of permits especially when the dredging operation threatens the stability of any DPWH infrastructure project.

7. Approval of Plan and Permits

Approval of plan and the requested permit to dredge shall be issued by the concerned DPWH offices in accordance with its delegated authorities, upon clearance from the DENR.

This Department Order supersedes all other issuances inconsistent herewith and shall take effect immediately.

Please be guided accordingly.

ROGELIO L. SINGSON
Secretary

Department of Public Works and Highways
Office of the Secretary
WIN4I02517

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
Manila

097, 13 DPWH
06-23-2016

21 JUN 2016

DEPARTMENT ORDER)
)
NO. 130)
Series of 2016 06.23.16)

SUBJECT: Guidelines For The Implementation Of The Provisions Of Republic Act No. 6685 and Republic Act No. 9710 or the Magna Carta of Women

Pursuant to Section 7 of RA 6685 ***and in accordance with Republic Act (RA) No. 9710 or the Magna Carta of Women (MCW), relevant labor and social legislations and international standards on decent work and gender equality*** the following Implementing Rules and Regulations are hereby issued:

1. The mandatory minimum percentage of 50% of the unskilled labor requirement shall be recruited ***and be equally accessible to both women and men,*** as follows:

   1.1 First priority shall be recruited from the unemployed bona fide residents of the locality/(barangay) where the project is being undertaken who are ready, willing and able as determined/certified by the City Mayor or Municipal Mayor concerned;

   1.2 If the unskilled labor requirement is not fully met by the recruitment pursuant to item 1.1 above, the deficiency shall be recruited from the unemployed bona fide residents of neighboring barangays of the city/municipality where the project is being undertaken who are ready, willing and able as determined/certified by the City Mayor or Municipal Mayor concerned;

   1.3 If still the unskilled labor requirement is not fully satisfied after the recruitment pursuant to items 1.1 and 1.2 above, then the deficiency shall be recruited from the unemployed bona fide residents of the province where the project is being undertaken who are ready, willing and able as determined/certified by the Governor.

2. The mandatory minimum 30% of the skilled labor requirement shall be recruited ***and be equally accessible to both women and men,*** as follows:

   2.1 First priority shall be recruited from unemployed bona fide residents of the locality (barangay) where the project is being undertaken who are ready, willing and able as determined by the City Mayor or Municipal Mayor concerned;

   2.2. If the skilled labor requirement is not fully met by the recruitment pursuant to item 2.1 above, the deficiency shall be recruited from the unemployed bona fide residents of neighboring barangays of the city/municipality where the project is being

undertaken who are ready, willing and able as determined/certified by the City Mayor or Municipal Mayor concerned;

2.3 If still the skilled labor requirement is not fully satisfied after the recruitment pursuant to item 2.1 and 2.2 above then deficiency shall be recruited from the unemployed bona fide residents of the province where the project is being undertaken who are ready, willing and able as determined/certified by the Governor.

3. In case of a project traversing two or more barangays/municipalities/cities/provinces, the labor requirement shall be recruited proportionately from the localities traversed by the project.

4. The Implementing Office (DPWH Regional Office/District or City Engineer's Office) shall, upon publication of the Invitation for Prequalification to Bid, advise the concerned City/Municipal Mayor or Governor, as the case may be, of the project to be bid and the labor requirements thereof and shall likewise advise them to submit a list ***of sex-disaggregated*** able, qualified and willing laborers (unskilled and skilled) in their respective localities, from which listing, the contractor shall select for employment the labor requirements of the project.

   This sex-***disaggregated*** list of laborers shall be submitted and be made available ***and accessible*** to the contractor upon award of the contract and before the Notice to Proceed is issued. In case of non-submission of this list within the period above-stated, the contractor has the option to employ the labor requirements, but preferably laborers from the barangay or locality where the project is located. Finally, this process of labor recruitment shall be coordinated with the DOLE Regional Office/Community Employment Center.

5. The above-mentioned Implementing Office shall see to it that the Instructions to Bidders and Trader Documents include a provision for strict compliance with RA 6685 and that the penalty clause provision thereof is included in the Conditions of the Contract to be entered into.

6. In the pre-bid conference, the Prequalification Bids and Awards Committee shall discuss and disseminate to all prequalified bidders the provisions of RA 6685 and emphasize to the bidders concerned that the organization chart for the project under bid, which shall accompany the bid proposal, must indicate the total number of the skilled and unskilled labor requirements of the project in which the mandatory minimum 50-30% local labor recruitment shall be based; otherwise, appropriate sanctions as provided by law/ regulation may be imposed.

7. Upon award of the contract and after the contractor has signed the contract and submitted the requirements for the approval of the contract, the contractor shall inform the concerned DOLE Regional Office – *(Community Employment Center-CEC)* ***Public Employment Services Office (PESO)*** of the (manpower) ***human resource*** requirements of the project so that the ***PESO*** can provide recruitment assistance to the contractor. The contractor shall then cause the posting of the "Notice of Labor

Requirements" in conspicuous areas (municipal hall, churches and project site) as specified and designated by the District, Provincial, City or Municipal authorities in either English or Filipino or in any local dialect***/language***, announcing that local residents are needed as laborers for the project. The notice shall contain the basic project information and instruction to responding labor applicants on where and when to register to the DOLE/(CEC)***PESO*** and to bring with them the necessary identification papers such as Voter's ID, Residence Certificate and/or certification from the Barangay Captain or in the absence of the Barangay, any other member of the Barangay Council that they are bona fide and actual residents of the place/locality where the project is being undertaken.

8. The "Certificate of Compliance" under oath to be submitted by the contractor/subcontractor as among the requirements for every progress billing, pursuant to Section 5 of RA 6685, shall be counter-checked by the District, Provincial or City/Municipal Engineer concerned before effecting the payment to ensure compliance.

9. ***The DPWH, concerned local government unit/s and Contractors/Sub-contractors shall purposively employ women, to comprise at least 20% of total workforce in skilled or unskilled positions, in various phases and stages of construction/civil work, from planning, design, pre-construction and construction and maintenance for each particular project. To facilitate the implementation of this provision, the aforementioned entities are hereby enjoined to closely coordinate with the Philippine Commission on Women (PCW), the Department of Education (DepEd), the Commission on Higher Education (CHED) and the Technical Education and Skills Development Authority (TESDA) on training provision and the maintenance of a sex-aggregated list of trained and qualified students on non-traditional skills as prescribed in 1.B, Section 16 of the Implementing Rules and Regulations (IRR) of the MCW. Close coordination with local officials of barangays where a project is being implemented is also advised as a means of recruiting sufficient number of females for available positions.***

   The DPWH, concerned local government unit/s and Contractors/Sub-contractors are also enjoined to develop their own programs to intensify women's participation in construction/civil work and to support the contractors in meeting the 20% female labor requirement.

10. ***The DPWH, concerned local government unit/s and Contractors/Sub-contractors are also enjoined to develop their own programs to intensify women's participation in construction/civil work. They shall likewise ensure that necessary protective measures and mechanisms, such as RAs 7877 - Anti-Sexual Harassment Policy, 10151 Employment of Night Workers, are set in placed to make the working environment friendly to both women and men.***

11. ***The DPWH Regional Directors/District Engineers/Project Engineers shall, during periodic site visits, monitor and report on the Contractor's/Sub-contractors compliance to the above-mentioned provision.***

Pursuant to Sections 7 and 8 of RA 6685 these implementing rules and regulations shall take effect immediately upon issuance thereof and shall apply to all contracts for infrastructure projects of the national, provincial, city and municipal government.

This Order supersedes Department Order No. 51 s. 1990 and shall take effect immediately.

ROGELIO L. SINGSON
Secretary

4.1.4 LDMC/RBdR

Department of Public Works and Highways
Office of the Secretary
WIN6Q41514

REPUBLIC OF THE PHILIPPINES
Department of Public Works and Highways
Department of Environment and Natural Resources
Department of the Interior and Local Government
Department of Transportation

JOINT MEMORANDUM CIRCULAR

No. 01
Series of 2019

DOTr
OFFICE OF THE SECRETARY
RECEIVED
MAR 14 2019
BY: 19 TIME: 001599

TO :

SUBJECT : Guidelines on the Issuance of Clearance and/or Permit for Dredging Within Waterways or Other Inland Bodies of Water

1. PURPOSE

This Joint Memorandum Circular (JMC) is being issued for the information and guidance of a qualified person who wish to apply for a clearance/permit to dredge within rivers, river deltas and other inland bodies of water. It prescribes the procedure in the application for the said clearance and/or permit and sets the standard and technical requirements in the planning, design, and implementation of dredging activities defined in the following sections. Further, it defines the roles and responsibilities, and limits of authority of each concerned Office and personnel.

2. SCOPE

The guidelines prescribed in this Joint Memorandum Circular shall be the basis for the processing of applications for clearance and/or permit to conduct dredging where commercial utilization of the dredged materials by the Permittee/Contractor (may include LGUs and other government agencies except DPWH) is involved regardless of whether the proposed dredging is intended to help in the Government's flood control program or solely for material extraction. Likewise, it shall cover dredging projects for flood control and navigation funded and to be implemented by the DPWH or LGUs, either by administration or by contract.

3. LEGAL BASES

3.1 Republic Act 7942 s. 1995 entitled "the Philippine Mining Act of 1995"

Section 2. Declaration of Policy

All mineral resources in public and private lands within the territory and exclusive

Time: _____

S REV 18-3100

economic zone of the Republic of the Philippines are owned by the State. It shall be the responsibility of the State to promote their rational exploration, development, utilization and conservation through the combined efforts of the Government and private sector in order to enhance national growth in a way that effectively safeguards the environment and protects the rights of affected communities.

3.2 Executive Order No. 292, s. 1987 [Book IV/Title XIV-Environment and Natural Resources/Chapter 1-General Provisions]

Section 1. Declaration of Policy

(1) The State shall ensure, for the benefit of the Filipino people, the full exploration and development as well as the judicious disposition, utilization, management, renewal and conservation of the country's forest, mineral, land, waters, fisheries, wildlife, off-shore areas and other natural resources, consistent with the necessity of maintaining a sound ecological balance and protecting and enhancing the quality of the environment and the objective of making the exploration, development and utilization of such natural resources equitably accessible to the different segments of the present as well as future generations.

Section 2. Mandate

(1) The Department of Environment and Natural Resources shall be primarily responsible for the implementation of the foregoing policy.

(2) It shall, subject to law and higher authority, be in charge of carrying out the State's constitutional mandate to control and supervise the exploration, development, utilization, and conservation of the country's natural resources.

3.3 Executive Order No. 292, s. 1987 [Book IV/ Title V-Public Works and Highways/ Chapter 1-General Provisions]

Section 1. Declaration of Policy

The State shall maintain an engineering and construction arm and continuously develop its technology, for the purposes of ensuring the safety of all infrastructure facilities and securing for all public works and highways the highest efficiency and the most appropriate quality in construction. The planning, design, construction and maintenance of infrastructure facilities, especially national highways, flood control and water resources development system, and other public works in accordance with national development objectives, shall be the responsibility of such an engineering and construction arm. However, the exercise of this responsibility shall be decentralized to the fullest extent feasible.

Section 2. Mandate

The Department of Public Works and Highways shall be the State's engineering and construction arm and is tasked to carry out the policy enunciated above.

Section 3. Powers and Functions

The Department, in order to carry out its mandate, shall:

(2) Develop and implement effective codes, standards, and reasonable guidelines to ensure the safety of all public and private structures in the country and assure efficiency and proper quality in the construction of public works;
Ascertain that all public works plans and project implementation designs are consistent with current standards and guidelines.

3.4 Amended IRR of the Water Code of the Philippines

Section 32. When Permit/Authority from the Department of Public Works and Highways is required

A permit/authority shall be secured from the Department of Public Works and Highways in the following instances:

a) Construction of dams, bridges and other structures in navigable or floatable waterways;

b) Cultivation of river beds, sand bars and tidal flats upon clearance from DENR;

c) Construction of private levees, revetments and other flood control and river training works; and

d) Restoration of river courses to former beds.

3.5 Mining Industry Coordinating Council Resolution No. 4 - "Adoption of Measures to Address the Black Sand Mining Operations in the Country" dated May 30, 2014, Item (c) of the dispositive portion

c) That in the case of river and/or river delta dredging activities, the Department of Public Works and Highways as the mandated agency, shall have the direct control and supervision of said activities, and that only the same activities as supervised by the DPWH may be issued with MPPs by the DENR-MGB, for the processing and disposition of the dredged materials upon clearance by the DPWH and in accordance with the pertinent provisions of RA 7076: "People's Small-Scale mining Act of 1991", EO No 79 and other applicable laws, and rules and regulations.

4. ACRONYMS AND DEFINITION OF TERMS

4.1 Acronyms

CNC - Certificate of Non-Coverage

CMRB - City Mining Regulatory Board

DENR - Department of Environment and Natural Resources

DILG - Department of the Interior and Local Government

DOTr - Department of Transportation

DPWH - Department of Public Works and Highways

ECC - Environmental Compliance Certificate

LGU - Local government unit

MGB - Mines and Geosciences Bureau

MPP - Mineral Processing Permit

PMRB - Provincial Mining Regulatory Board

PPE - Personal Protective Equipment

4.2 Definition of Terms

For the purpose of this JMC, the following definition of terms shall be adopted:

Applicant – Qualified Person seeking a mining permit/contract and/or dredging clearance.

Buffer Zone – A ten (10) meter easement measured from the toe of existing riverbanks and/or river structures, such as dikes, revetment, nose of spur dikes and other river training structures, towards the river main channel.

Commercial Utilization – the act of trading the dredged materials to whatever purpose it may serve in the market

Control Map – a map of geographic locations and limits of all proposed, on-going and completed dredging operations.

Dredging – excavation operation done within waterways or other inland bodies of water with the purpose of gathering up bottom sediments and disposing them at a different location (for flood control, navigation, reclamation, beach nourishment, environmental remediation, mining and construction).

Dredging Clearance – clearance issued by the DPWH to qualified persons who will conduct dredging with commercial utilization

Dredging Permit – authority issued by DPWH to LGUs and other government agencies which will conduct dredging without commercial utilization of dredged materials.

Dredged Materials	–	refers to materials taken from the riverbed, lakebed and/or seabed.
Mining Operations	–	mining activities involving exploration, feasibility study, development and utilization.
Mining Permits	–	include Exploration, Quarry, Sand and Gravel (Commercial, Industrial and Exclusive), Gratuitous (Government or Private), Special Mineral Extraction Permit (SMEP), Guano, Gemstone Gathering and Small-Scale Mining Contracts.
Permittee/ Contractor	–	holder of mining permit/contract and/ or dredging permit.
Qualified Person	–	defined under Republic Act 7942 as any citizen of the Philippines with capacity to contract, or a corporation, partnership, association, or cooperative organized or authorized for the purpose of engaging in mining, with technical and financial capability to undertake mineral resources development and duly registered in accordance with law at least sixty per centum (60%) of the capital of which is owned by citizens of the Philippines: Provided that a legally organized foreign-owned corporation shall be deemed a qualified person for purposes of granting an exploration permit, financial or technical assistance agreement or mineral processing permit. For the purpose of this JMC, Qualified Person shall include LGUs.
Quarrying	–	the process of extracting, removing and disposing quarry resources found on or underneath the surface of private or public land.
River delta	–	coastal accumulations, both subaqueous and subaerial of river-derived sediments adjacent to, or in close proximity to the source stream, including the deposits that have been secondarily molded by various marine agents such as waves, currents, or tides
Spoil Site	–	an environmentally acceptable, open or confined, geographical area– inland or offshore, sustainable for the disposal, containment, and management of dredged materials.
Standard Requirements	–	general and technical requirements/conditions
Statutory Requirements	–	rules and regulations as prescribed by state existing laws and policies.

5. APPLICATION FOR CLEARANCE/PERMIT

To ensure timely and efficient action on applications for clearance and/or permit for dredging, the following procedure shall be followed:

5.1 Dredging with Commercial Utilization of Dredged Materials

1) Any qualified person who intends to apply for a mining permit for the commercial utilization of dredged materials shall seek endorsement (LGU Resolution) from the concerned LGU(s) that may be affected by the clearance/permit application. The 2 out of 3 rule shall be applied, e.g., endorsement of at least 2 of the 3 LGU levels (provincial, city/municipal and barangay).

   In case area is covered by ancestral domain, free and prior informed consent shall be obtained from the NCIP.

2) Upon obtaining the required endorsement from the concerned LGUs, the Applicant shall file an application for mining permit with the complete set of requirements, including electronic file of survey data, together with the Work Program (MGB Form No. 5-4 or 6-2), required under Section 74 of DAO 2010-21 (IRR of RA 7942), with the:

   a. Provincial/City Mining Regulatory Board for areas covering not more than five (5) hectares

   b. MGB Regional Director for areas more than five (5) hectares but not more than twenty (20) hectares.

   c. DENR Secretary for areas more than twenty (20) hectares but not more than one-hundred (100) hectares.

   Provided further that only one permit shall be granted to a qualified person in a municipality at any one time under such terms and conditions.

   Any application for mining permit that transcends into two (2) or more regions/provinces/cities shall be filed with the Regional Office/Provincial/City Mining Regulatory Board which has the largest area covered by the application, copy furnished the other Regional Office(s)/Provincial/City/Mining Regulatory Board concerned.

3) The concerned P/CMRB or the DENR-MGB Regional Office shall check in the control maps if the area is free/open for mining application. The "First time-in Principle" shall be strictly observed in receiving of dredging application based on the date and time of receipt of application. P/CMRB shall endorse the application to the MGB Regional Office for Area Status Clearance prior to processing the application. If the area is found to be within areas open to mining and has fully complied the mandatory requirements, the applicant shall pay the prescribed filing fee on the same working day or within eight (8) working hours.

4) The concerned P/CMRB or the DENR-MGB Regional Office shall endorse the application to the concerned DPWH District Engineering Office (DEO) to check if the area is covered by existing application for dredging permit/clearance or flood control project. The DPWH DEO after checking its control map shall inform the P/CMRB or the DENR-MGB Regional Office on the results of its evaluation.

5) A Notice of Application for Mining Permit shall be issued by the P/CMRB or the DENR-MGB Regional Office. The applicant shall cause the publication of the Notice of Mining Application once in two (2) newspapers: one of general circulation published in Metro Manila and another published in the municipality or province where the proposed area is located.

6) The Applicant shall submit to the DPWH DEO all the documentary requirements prescribed under Section 6 of the JMC.

7) The DPWH District Engineer shall investigate each application filed with the DEO, and if necessary, conduct public hearings thereon and shall transmit his report and recommendation to the DPWH Regional Director who, after proper review, shall transmit the application with its supporting documents and recommendations to the DPWH Secretary or his duly authorized official for appropriate action. If deficiencies or non-conformities are found, the Applicant shall immediately be notified for rectification.

8) Upon evaluation and the application is found in order, the DPWH shall approve the dredging plans and issue a dredging clearance to the Applicant signed by the DPWH Secretary or his duly authorized official.

9) The Applicant shall secure the necessary Environmental Clearance (Certificate of Non-Coverage (CNC)/Environmental Compliance Certificate (ECC)).

10) The DENR-MGB Regional Office or Provincial/City Mining Regulatory Board concerned shall then approve/issue the mining permit after the issuance of the CNC/ECC and shall notify the Permittee/Contractor to cause the registration of the same within fifteen (15) working days from receipt of the written notice. Registration is effected only upon payment of the required fees, taxes and other charges. The DENR-MGB Regional Office concerned shall officially release the mining permit to the Permittee/Contractor after registration.

11) The DENR-MGB Regional Office concerned shall also furnish the duly registered mining permit to the concerned Provincial Governor and Municipal Mayor copy furnished the Barangay Chairman together with the approved work program and dredging plan.

12) The Permittee/Contractor shall notify the DPWH DEO/RO on its implementation schedule

13) The transport of dredged materials by a permit holder must be accompanied by an Ore Transport Permit (MGB Form No. 12-1) issued by the concerned P/CMRB and/or DENR-MGB Regional Director prior to the transport of dredged material pursuant to Chapter XII Section 117 of Administrative Order No. 2010 – 21.

14) If the dredged material shall be transported outside the Philippines, the applicant shall apply for a Mineral Ore Export Permit (MOEP) from the Office of the Provincial Governor or the DENR-MGB Regional Director concerned pursuant to the applicable provisions of DAO No. 2008 – 20 and DMO No. 2009 – 01.

5.2. DPWH Flood Control Dredging Projects

DPWH dredging projects for flood control involve the excavation, vertical transport and placement of the dredged materials into designated spoil site but without commercial utilization of the same. Such projects are implemented by the DPWH through its Unified Project Management Office for Flood Control Management Cluster (UPMO-FCMC), Regional Offices and/or District Engineering Offices, either by administration or by contract, and shall be in conformity with existing relevant DPWH guidelines and issuances.

1) The DPWH Implementing Office (IO) shall prepare all the documentary requirements prescribed under Section 6 of this JMC and other DPWH issuances.

2) Upon approval of the plans in accordance with the delegated authorities, the IO shall secure a CNC/ECC from the Environmental Management Bureau, DENR, attaching the approved plans to the application.

5.3. Dredging Projects for flood control, navigation and other purposes to be funded and implemented by the LGUs and other government agencies without commercial utilization

1) The Applicant after obtaining LGU Resolution, shall file an application for dredging permit before the DPWH DEO concerned.

2) The DPWH DEO shall check its control map if the proposed area is covered by existing application for dredging permit/clearance or approved flood control project. If the area upon is found clear of any dredging permit/clearance applications or flood control project, the DPWH shall advise the Applicant to prepare all the requirements under Section 6 of this JMC. Subsequently, the DPWH shall update its control map.

3) The complete set of requirements shall be submitted by the Applicant, to the DPWH DEO. The designated spoil site shall be evaluated and use of dredged materials clearly indicated. If deficiencies or non-conformities are found, the Applicant shall be immediately notified for compliance and rectification.

4) The applicant LGU and other government agencies i.e. DENR, Philippine Reclamation Authority and others, shall issue a certification that there is no commercial utilization of the dredged materials and that there is no intent to use the dredged materials other than that as specified in the application for permit.

5) The DPWH District Engineer shall investigate each application filed with the DEO, and if necessary, conduct public hearings thereon and shall transmit his report and recommendation to the DPWH Regional Director who, after proper review, shall transmit the application with its supporting documents and recommendations to the DPWH Secretary or his duly authorized official for appropriate action.

6) Upon evaluation and the application is found in order, the DPWH shall approve the dredging plans and require the Applicant to secure the necessary Environmental Clearance (Certificate of Non-Coverage (CNC) or Environmental Compliance Certificate (ECC)).

7) The DPWH Secretary or his duly authorized official shall then approve/issue the dredging permit.

8) The Permittee shall notify the DPWH on its implementation schedule.

5.4 DENR River Restoration through Dredging Activities

DENR River Restoration through dredging activities in heavily silted river channels, including disposal of extracted materials, shall be covered by a separate Order to be issued by the DENR in coordination with DPWH. Issuance of the dredging permit/clearance by the DPWH shall be based on the Detailed Engineering Design Plans.

6. REQUIREMENTS FOR PLANNING AND DESIGN STAGE

6.1 Pre-dredging Survey

Pre-dredging survey shall be undertaken by the proponent to serve as basis for the computation of volume to be dredged, identification of appropriate equipment to be used, calculation of project duration, and establishment of necessary control measures. The survey works shall include topographic, hydrographic, bathymetric survey, and water quality surveys in accordance with the DPWH Design Guidelines, Criteria and Standards (DGCS) 2015, Volume 2B – Engineering Surveys.

1) In areas affected by tidal action (rise and fall of water) such as seabed, estuary, coastal area, etc., all elevations shall be referred to the mean lower low water (MLLW) datum, elev. 0.00.

2) In areas not affected by tidal action such as riverbed, floodway channel, creek or estero, etc., all elevations shall be referred to a bench mark (BM) of known coordinates and elevation based on mean sea level (MSL) established by the National Mapping and Resource Information Authority (NAMRIA).

3) Profile shall be taken along the centreline, left and right banks and deepest river bed of the river all through out the required stretch extending twice the length of the proposed limits on the upstream and downstream of the proposed dredging project.

4) All cross sections shall be taken facing downstream spaced as required in DPWH DGCS 2015 Volume 2B – Engineering Surveys and shall be properly indicated and noted in the plans. Cross sections shall be extended at least 20 meters from both banks to the land side.

6.2 Soil Investigation

In order to establish the representative riverbed material gradation as well as soil parameters at the banks, soil investigation and sediment transport analysis shall be conducted in accordance with DPWH DGCS 2015, Volume 2C – Geological & Geotechnical Investigations.

6.3 Design and Related Reports

a. The design report shall contain the following:
- Project Impact Analysis
- Purpose and necessity of the dredging project
- Methodology of the hydrologic, hydraulic, sediment yield and transport, scouring and slope stability analyses
- Hydrologic analysis using HEC-HMS and/or other acceptable rainfall-runoff analysis software
  Hydraulic analysis to determine the existing capacity of the river and water surface profile for with and without dredging works using HEC-RAS and/or other acceptable river hydraulic analysis software
- Sediment yield and transport analysis
- Scouring analysis
- Slope stability analysis

b. Geotechnical investigation report

c. Detailed Quantity calculation report

d. Methodology report which includes, among others but not limited to the mitigating measures to minimize if not avoid turbidity, spillage and other environmental impacts of dredging works

e. Identification and designation of spoil site

Based on the surveys and analyses, the proponent shall come up with an optimum channel design profile which shall serve as reference for the execution of the dredging project.

The aforesaid requirements are not necessary if previous elevations of the riverbed are simply to be restored to maintain a certain flood conveyance capacity which will be supported by specific-gauge analysis method, or its equivalent, that assesses trends in river bed elevation changes.

6.4 Design Engineering Design Plan (to be attached to the Dredging Plan as Annex)

The Plan shall contain, but not limited to the following:
- Cover sheet
- Index of drawings
- Location map and vicinity map
- Plan showing location of spoil site for dredged materials
- General notes, legends/abbreviations and symbols and technical specifications
- Geotechnical investigation showing the Borehole Locations and Idealized Soil Profile
- Typical drawings
- Plan and longitudinal profile
- Cross-sections with tabulated estimated quantities

6.5 Dredging Reports

The Dredging Plan shall contain, but not limited to the following:

- Executive Summary
- General Project Information
- Site Description
- Equipment and Operations
- Dredge Positions and Dredging Operation
- Monitoring
- Target volume to be dredged
- List of equipment and other required resources
- Operational Cost Computation
- Timeline and Schedule
- Daily Operations Report
- PPE Needed
- Health and Safety Plan
- Quality Management Plan
- Activity Hazard Analysis
- Hazard and Damage Mitigation Plan

7. STANDARD REQUIREMENTS/TERMS

1) During the planning stage, the applicant must consider the Term of the Mining Permit being applied for in determining the minimum number of equipment to be deployed and in preparing the timeline and schedule of activities.

2) To ensure that the proposed dredging will be completed within the term of the Mining Permit, the applicant is required to attach a proof of technical and financial capability to its application. This shall contain the list of equipment, whether owned or leased, to be used for the proposed dredging, with their corresponding capacities and current location.

3) The extraction, removal and/or disposition of materials under the Permit shall be confined within the area specified therein, the boundaries of which, according to the application, are established on the ground with prominent marks;

4) Taxes and royalties shall be paid by the Permittee/Contractor to the appropriate Government agency.

5) The top edge of dredging works shall not go beyond the buffer zone. For narrow waterways with defined banks and/or existing bank protection on which the aforementioned cannot be applied, the stability of the slope shall be analyzed and the bottom elevation of dredging shall be set not deeper than the top of foot protection, e.g., cutoff wall or pile cap.

6) Dredging works within one (1) kilometer from bridges is prohibited unless prior clearance from the Government agency(ies) concerned is obtained and justification with corresponding analysis that the proposed dredging will not affect the overall stability of the subject bridge is submitted.

7) Allowance for over-dredging must be strictly observed in the design and execution of the dredging project, as specified in the DPWH Standard Specifications for Item 805 – Dredging.

8) The Government authorized representatives shall have the right to exercise visitorial powers over the area as well as to station representative(s) there at.

8. STATUTORY REQUIREMENTS

1) Except for areas allowed by DPWH based on the approved plan, the proposed dredging works shall comply with the existing rules and regulations of the Water Code of the Philippines and Section 79.a of DENR Administration Order (DAO) No. 2010-21.

2) The proposed dredging works shall likewise comply with Section 19.b of RA 7942 (Philippine Mining Act of 1995) and Section 15.b.2. of DENR Administration Order (DAO) No. 2010-21, pertaining to one of the areas closed to mining applications, which states "near or under public or private buildings, cemeteries, archaeological and historical sites, bridges, highways, waterways, railroads, dams or other infrastructure projects or public or private works including plantations or valuable crops except upon written consent of the Government agency or private entity concerned".

3) Pursuant to PD 1151, Philippine Environmental Policy, the proponent shall prepare, file and include in every action, project or undertaking which significantly affects the quality of the environment a detailed statement on:

   a. the environmental impact of the proposed action, project and undertaking;

   b. any adverse environmental effect which cannot be avoided should the proposal be implemented;

   c. alternative to the proposed action;

   d. a determination that the short-term uses of the resources of the environment are consistent with the maintenance and enhancement of the long- term productivity of the same; and

   e. whenever a proposal involves the use of depletable or non-renewable resources, a finding must be made that such use and commitment are warranted.

The result of the Environmental Impact Assessment is documented and submitted to the Environmental Management Bureau, DENR, for review and evaluation as basis for issuance of Environmental Compliance Certificate.

4) In accordance with DAO No. 2010 – 21, if results of exploration reveal the presence of mineral deposits economically and technically feasible for mining operations, the Permittee shall, within the term of the Exploration Permit, file a declaration of mining project feasibility.

5) Insert "All dredging operations with mining permits shall comply with R.A. No. 7942, RA 7076, and their implementing rules and regulations, and other applicable laws, rules and regulations.")

9. APPROVAL OF PLANS AND PERMITS

The Project Design Report and Plans for proposed dredging work shall be submitted to the concerned DPWH Regional Office for review and evaluation. Whereas, for dredging areas that transcend two or more regions, the requirements shall be submitted to the Office of the Secretary, DPWH. Approval of plans shall be in accordance with the delegated authorities for this JMC. The DPWH Secretary or his duly authorized official shall approve the dredging permit or clearance whichever is applicable.

Approval and issuance of appropriate mining permits/contracts shall be in accordance with the Philippine Mining Act of 1995 and its Implementing Rules and Regulations, and other relevant issuances.

10. IMPLEMENTATION AND MONITORING

1) Before any activity could be started on site, the DPWH and the DoTr, through the Bureau of Equipment of the DPWH and the Philippine Coast Guard, respectively, shall inspect and validate all equipment stated in the proof of technical capability of the Permittee.

2) As-Staked plan shall be prepared by the Permittee after the conduct of pre-construction survey and shall comply with the provisions of DPWH Department Order (D.O.) No. 15, series of 2016 to verify the actual field conditions prior to commencement of the project.

3) Proper station markers must be established to delineate boundaries of the dredging area.

4) The dredging operation shall start at the downstream reaches going upstream as practicable as possible and shall be carried out to the specified depth within the

allowable over-dredging and limited to the scope of the project defined in the Project Design Report and Design Plan.

5) Dredging shall be conducted in a manner that will not adversely affect the safety of navigation and will ensure accommodation of other marine activities such as fishing, aquaculture, transportation, etc.

6) During the project execution, regular monitoring of actual accomplishment against the design profile, lines and grades shall be performed by the oversight agencies. The Permittee shall install water level gauges for ungauged rivers at representative locations to be determined by the DPWH, through the Bureau of Design, for monitoring, assessment and evaluation of the impacts of dredging works.

7) Hydrographic survey of the dredged area must be conducted by the Permittee quarterly, and proper documentation must be submitted to the oversight agencies. This includes the volume dredged, distance advanced, and safety and environmental compliance.

8) Upon reaching the required volume as per approved plan or validity of the permit, a post-dredging survey shall be jointly conducted by the Permittee and the oversight agencies which shall be the basis for the preparation of "As-Built" Plan by the Permittee. The copies of the said "As-Built" Plans by the Permitee shall be submitted to the DPWH Central Office to store for safekeeping and future reference. The DPWH shall verify the final channel profile based on the post-dredging survey against the design profile and shall be the basis for issuance of "close-out clearance". Dredging tolerances shall be carefully examined and necessary measures must be taken prior to project close-out.

11. CANCELLATION/REVOCATION/TERMINATION OF PERMIT

Any permit or clearance issued may be cancelled/revoked/terminated by the DENR Secretary or the DPWH Secretary based on the recommendation of any member of the Inter-Agency Monitoring Committee after due process based on any of the following grounds:

a. Failure to comply with the terms and conditions of the Permit and/or ECC;

b. Failure to pay fees, royalties and taxes due to the government without valid grounds;

c. Falsehood or omission of facts in the application for permit/clearance which may alter, change or affect substantially the facts set forth in the said statements;

d. Any violations on the standard requirements listed in Section 7, especially when the dredging operations threatens the stability of any public infrastructure; and

e. Violation of existing laws, policies and regulations.

The DENR Regional Director may immediately issue an Interim Cease and Desist Order (CDO) where there is a prima facie evidence of the above grounds which shall be effective for a period not longer than seven (7) days. The Interim CDO shall be considered a regular CDO upon confirmation of the Board or the DENR Secretary, as the case may be. Such confirmation may only be made prior to the lapse of the interim CDO.

12.INTER-AGENCY MONITORING COMMITTEE

An inter-agency monitoring committee composed of representatives from the DENR, DPWH, DILG and the Philippine Coast Guard shall be created to monitor the implementation of projects issued with permit guided by this JMC and ensure that all provisions of this JMC are strictly observed at all times.

The roles and responsibilities are as follows:

12.1 Department of Environment and Natural Resources (DENR)

a. The DENR shall monitor the compliance of the dredging operation to the terms and conditions of the ECC and the Mining Permit/Contract.

b. It shall ensure that only the quantity of materials allowed in the mining permit/contract are extracted and/or transported, and that taxes and royalties are paid by the Permittee/Contractor.

12.2 Department of Public Works and Highways (DPWH)

a. The DPWH shall regularly monitor and check conformance of the dredging operation with the Dredging Permit/Clearance, Dredging Plan and approved design specifications.

b. In addition, the DPWH shall check if the equipment on-site conform/s with the equipment declared by the Permittee in the proof of technical and financial capability and pledged by the Permittee for the project.

c. The DPWH shall recommend the suspension/revocation of the permit for the operation should the Permittee fail to declare all the equipment used for the actual operation, or should the Permittee lack the necessary equipment to accomplish the project within the term of the permit.

d. The DPWH shall also maintain and update a control map delineating the boundaries of areas covered by approved dredging permit/clearance or with application for such permit. The control map shall contain also the ongoing flood control projects of the DPWH as well as projects programmed for the following five (5) years.

12.3 Department of the Interior and Local Government (DILG)

a. Ensure the compliance of all LGU in enforcing this circular and other applicable laws
b. Ensure that all LGUs comply with the existing environmental laws and regulations.

12.4 Department of Transportation (DoTr)

a. The DoTr, through the Philippine Coast Guard, shall monitor and ensure that the vessels employed by the Permittee are fit for purpose, and that measures are taken in order to ensure the protection of the environment and personnel during the operation of these vessels.

13.PENAL PROVISION

Pursuant to Sec. 102 of RA 7942, any person undertaking exploration work without the necessary permit shall, upon conviction, be penalized by a fine of not exceeding Fifty Thousand Pesos (P50,000.00). Hence, any dredging operation undertaken with intent to *transport the dredged material either for utilization or commercial disposition without the* appropriate permit shall be penalized accordingly.

In addition, pursuant to Sec. 103 of RA 7942, any person extracting minerals and disposing the same without a mining agreement, lease permit, license, or steals minerals and ores or the products thereof from mines or mills or processing plants, shall, upon conviction, be imprisoned from six (6) months to six (6) years or pay a fine from Ten Thousand pesos (P10,000.00) to Twenty Thousand Pesos (P20,000.00), or both, at the discretion of the appropriate court. In addition, he shall be liable to pay damages or compensation for the minerals removed, extracted, and disposed of. In the case of associations, partnerships, or corporations, the president and each of the directors thereof shall be responsible for the acts committed by such association, partnership, or corporation. Penal provisions under mining act shall apply for mining contracts/permits.

14.TRANSITORY PROVISION

All entities issued with mining permit/contract on or before the signing of this Joint Memorandum Circular, but did not undergo DPWH evaluation, may continue their operation until the expiration of the term of the permit. Renewal or extension of the Permit/Contract shall be covered by these guidelines.

15.SEPARABILITY CLAUSE

If any clause, sentence, section or provision of these implementing rules and regulations is held or declared to be unconstitutional or invalid by a competent court, the remaining parts of these implementing rules and regulations shall not be affected thereby.

16. REPEALING AND AMENDING CLAUSE

All issuances inconsistent with or contrary to the provisions of these Joint Memorandum Circular are hereby repealed or modified accordingly.

17. EFFECTIVITY

This Joint Memorandum Circular shall take effect fifteen (15) days following its complete publication in two newspapers of general circulation, and fifteen (15) days after registration with the office of the National Administrative Register.

MARK A. VILLAR
DPWH Secretary

ROY A. CIMATU
DENR Secretary

EDUARDO M. AÑO
DILG Secretary

ARTHUR P. TUGADE
DOTr Secretary

ANNEX L – ENVIRONMENTAL COMPLIANCE CERTIFICATE

Republic of the Phillippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU XI
OFFICE OF THE REGIONAL DIRECTOR
3rd Avenue corner V. Guzman St., Brgy. 27-C, Sta. Ana, Davao City
Email address: embdavao@emb.gov.ph / website: r11.emb.gov.ph / Tel No.:(082)234-0061

15 August 2022

ECC-R11-2208-0007

PROJECT DIRECTOR RAMON A. ARRIOLA III
Department of Public Works and Highways –
Flood Control Management Cluster (UPMO-FCMC),
DPWH 2nd St., Port Area, Manila

Subject: **ENVIRONMENTAL COMPLIANCE CERTIFICATE**

Dear **PD Arriola**:

This refers to your application for an Environmental Compliance Certificate (ECC) for the proposed **Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)** to be located in Brgys. Bucana, 5-A, 1-A, 2-A, 3-A,8-A,19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City.

After satisfying the requirements of Presidential Decree No. 1586 and its Implementing Rules and Regulation, this Bureau has decided to grant an ECC for the above-mentioned project.

In this regard, the proponent is expected to fully implement the measures presented in the Environmental Impact Statement (EIS), intended to protect and mitigate the project's predicted adverse impacts on community health, welfare, and the environment. Environmental considerations shall be incorporated in all phases and aspects of the project.

This certificate does not create any right nor can it be used as an authorization to implement or commence with the operation of the project.

This Office shall be monitoring the project periodically to ensure strict compliance with the stipulations cited in the attached ECC.
Please be guided accordingly.

Very truly yours,

MARIO N. BULACAN, PME, MPA
Regional Director

O.R. No. : 6001838
Processing Fee : 10,000
Date : August 1, 2022

Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU XI
OFFICE OF THE REGIONAL DIRECTOR
3rd Avenue corner V. Guzman St., Brgy. 27-C, Sta. Ana, Davao City
Email address: embdavao@emb.gov.ph / website: r11.emb.gov.ph / Tel No.:(082)234-0061

ENVIRONMENTAL COMPLIANCE CERTIFICATE
(Issued pursuant to Presidential Decree No. 1586 and its IRR)
ECC-R11-2208-0007

THIS IS TO CERTIFY THAT THE PROPONENT, **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS FLOOD CONTROL MANAGEMENT CLUSTER (UPMO-FCMC)**, represented by its Project Director, **RAMON A. ARRIOLA III** is granted this Environmental Compliance Certificate (ECC), for the proposed **Flood Control and Drainage Project in Davao City (Davao River),** by the Department of Environment and Natural Resources (DENR), through the Environmental Management Bureau (EMB).

SUBJECT ONLY to the conditions and restrictions set in this ECC and in the attached document labelled as Annexes A and B.

This Certificate is issued with the following details:

PROJECT DESCRIPTION

The ECC covers the proposed Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)

The said project is an environmental enhancement to alleviate flood in Davao City and shall have the following components:

Component	***Barangays Covered***	***Description***
Component A: Dredging works	Bucana 1-A 2-A 5-A 8-A 19-B Ma-a Tigatto Wa-an Mandug New Carmen	*Davao River (0+500 to 23 km upstream)*
Component B: Cut-off works - cum-bridge	19–B Ma-a Tigatto	*Sta. 6+500 – Sta. 12+700* *2 bridges located in Brgy. Ma-a* • *upstream bridge (near Crocodile Park) at Sta. 11+188* • *downstream bridge at Sta. 8+117*

Environmental Compliance Certificate
Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

Component C: Three (3) Retarding ponds	*Mandug New Carmen New Valencia Callawa*	**Retarding Pond**	**Area (km2)**	**Service capacity (MCM)**	**Excavated Volume (MCM)**
		RP 08	*0.75*	*4.7*	*6.3*
		RP 09	*0.37*	*2.2*	*3.0*
		RP 11	*0.67*	*4.5*	*6.2*

Geographical Coordinates of the project

Component A: Coordinates of the Location of River Dredging works, DFCDMP, 2021

No.	Latitude	Longitude	No.	Latitude	Longitude
1	7° 10' 15.059" N	125° 34' 25.607" E	19	7° 6' 46.089" N	125° 35' 15.670" E
2	7° 10' 0.273" N	125° 34' 23.512" E	20	7° 6' 32.168" N	125° 35' 21.286" E
3	7° 9' 51.585" N	125° 34' 10.648" E	21	7° 6' 23.869" N	125° 35' 34.955" E
4	7° 9' 42.063" N	125° 34' 6.633" E	22	7° 6' 11.406" N	125° 35' 39.589" E
5	7° 9' 35.181" N	125° 34' 21.021" E	23	7° 5' 16.497" N	125° 35' 30.891" E
6	7° 9' 22.770" N	125° 34' 30.726" E	24	7° 5' 1.863" N	125° 35' 34.619" E
7	7° 9' 6.786" N	125° 34' 33.001" E	25	7° 4' 46.394" N	125° 35' 39.241" E
8	7° 8' 53.484" N	125° 34' 40.760" E	26	7° 4' 35.252" N	125° 35' 29.362" E
9	7° 8' 39.063" N	125° 34' 47.952" E	27	7° 4' 23.875" N	125° 35' 20.139" E
10	7° 8' 29.442" N	125° 35' 0.909" E	28	7° 4' 18.339" N	125° 35' 32.843" E
11	7° 8' 16.908" N	125° 34' 57.681" E	29	7° 4' 12.590" N	125° 35' 47.758" E
12	7° 8' 4.969" N	125° 34' 53.851" E	30	7° 4' 0.057" N	125° 35' 57.697" E
13	7° 7' 50.878" N	125° 35' 0.565" E	31	7° 3' 54.638" N	125° 36' 11.982" E
14	7° 7' 42.845" N	125° 35' 13.047" E	32	7° 3' 43.339" N	125° 36' 21.748" E
15	7° 7' 27.955" N	125° 35' 9.194" E	33	7° 3' 28.109" N	125° 36' 17.048" E
16	7° 7' 14.303" N	125° 35' 5.490" E	34	7° 3' 12.285" N	125° 36' 19.740" E
17	7° 7' 7.353" N	125° 34' 53.776" E	35	7° 2' 56.781" N	125° 36' 24.533" E
18	7° 6' 58.631" N	125° 35' 6.718" E	36	7° 2' 47.657" N	125° 36' 27.770" E

Component B : Coordinates of the Location of Cut-off works, DFCDMP, 2021

No.	Latitude	Longitude	No.	Latitude	Longitude
1	7° 6' 10.399" N	125° 35' 36.889" E	12	7° 5' 18.723" N	125° 35' 34.694" E
2	7° 6' 3.969" N	125° 35' 37.418" E	13	7° 5' 25.066" N	125° 35' 36.004" E
3	7° 5' 58.063" N	125° 35' 34.875" E	14	7° 5' 31.308" N	125° 35' 34.586" E
4	7° 5' 53.007" N	125° 35' 30.781" E	15	7° 5' 36.496" N	125° 35' 30.690" E

5	7° 5' 47.786" N	125° 35' 27.056" E	16	7° 5' 42.828" N	125° 35' 29.565" E
6	7° 5' 41.447" N	125° 35' 25.784" E	17	7° 5' 48.727" N	125° 35' 31.973" E
7	7° 5' 35.182" N	125° 35' 27.357" E	18	7° 5' 53.694" N	125° 35' 36.176" E
8	7° 5' 29.935" N	125° 35' 31.184" E	19	7° 5' 59.000" N	125° 35' 39.929" E
9	7° 5' 23.652" N	125° 35' 32.043" E	20	7° 6' 5.317" N	125° 35' 41.240" E
10	7° 5' 17.191" N	125° 35' 29.870" E	21	7° 6' 11.773" N	125° 35' 40.490" E
11	7° 5' 15.107" N	125° 35' 33.115" E			

Component C: Coordinates of the location of retarding ponds, DFCDMP, 2021

No.	Latitude	Longitude	No.	Latitude	Longitude
RETARDING POND 8			***RETARDING POND 11***		
1	7° 11' 57.018" N	125° 33' 34.883" E	1	7° 10' 48.856" N	125° 33' 35.729" E
2	7° 12' 1.411" N	125° 33' 34.390" E	2	7° 10' 46.783" N	125° 33' 37.114" E
3	7° 12' 5.132" N	125° 33' 33.842" E	3	7° 10' 45.018" N	125° 33' 38.655" E
4	7° 12' 8.918" N	125° 33' 31.174" E	4	7° 10' 41.365" N	125° 33' 36.256" E
5	7° 12' 6.322" N	125° 33' 24.230" E	5	7° 10' 38.372" N	125° 33' 35.722" E
6	7° 12' 9.902" N	125° 33' 21.458" E	6	7° 10' 36.609" N	125° 33' 37.057" E
7	7° 12' 16.061" N	125° 33' 19.113" E	7	7° 10' 36.752" N	125° 33' 39.074" E
8	7° 12' 23.287" N	125° 33' 19.826" E	8	7° 10' 38.136" N	125° 33' 40.995" E
9	7° 12' 29.134" N	125° 33' 17.997" E	9	7° 10' 41.377" N	125° 33' 43.289" E
10	7° 12' 34.973" N	125° 33' 17.513" E	10	7° 10' 43.064" N	125° 33' 46.401" E
11	7° 12' 37.527" N	125° 33' 22.440" E	11	7° 10' 43.401" N	125° 33' 50.695" E
12	7° 12' 40.162" N	125° 33' 31.608" E	12	7° 10' 42.290" N	125° 33' 55.446" E
13	7° 12' 40.554" N	125° 33' 35.282" E	13	7° 10' 40.518" N	125° 33' 58.332" E
14	7° 12' 41.205" N	125° 33' 39.010" E	14	7° 10' 38.329" N	125° 34' 1.888" E
15	7° 12' 40.044" N	125° 33' 43.347" E	15	7° 10' 31.831" N	125° 34' 9.505" E
16	7° 12' 36.252" N	125° 33' 47.256" E	16	7° 10' 29.939" N	125° 34' 6.081" E
17	7° 12' 31.125" N	125° 33' 49.710" E	17	7° 10' 28.315" N	125° 34' 0.953" E
18	7° 12' 28.332" N	125° 33' 50.418" E	18	7° 10' 24.528" N	125° 33' 54.623" E
19	7° 12' 26.578" N	125° 33' 50.150" E	19	7° 10' 21.451" N	125° 33' 50.831" E
20	7° 12' 24.719" N	125° 33' 49.984" E	20	7° 10' 18.949" N	125° 33' 45.646" E
21	7° 12' 20.096" N	125° 33' 45.614" E	21	7° 10' 17.942" N	125° 33' 40.986" E
22	7° 12' 12.629" N	125° 33' 41.590" E	22	7° 10' 19.197" N	125° 33' 38.201" E
23	7° 12' 2.725" N	125° 33' 39.466" E	23	7° 10' 22.323" N	125° 33' 33.305" E
24	7° 11' 59.024" N	125° 33' 36.394" E	24	7° 10' 25.134" N	125° 33' 29.443" E
RETARDING POND 9			25	7° 10' 27.013" N	125° 33' 25.833" E
1	7° 12' 6.155" N	125° 33' 44.971" E	26	7° 10' 28.902" N	125° 33' 20.569" E
2	7° 12' 5.362" N	125° 33' 48.173" E	27	7° 10' 30.971" N	125° 33' 20.012" E
3	7° 12' 1.796" N	125° 33' 48.670" E	28	7° 10' 33.086" N	125° 33' 20.386" E
4	7° 11' 56.596" N	125° 33' 45.693" E	29	7° 10' 35.866" N	125° 33' 21.953" E
5	7° 11' 51.187" N	125° 33' 43.284" E	30	7° 10' 39.104" N	125° 33' 24.815" E
6	7° 11' 44.577" N	125° 33' 42.988" E	31	7° 10' 42.963" N	125° 33' 27.526" E
7	7° 11' 36.205" N	125° 33' 43.924" E			
8	7° 11' 30.067" N	125° 33' 42.596" E			

9	7° 11' 24.587" N	125° 33' 43.600" E
10	7° 11' 21.629" N	125° 33' 46.014" E
11	7° 11' 15.790" N	125° 33' 46.498" E
12	7° 11' 10.425" N	125° 33' 45.486" E
13	7° 11' 8.158" N	125° 33' 44.387" E
14	7° 11' 12.011" N	125° 33' 38.927" E
15	7° 11' 13.840" N	125° 33' 35.111" E
16	7° 11' 15.803" N	125° 33' 34.915" E
17	7° 11' 17.924" N	125° 33' 34.461" E
18	7° 11' 18.588" N	125° 33' 35.654" E
19	7° 11' 27.462" N	125° 33' 37.359" E
20	7° 11' 31.956" N	125° 33' 37.177" E
21	7° 11' 46.691" N	125° 33' 34.415" E
22	7° 11' 50.201" N	125° 33' 34.797" E
23	7° 11' 53.593" N	125° 33' 37.867" E
24	7° 11' 59.713" N	125° 33' 42.349" E
25	7° 12' 3.115" N	125° 33' 43.558" E

This Certificate is issued in compliance with the requirements of Presidential Decree No. 1586, and its Implementing Rules and Regulations. Non-compliance with any of the provisions of this Certificate including the mitigating measures cited herein shall be a sufficient cause for its cancellation and/or imposition of a fine in an amount not to exceed Fifty Thousand Pesos (P50,000.00) for every violation thereof without prejudice to the imposition of fines and penalties under other environmental laws. The EMB, however, is not precluded from reevaluating and correcting any deficiencies or errors that may be found after issuance hereof.

Issued at EMB-R11, 3rd Avenue cor. V. Guzman St., Brgy. 27-C, Sta. Ana, Davao City this 15 August 2022.

Recommending Approval:

ALNULFO M. ALVAREZ, RF, EnP, MENP
Chief, Clearance & Permitting Division

Approved:

MARIO N. BULACAN, PME, MPA
Regional Director

Environmental Compliance Certificate
Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

SWORN ACCOUNTABILITY STATEMENT

I, **RAMON A. ARRIOLA III**, Project Director, representing Department Of Public Works And Highways Flood Control Management Cluster (UPMO-FCMC), with office address located at DPWH 2nd St., Port Area, Manila takes full responsibility in complying with all conditions in this Environmental Compliance Certificate (ECC).

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS –
FLOOD CONTROL MANAGEMENT CLUSTER (UPMO-FCMC)

By:

RAMON A. ARRIOLA III
Project Director

TIN No. _____

Subscribed and sworn before me this _____, the above-named affiant taking oath presenting _____, issued on _____ at _____.

Notary Public

Doc. No. _____
Page No. _____
Book No._____
Series of _____

Environmental Compliance Certificate
Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

ANNEX A

I. ENVIRONMENTAL MANAGEMENT

All commitments, mitigating measures and monitoring requirements, especially those contained in the Environmental Impact Statement Report, particularly in the Environmental Management and Monitoring Plan (EMMoP), shall be instituted to minimize any adverse impact to the environment throughout the project implementation including among others the following, *to wit*:

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
A. Pre-Construction Phase		
Displacement and loss of livelihood especially sand ang gravel concessionaire	- Develop and implement Information, Education and Communication (IEC) program - Compensation of sand and gravel concessionaire will be based on the existing government guidelines-Hiring of locally qualified labor. - Involve the community in the design, formulation and resettlement action plan	Full implementation of the project preparation activities of UPMO -DPWH and DPWH XIUPMO-DPWH in coordination with City LGU. Included in RAP 100 % Secure tenurial instruments/ permits 100% ROW/Land acquisition and compensation in compliance with RA 10752
B. Construction and Operation Phase		
B.1 River Dredging		
Various earthmoving activities (e.g. road construction, embankment construction, etc), if not done properly could result in slope stability problems, as well as alteration of the topography, erosion and siltation.	- Geological investigation (e.g. landslide mapping); - geotechnical investigation; - hydrological investigation; - slope stability analysis of critical slopes; - reshaping of the slopes, - installation of retaining structures; - surface & subsurface drainage (e.g. diversion of	100 % compliance to DPWH-DENR-DILG-DOTR JMC No. 2019-01

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
	clear water, subsurface drains beneath stockpiles on slopes if seepages are present); - Construction of silt traps.	
Degradation of water quality(siltation)	- Installation of silt curtain	100% no soil erosion/ siltation
Generation of dredged materials	- Handling and disposal should be in accordance with DPWH DO 139 –2014 and JMC 01 –2019 - Formulation of dredging master plan for Davao River - Identify sufficient and suitable disposal site	100% no spoil materials will be left unattended and no mud/dirt shall be transferred in the road
Emission from heavy equipment	- Use new less emission models	100% compliance to RA 8749
Noise generation	- Provision of muffler to lessen noise - Day time work schedule, if possible	100% Noise within standard (NPCC MC 002 Series of 1980)
Dredging debris	- Clean debris and dispose properly: solid waste according to RA 9003, used oil according to RA 6969	100% no spoil materials will be left unattended and no mud/dirt shall be transferred in the road
B.2 Cut-off works		
Removal of vegetation including economically and ecologically important species	- Prioritize ecologically and economically important species in the conservation initiatives - Establish a nursery - Practice tree balling of endemic tree species and facilitate immediate transfer to open areas - Propagate endemic plant species	100 % Secure tenurial instruments/ permits
Destruction and fragmentation of wildlife habitat	- Establish buffer zone	100 % compliance to DENR -FMB/BMB

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
Generation of vegetative wastes	- Re-use vegetative waste as compost, and growing plant medium	100% compliance of RA 9003
Generation of construction debris	- Proper disposal of construction debris and implement integrated Solid Waste Management Plan (SWMP)	100% compliance of RA 9003
Generation of land pollutants (excavated materials)	- Identify sufficient and appropriate/suitable disposal site of excavated soil. The location, capacity, etc will designed in the next stage, i.e Detailed Engineering Design (DED)	100% no spoil materials will be left unattended and no mud/dirt shall be transferred in the road
Change in land use	- Implement appropriate land use zoning	UPMO-DPWH in coordination with the City Government on the re-zoning of the site
Soil erosion	- Proper engineering design of permanent facilities - Provide buffer zone - Conduct geotechnical study - Stabilize riverbanks	100% no soil erosion/siltation
- Siltation of Davao River (downstream) - Sedimentation of Davao Gulf	- Provision of silt curtains and siltation ponds - Proper scheduling of works - Provision of temporary sewerage system for workers	100% no soil erosion/siltation 100% compliance to RA 9275
Increase in the concentration of PM10, PM2.5, NO2, SO2and CO	- Use new model low emission vehicles - Regular maintenance of hauling trucks and heavy equipment - Regular watering of dust generating mounds - Install cover of hauling trucks - No overloading of hauling vehicles - Tree planting in open areas	100% compliance to RA 8749

Environmental Compliance Certificate
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Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
Noise disturbance	- Provision of muffler - Establishment of buffer zones - Close coordination with the CLGU and BLGU	100% Noise within standard (NPCC MC 002 Series of 1980)
Damage to roads and bridges	- No overloading of vehicles - Regular maintenance of roads, e.g. re-graveling, pothole patching, scraping of droppings	100% compliance to the existing guidelines
Accidents and Congestion of traffic	- Reroute access - Putting up of traffic warning signs - Establishment of construction buffer and containment barriers - Proper scheduling of hauler trucks in reference of the truck ban schedule - Provision of sufficient sidewalks and access routes-Coordinate with CTMO and BLGUs - Conduct road safety campaign Provision of road safety equipment	UPMO-DPWH in coordination with traffic division of the City implement measures to avoid traffic congestion
Construction debris	- Dispose in accordance with RA 9003	100% no spoil materials will be left unattended and no mud/dirt shall be transferred in the road
B.3 Retarding Ponds		
Removal of vegetation including economically and ecologically important species	- Prioritize ecologically and economically important species in the conservation initiatives - Propagate endemic plant species - Establish a nursery	100 % Secure tenurial instruments/ permits
Destruction and fragmentation of wildlife habitat Disturbance/ displacement of wildlife	- Establish buffer zone - Practice tree balling of endemic tree species and facilitate immediate transfer to open areas	100 % compliance to DENR -FMB/BMB

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
	- Re-establish vegetation in the ponds during non-flood period in order to recolonize faunal species	
Change in land use	- Implement appropriate land use zoning	UPMO-DPWH in coordination with the City Government on the re-zoning of the site
Soil Erosion	- Proper engineering design of permanent facilities - Provide buffer zone - Conduct geotechnical study	100% no soil erosion/ siltation
Generation of vegetative wastes	- Re-use vegetative waste as compost, and growing plant medium	100% compliance to RA 9003
Generation of construction debris	- Proper disposal of construction debris and implement integrated Solid Waste Management Plan	100% collected/hauled construction debris 100% compliance to RA 9003
Generation of land pollutants (excavated materials)	- Identify sufficient and appropriate/suitable disposal site of excavated soil. The location, capacity, etc will designed in the next stage, i.e Detailed Engineering Design (DED)	100% no spoil materials will be left unattended and no mud/dirt shall be transferred in the road
Siltation of Davao River (downstream) Sedimentation of Davao Gulf	- Provision of silt curtains and siltation ponds - Proper scheduling of works - Provision of temporary sewerage system for workers	100% no siltation 100% compliance with RA 9275
Increase in the concentration of PM10, PM2.5, NO2, SO2 and CO	- Use new model low emission vehicles - Regular watering of dust generating mounds - Install cover of hauling trucks - No overloading of hauling vehicles	100% compliance to DAO 2000-81 and no dust emission 100% compliance to RA 8749

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
	- Regular maintenance of hauling trucks and heavy equipment - Tree planting in open areas	
Noise disturbance	- Provision of mufflers - Limit the construction time to given standard hours or limit night work to avoid the distraction of nearby establishments like residential areas - Close coordination with the CLGU and BLGU - Establishment of buffer zones	100% Noise within standard (NPCC MC 002 Series of 1980) 100% compliance to RA 8749
Damage to roads and bridges	- No overloading of vehicles - Regular maintenance of roads, e.g. re-graveling, pothole patching, scraping of droppings	100% compliance to the existing guidelines
Congestion of traffic	- Reroute access - Putting up of traffic warning signs - Establishment of construction buffer and containment barriers - Proper scheduling of hauler trucks in reference of the truck ban schedule - Provision of sufficient sidewalks and access routes - Coordinate with CTMO and BLGUs - Conduct road safety campaign - Provision of road safety equipment	UPMO-DPWH in coordination with traffic division of the City to implement measures to avoid traffic congestion
Generation of construction debris	- Dispose in accordance with RA 9003	100% collected/hauled construction debris
Possible collapse of Retarding Ponds and Cut off Works banks	- Conduct a regular monitoring and maintenance	100% compliance of the existing structure guidelines
B.2. Construction Installation, and operation of temporary site facilities (field offices and barracks)		

POTENTIAL IMPACT PER PROJECT ACTIVITY PER PROJECT PHASE	MITIGATING MEASURES	RATING/ PERFORMANCE OF MITIGATING MEASURES
Generation of solid Wastes	- Segregation of wastes and provision of waste storage facility - Provision of an MRF including composting area - Hauling of solid wastes by third party hauler with permit/clearance from LGU	100% conformance to RA 9003
Degradation of air quality due to use of generator set (if any)	Regular maintenance of the generator set	100% compliance to RA 8749
Generation of hazardous materials	- Provision of centralized storage facility/area and collected by hazardous wastes DENR accredited 3rd party haulers/treaters. - Hazardous waste generation ID shall be secured from EMB.	100% compliant to RA 6969
Degradation of surface water quality due to contamination from domestic wastewater	- Provision of portalets for construction workers *Note: at least one (1) portalet for 25 workers where the number of male workers exceeds 100 (as per IRR-Industrial Hygiene, PD 856 Amending Administrative Order 111 Series of 1991)* - Provision of septic tank or wastewater collection system for workers - Hauling of wastewater from portalets/ septic tank by third party contractor with licensed/permit from LGU and with valid Discharge Permit for wastewater treatment facility	100% no discharge of domestic wastewater to nearby bodies of water

II. GENERAL CONDITIONS

1. The proponent shall Comply with all the provisions of **RA 9275, the Philippine Clean Water Act of 2004 and its Implementing Rules and Regulations;**

2. The proponent shall Install and maintain air pollution control devices to minimize dust and gas emissions from different sources. Impose speed limit and conduct daily road watering. Likewise, the proponent shall ensure that emissions at all times comply with the DENR standards and with all the provisions of **RA 8749, the Philippine Clean Air Act of 1999 and its Implementing Rules and Regulations;**

3. The proponent shall install, operate, and maintain collection, handling, treatment, storage and disposal facilities or any system serving different sources of hazardous waste. The system shall be properly operated to ensure compliance with all the provisions of **RA 6969, the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 and its Implementing Rules and Regulations;**

4. The proponent shall install, operate and maintain collection, handling, treatment, storage and disposal facilities or any system serving different sources of solid waste. The system shall be properly operated to ensure compliance with all the provisions of **RA 9003, the Ecological Solid Waste Management Act of 2000 and its Implementing Rules and Regulations;**

5. The proponent shall submit **Compliance Monitoring Report (CMR)** semiannually, July and January of every year, together with the operation's extraction rate reports of dredging activity;

6. Planting of appropriate tree species shall be undertaken in coordination with DENR CENRO in support to National Greening Program of the DENR to compensate for the loss of vegetation. Replacement of trees shall follow the following ratio: 50 trees for one (1) planted tree cut and 100 trees for one (1) naturally growing tree cut;

7. Proponent shall conduct an effective **Information, Education and Communication (IEC) Program** to inform and educate all stakeholders, especially its contractors, workers, and local residents about the mitigating measures embodied in its EIS, the conditions stipulated in this Certificate and the environmental and human safety features of the project for greater awareness, understanding and sustained acceptance of the project;

8. The proponent shall designate a **Pollution Control Officer (PCO) or any equivalent designation** and secure accreditation at DENR-EMB XI within six (6) months from the issuance of this ECC who shall take charge of the environmental concerns of the project;

9. That the proponent shall conduct **Engineering Geological and Geohazard Assessment** duly endorsed by MGB prior to project implementation and shall implement proper engineering mitigating measure as recommended especially for the cut of works and retarding ponds;

10. The proponent shall ensure that all affected properties and stakeholders shall be justly compensated based on the existing guidelines of DPWH. The

proponent shall submit a report containing compensation based on the result of the survey in the CMR;

11. That stockpile of spoils from civil works and construction debris shall be placed away from drainage routes and proper disposal of the same shall be effected. The same should not in any manner cause nuisance and hazards to the public during its disposal/hauling. Likewise, appropriate measures shall be undertaken for the avoidance of noise, water, land and dust pollution during construction;

12. The proponent shall ensure not to damage private or public structure/utilities (i.e. electric post, water supply pipes, etc.). In the event that such accident occurs, proper and immediate restoration and/or compensation should be undertaken;

13. The proponent shall provide warning devices/signs and construction site shall be illuminated during night time to avoid accidents. The retention pond must also be provided with appropriate and adequate railings in order to prevent accidents;

14. That the proponent shall conduct **soil test for the dredged materials** to ensure no contamination of heavy metals and shall properly disposed thereafter;

15. That the proponent shall establish water quality monitoring sampling station for **Total Suspended Solids (TSS)** in Davao Gulf**;**

16. The proponent shall ensure that its contractors and sub-contractors strictly comply with the relevant conditions of this Certificate;

17. The proponent shall submit an Abandonment Plan to DENR-EMB XI at least six (6) months prior to project abandonment. The plan shall include rehabilitation measures/clean-up, remediation of areas affected by the project and proposed alternative projects in the area;

18. Close monitoring of the project should be undertaken by the proponent to maintain a high level of safety and efficiency during operation;

19. That the DENR-EMB XI is not accountable to any untoward incident that may happen to the project caused by *force majeure*, structural defects or non-implementation of any requirement based on existing laws or whatever cause;

20. That the Proponent shall see to it that copy of this ECC shall be furnished to all agencies/offices and Local Government Unit (LGU) concerned within one (1) month from receipt thereof. A certification shall be submitted by the Proponent to DENR-EMB XI that said copy has been delivered and duly stamped as received by the concerned agencies/offices;

III. RESTRICTIONS

21. That the **Dredging Master Plan and Detailed Engineering Design** pursuant to DPWH-DENR-DILG-DOTR JMC No. 2019-01 shall be submitted to this Office prior to project implementation;

22. The proponent shall coordinate with other concerned Government Agencies in the management of the project and shall implement only after securing all the necessary and relevant permits from other pertinent Government Agencies;

23. No other activities shall be undertaken other than what was stipulated in the EIS document. Any expansion or modification of the Project beyond the project description or any change in the activity or transfer of location, or realignment, shall be subject to a new EIA study;

24. In case of transfer of ownership of this Project, these same conditions and restrictions for which written notification must be made by herein grantee to EMB within fifteen (15) working days from such transfer; and

25. No cutting of trees specially banned species shall be done along the route without proper clearance from authorities and be subjected to Forestry laws, rules and regulations. Permit to Cut from the nearest DENR CENRO shall be secured prior to cutting of trees. Burning of waste generated from land clearings such as leaves and branches shall be strictly prohibited.

Environmental Compliance Certificate
Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

ANNEX B

PROJECT ASSESSMENT PLANNING TOOL

For the assistance and guidance of the Proponent and Government agencies concerned in the management of the Project and for better coordination in mitigation of the impacts of the Project on its surrounding areas and the environment, the following recommendations are forwarded to the parties and authorities concerned for appropriate action.

Environmental Planning Recommendations and Regulatory Requirements for the Proponent
Local Government Unit (LGU)
1. The proponent shall give priority employment to qualified local residents. Adequate public information for jobs available to local residents in the affected areas shall be provided;
2. The proponent shall coordinate with the concerned LGU for the implementation of Solid Waste Management Plan;
3. The proponent shall comply with the Building Code and Sanitation Code of the Philippines;
4. The proponent shall maintain the drainage ways along with the road grading;
5. The proponent shall coordinate with the concerned LGU(s) in the implementation of traffic management plan
6. The host communities will be kept informed of the duration and timing of any noisy construction
7. That the proponent shall coordinate with the concerned LGU for the appropriate use of the project after construction.
DENR- Mines and Geosciences Bureau (for bridge projects/retarding ponds)
8. The proponent shall implement the recommendation in the Geohazard Identification Report (GIR) / Geohazard Assessment Report (GAR) and proper mitigating measure on the identified possible geologic hazards in the project area
DENR / PCA
9. The proponent shall secure tree cutting permit

Environmental Compliance Certificate
Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

DOLE - Bureau of Working Condition
10. The proponent shall comply with the Labor Code of the Philippines 11. The proponent shall provide safety measures and appropriate PPE to workers
DENR - Biodiversity Management Bureau (BMB)
12. The proponent shall coordinate with BMB for the preparation and implementation of the Biodiversity and Monitoring Systems pursuant to Technical Bulletin Nos. 2016-05 and 2019-04
Environmental Planning Recommendations for the Proponent
13. That a 2' X 4' billboard containing this message: **"Notice to the Public, This Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River) has been issued an Environmental Compliance Certificate (ECC-R11-2208-0007) by the Environmental Management Bureau of the Department of Environment and Natural Resources, Region XI on 15 August 2022.** This signage must be installed in areas where the components are located to inform the general public prior and during the operation. 14. That proponent shall implement a health and safety program of its workers and shall comply to the Health Protocol mandated by the Department of Health (DOH) 15. That the proponent shall observe cleanliness and orderliness during the construction and operation of the projects to prevent accidents
16. Strict implementation of Right-Of-Way (ROW) Action Plan (RAP).

For the dissemination and proper action of the agencies concerned.

ALNULFO M. ALVAREZ, EnP, RF,MEnP
Chief, Clearance and Permitting Division

MARIO N. BULACAN,PME, MPA
Regional Director

Environmental Compliance Certificate
Project for Master Plan and Feasibility Study on Flood Control and Drainage in Davao City (Davao River)
Brgys. Bucana, 5-A, 1-A, 2-A, 3-A, 8-A, 19-B, Ma-a, Tigatto, Waan, Mandug, New Carmen, New Valencia and Callawa, Davao City
Department of Public Works and Highways Flood Control Management Cluster

ANNEX M – ENVIRONMENTAL MONITORING FORM BASED ON THE JICA GUIDELINE

Environmental Monitoring Form
(1) River Dredging

Construction Phase

1) Air Quality

Date:

Items	Value	Standard Value[1)]	Location	Remarks (method, etc.)
CO		9 ppm		
SO2		180 ug/m^3		
NO2		150 ug/m^3		
PM10		150 ug/m^3		
PM2.5		35 ug/m^3		
Dust	-	-		Direct observation

1) DENR NAAQGV, 24-hours average except CO: 8-hours average.

2) Water Quality

Date:

Items	Value	Standard Value[1)]	Location	Remarks (method, etc.)
BOD		Class A: 3 mg/L Class B: 5 mg/L		
DO		Class A: 5 mg/L and over Class B: 5 mg/L and over		
Fecal coliform		Class A: 200 MPN/100mL Class B: 200 MPN/100mL		
pH		Class A: 6.5 – 8.5 Class B: 6.5 – 8.5		
Inorganic phosphate		Class A: 0.025 mg/L Class B: 0.025 mg/L		
TSS		Class A: 50 mg/L Class B: 65 mg/L		
Oil & Grease		Class A: 1 mg/L Class B: 1 mg/L		
Heavy metals Pb Hg As Cd Cr^{6+}		Pb: 0.01mg/L Hg: 0.001mg/L As: 0.01mg/L Cd: 0.03mg/L Cr6+: 0.01mg/L		
Turbidity	-	-		Direct observation

1) DAO 2016-008, except inorganic phosphate and fecal coliform: DAO 2021-19

3) Waste

Date:

Items	Description
Record of treatment or disposal of waste, manifest	
Observation of storage condition of the waste	

4) Soil Condition (dredged/ excavated soil)

Date:

Items	Value	Standard Value	Location	Remarks (method, etc.)
Arsenic (As)		8.2 mg/kg (NOAA[2)])		
Cadmium (Cd)		1.2 mg/k (NOAA)		
Chrome (Cr)		373 mg/kg (Canada[3)])		
Lead (Pb)		35 mg/kg (Canada		
Mercury (Hg)		0.17 mg/kg (Canada)		
Spillage of toxics	-	-		Direct observation

1) NOAA: NOAA Sediment Quality Guidelines developed for National Status and Trends Program.
2) Canadian Environmental Quality Guidelines (2001). Canadian Sediment Quality Guidelines for the Protection of Aquatic life. Canadian Council of Ministers of the Environment.

5) Noise, vibration

Date:

Items	Time of measurement	Value[1)]	Standard[2)]	Location	Remarks (source of noise, etc.)
Noise level	Morning ( )		50 dBA		
	Noon ( )		55 dBA		
	Evening ( )		50 dBA		
	Night ( )		45 dBA		
Noise Vibration[3)]	During construction	-	-		Direct monitoring, hearing

1) Median of seven highest recorded noise levels
2) National Pollution Control Commission. (NPCC) memorandum circular no. 002, 1980
3) Since no standard is set in the Philippines, it is temporary monitored by hearing, etc.

6) Ecosystem

Date:

Items	Description
Observation, sampling of aquatic biota	
Hearing	

7) Social Environment

Local economies, Labor conditions, Accidents

Date:

Items	Description
Observation of traffic condition, etc.	
Record of accidents	
Hearing	
Public consultation	
Others	

8) Complainants

Number of complaints	Description	Counter action and results

Operation Phase

1) Social Environment

Local economies

Date:

Items	Description
Observation of traffic condition, etc.	
Record of accidents	
Hearing	
Public consultation	
Others	

2) Complainants

Number of complaints	Description	Counter action and results

(2) Retarding Ponds

Construction Phase

1) Air Quality

Date:

Items	Value	Standard Value[1)]	Location	Remarks (method, etc.)
CO		9 ppm		
SO2		180 ug/m^3		
NO2		150 ug/m^3		
PM10		150 ug/m^3		
PM2.5		35 ug/m^3		
Dust	-	-		Direct observation

1) DENR NAAQGV, 24-hours average except CO: 8-hours average.

2) Water Quality

Date:

Items	Value	Standard Value[1)]	Location	Remarks (method, etc.)
BOD		Class A: 3 mg/L		
DO		Class A: 5 mg/L and over		
Fecal coliform		Class A: 200 MPN/100mL		
pH		Class A: 6.5 – 8.5		
Inorganic phosphate		Class A: 0.025 mg/L		
TSS		Class A: 50 mg/L		
Oil & Grease		Class A: 1 mg/L		
Heavy metals Pb Hg As Cd Cr6+		Pb: 0.01mg/L Hg: 0.001mg/L As: 0.01mg/L Cd: 0.03mg/L Cr6+: 0.01mg/L		
Turbidity	-	-		Direct observation

1) DAO 2016-008, except inorganic phosphate and fecal coliform: DAO 2021-19

3) Waste

Date:

Items	Description
Record of treatment or disposal of waste, manifest	
Observation of storage condition of the waste	

4) Soil Condition (dredged/ excavated soil)

Date:

Items	Value	Standard Value	Location	Remarks (method, etc.)
Arsenic (As)		8.2 mg/kg (NOAA[2)])		
Cadmium (Cd)		1.2 mg/k (NOAA)		
Chrome (Cr)		373 mg/kg (Canada[3)])		
Lead (Pb)		35 mg/kg (Canada		
Mercury (Hg)		0.17 mg/kg (Canada)		
Spillage of toxics	-	-		Direct observation

1) NOAA: NOAA Sediment Quality Guidelines developed for National Status and Trends Program.
2) Canadian Environmental Quality Guidelines (2001). Canadian Sediment Quality Guidelines for the Protection of Aquatic life. Canadian Council of Ministers of the Environment.

5) Noise, vibration

Date:

Items	Time of measurement	Value[1)]	Standard[2)]	Location	Remarks (source of noise)
Noise level	Morning ( )		50 dBA		
	Noon ( )		55 dBA		
	Evening ( )		50 dBA		
	Night ( )		45 dBA		
Noise Vibration[3)]	During construction	-	-		Direct monitoring, hearing

1) Median of seven highest recorded noise levels
2) National Pollution Control Commission. (NPCC) memorandum circular no. 002, 1980
3) Since no standard is set in the Philippines, it is temporary monitored by hearing, etc.

6) Ecosystem

Date:

Items	Description
Observation, sampling	
Hearing	
Condition of utilization for eco-tourism	

7) Hydrology

Date:

Items	Description
Hydrological condition	
Hearing	
Records of flood	

8) Social Environment

Poor/Vulnerable, Local economies, Existing social infrastructures and services, Utilization of land and local resources, Gender, Children's rights, Infectious diseases, Labor conditions, Accidents

Date:

Items	Description
Observation of traffic condition, etc.	
Record of accidents	
Hearing	
Public consultation	
Others	

9) Complainants

Number of complaints	Description	Counter action and results

Operation Phase

1) Social Environment

Infectious diseases, Accidents

Date:

Items	Description
Record of accidents	
Hearing	
Public consultation	
Others	

2) Complainants

Number of complaints	Description	Counter action and results

(8) Priority Project on the Davao River (Cut-off Works)

Construction Phase

1) Air Quality

Date:

Items	Value	Standard Value[1)]	Location	Remarks (method, etc.)
CO		9 ppm		
SO2		180 ug/m^3		
NO2		150 ug/m^3		
PM10		150 ug/m^3		
PM2.5		35 ug/m^3		
Dust	-	-		Direct observation

1) DENR NAAQGV, 24-hours average except CO: 8-hours average.

2) Water Quality

Date:

Items	Value	Standard Value[1)]	Location	Remarks (method, etc.)
BOD		Class B: 5 mg/L		
DO		Class B: 5 mg/L and over		
Fecal coliform		Class B: 200 MPN/100mL		
pH		Class B: 6.5 – 8.5		
Inorganic phosphate		Class B: 0.025 mg/L		
TSS		Class B: 65 mg/L		
Oil & Grease		Class B: 1 mg/L		
Heavy metals Pb Hg As Cd Cr6+		Pb: 0.01mg/L Hg: 0.001mg/L As: 0.01mg/L Cd: 0.03mg/L Cr6+: 0.01mg/L		
Turbidity	-	-		Direct observation

1) DAO 2016-008, except inorganic phosphate and fecal coliform: DAO 2021-19

3) Waste

Date:

Items	Description
Record of treatment or disposal of waste, manifest	
Observation of storage condition of the waste	

4) Soil Condition (dredged/ excavated soil)

Date:

Items	Value	Standard Value	Remarks (location, method, etc.)
Arsenic (As)		8.2 mg/kg (NOAA[1)])	
Cadmium (Cd)		1.2 mg/k (NOAA[1)])	
Chrome (Cr)		373 mg/kg (Canada[2)])	
Lead (Pb)		35 mg/kg (Canada[2)])	
Mercury (Hg)		0.17 mg/kg (Canada[2)])	
Spillage of toxics			Direct observation

1) NOAA: NOAA Sediment Quality Guidelines developed for National Status and Trends Program.
2) Canadian Environmental Quality Guidelines (2001). Canadian Sediment Quality Guidelines for the Protection of Aquatic life. Canadian Council of Ministers of the Environment.

5) Noise, vibration

Date:

Items	Time of measurement	Value[1)]	Standard[2)]	Location	Remarks (source of noise)
Noise level	Morning ( )		50 dBA		
	Noon ( )		55 dBA		
	Evening ( )		50 dBA		
	Night ( )		45 dBA		
Noise Vibration[3)]	During construction	-	-		Direct monitoring, hearing

1) Median of seven highest recorded noise levels
2) National Pollution Control Commission. (NPCC) memorandum circular no. 002, 1980
3) Since no standard is set in the Philippines, it is temporary monitored by hearing, etc.

6) Ecosystem

Date:

Items	Description
Observation, sampling	
Hearing	
Condition of trees planted	

7) Hydrology

Date:

Items	Description
Hydrological condition	
Hearing	
Records of flood	

8) Social Environment

Poor/Vulnerable, Local economies, Existing social infrastructures and services, Community severance, Utilization of land and local resources, Landscape, Gender, Children's rights, Infectious diseases ,Labor conditions Accidents

Date:

Items	Description
Observation of traffic condition, etc.	
Record of accidents	
Hearing	
Public consultation	
Others	

9) Complainants

Number of complaints	Description	Counter action and results

Operation Phase

1) Social Environment

Existing social infrastructures and services, Community severance, landscape Infectious diseases, Accidents

Date:

Items	Description
Observation of traffic condition, etc.	
Record of accidents	
Hearing	
Public consultation	

2) Complainants

Number of complaints	Description	Counter action and results