CHAPTER 9
SPATIAL DEVELOPMENT FRAMEWORK FOR GREATER COTABATO AND CITY

9.1 Greater Cotabato Spatial Development Policies and Strategies

9.1.1 Overall Spatial Development Policies

The current development trend of the Greater Cotabato area is characterized by the predominance of Cotabato City as its primary urban center. The city is leading the socio-economic development in the area surrounded by municipalities predominantly devoted to agriculture production. The existing regional infrastructure facilities such as the Polloc Port in the municipality of Parang, Maguindanao together with the potential and relevant strategies of development being pursued in the Greater Cotabato area are expected to level up its development in line with the South-Central Mindanao Development Corridor's thrust.

On the other hand, Cotabato City faces a significant issue of physical limitation of available land resources to expand its urbanization and enhance its roles and functions as the primary regional urban center of the Greater Cotabato area. In view hereof, the promising development of the Greater Cotabato area would necessarily require consolidation and enhancement of the entire area involving the city and all surrounding municipalities in an integrated approach. The following are set as the overall spatial development strategy.

- **Harmonious and collaborative development as one regional center of Greater Cotabato:** Every municipality in the Greater Cotabato area should play a definite role in integrating socio-economic development as one united Regional Center without creating disparity towards a self-sustained local government. It should strategically provide for urban services shared by municipalities and for economic development utilizing hinterland agricultural lands and coastal area resources. Meanwhile, Cotabato City would play a key role in delivering regional urban services as the center for the institution, education, health, financial, and trade development.
- **Driving BARMM and neighboring areas through productive and innovative development by Greater Cotabato:** The Greater Cotabato area should play an essential role in leading and promoting productive and innovative socio-economic development in BARMM and neighboring areas. Cotabato City has a pivotal function to achieve such development by taking advantage of the cumulative economic and human resources as indispensable elements to create and promote innovation in productive resource-based development for agriculture and fishery through the provision of demonstration farm services and facilities for the Greater Cotabato area. The surrounding municipalities and hinterlands could become the practical stations and fields collaborating with Cotabato City.

9.1.2 Economic Development Policies for Greater Cotabato and City

Cotabato City has several issues concerning economic development such as low production of primary sector industry (agriculture and fishery), limited secondary sector industry (food processing by SMEs), insufficient transport and infrastructure services against demands (e.g. power supply, water supply, logistic services) and insufficient tertiary sector industry (e.g. lack of efficient logistic function, insufficient tourism infrastructure against demand). For now, the surrounding municipalities in Maguindanao Province has played are the leading producers of various agricultural commodities (e.g., coconut, banana, palay, corn, livestock, poultry, fishery) for the province. From the gap analysis within Cotabato City and surrounding municipalities in the Greater Cotabato area, the following directions for economic development for Greater Cotabato and City are illustrated.

- **Key economic sectors to be enhanced:** Three vital fields in Greater Cotabato area, namely 1) agribusiness and agro-industry including aquaculture; 2) regional and international trade and distribution services; and 3) urban service industry; would contribute to strengthening the economic development for Greater Cotabato taking into account of the advantages of the economic development corridors in association with transportation nodes of Polloc Seaport (and Timako Port once completed) and Awang Airport, and each economic competence of the city and municipalities. Also, tourism and recreational development is a promising sector which is one of the effective industry sectors not requiring large investments.
- **Enhancement of economic development cluster formulation for Greater Cotabato:** An economic cluster development can be influenced by the geographic concentration of horizontally and vertically connected establishments and institutions in each municipality and the city by fields, along with their related government, academic and private sector stakeholders. The economic development cluster in Greater Cotabato aims at the concentration of economic activities around agriculture/aquaculture process or product and related products for which Cotabato City could contribute to the processing and distribution, rapid transmission of ideas and resources from a variety of sources boosting productivity and innovation including access to ICT, research and development (R&D), skilled workers, quality certification services to surrounding production areas.
- **Governmental supports for economic development:** Government support to enhance economic development for Greater Cotabato is an essential element for improving and upgrading the investment environment including competitive infrastructure facilities and human resource development, where further foreign direct investment (FDI) or domestic direct investment (DDI) would be attracted. Particularly, government support for nurturing Small and Medium Enterprises (SMEs) and micro-business is expected to be fostered through a finance arrangement, capacity empowerment for business management, market promotion, and technical renovation.

Figure 9.1-1 illustrates a desirable formulation of the economic cluster development for Greater Cotabato and the city, taking account of linkage and interrelation in potential economic sectors with surrounding municipalities and their hinterland production areas or tourism resource areas associated with roles and functions of Cotabato City and the corridor development.

9.1.3 Spatial Development Strategies for Greater Cotabato Area

To realize the development goals and policies of the Greater Cotabato, the following spatial development strategies are adopted: a) concentration or regional agglomeration; b) connectivity; and c) vulnerability reduction. These strategies are consistent with those stated in the regional development framework for Greater Cotabato and The National Spatial Strategy.

(1) Green Growth Agglomeration

1) Cluster Development with Green Economic Development

The cluster approach can be applied to the Greater Cotabato area to enhance the innovation of interrelated industries with the utilization of sustainable technology and eco-management practices. The cluster approach allows the growth of local industries by providing shared support services, infrastructure, and workforce skills. It can also facilitate the provision of urban services through the mutual interactions among connected municipalities in the Greater Cotabato area.

2) The role for Urban Centers in Greater Cotabato

The role of urban centers in the city and each municipality would be an important factor to provide the character and function of cluster development as cores of each cluster, where each center of municipalities would play key roles in enhancing and supporting business support services and institutions for the cluster.

- **Primary regional center (PRC: Cotabato City)** The city will play a central role in formulating urban conurbation with emphasis on the regional services provider such as commercial business and financial and banking, regional administration, regional health service, higher education service, etc.
- **Secondary regional centers (SRC: Parang, Sultan Mastura, Sultan Kudarat, Datu Odin Sinsuat):** The secondary regional centers could be promoted through socio-economic linkage with Cotabato City, sharing thematic economic services and development in the Greater Cotabato area maximizing agriculture and aquaculture resources development in each hinterland of a municipality.
- **Management organization for Greater Cotabato area**: Cotabato City will play a lead role in formulating urban conurbation with emphasis as the regional services provider in association with a new status by creating a Council of Mayors for Greater Cotabato (CMGC) to formulate development plans for the Greater Cotabato (e.g. planning by MMDA: Metro Manila Development Authority)

Table 9.1-1 Proposed Roles and Functions of City and Municipalities in Greater Cotabato Area

Urban Centers Role	City and Municipality	Proposed Key Urban Function						Development Opportunities	
		Class	COM-BIZ Center	PRD Center	ADM Center: Regional	ADM Center: Local	Transport/Logistic Hub	Hinterland Production Area	Planned Programs
Primary Regional Center	Cotabato City	ICC	●	◎	●	●	●P	AG (rice)/ AQ (tilapia, etc)	Bangsamoro Development Corridor (BDC)
Secondary Regional Center	Parang	M	◎	●	◎	●	●G/P	AG (food/industrial crops) /AQ	South Central Mindanao Development Corridor (SCMD)
	Sultan Mastura	M	○	○	--	●	◎G/P		
	Sultan Kudarat	M	◎	◎	--	●	--		
	Datu Odin Sinsuat	M	○	◎	--	●	◎G	AG (rubber, etc)	BDC
	Barangays in ex-Pigkawayan	M	○	○	--	○	--	AG	SCMD

Note1: M: Municipalities, ICC: Independent Component City, COM-BIZ: Commercial and business, PRD: Production, ADM: Administration (Central, Regional, Local), AG: agriculture, AQ: aquaculture
Legend: ●=Key role, ◎= Secondary ○= Supportive, P: Passenger transport, G: Goods transport
Source: JICA Study Team

3) Clustering Urban Centers and Hinterlands for Greater Cotabato Economic Development

The Greater Cotabato could be integrally clustered among municipalities sharing and complementing each other's characteristics, resources, and potentials as development drivers together with the existing agriculture and aquaculture production areas. Key infrastructures, such as road and other transport facilities to include the existing Polloc Seaport and even the new airport project being proposed are essential elements of the corridor development.

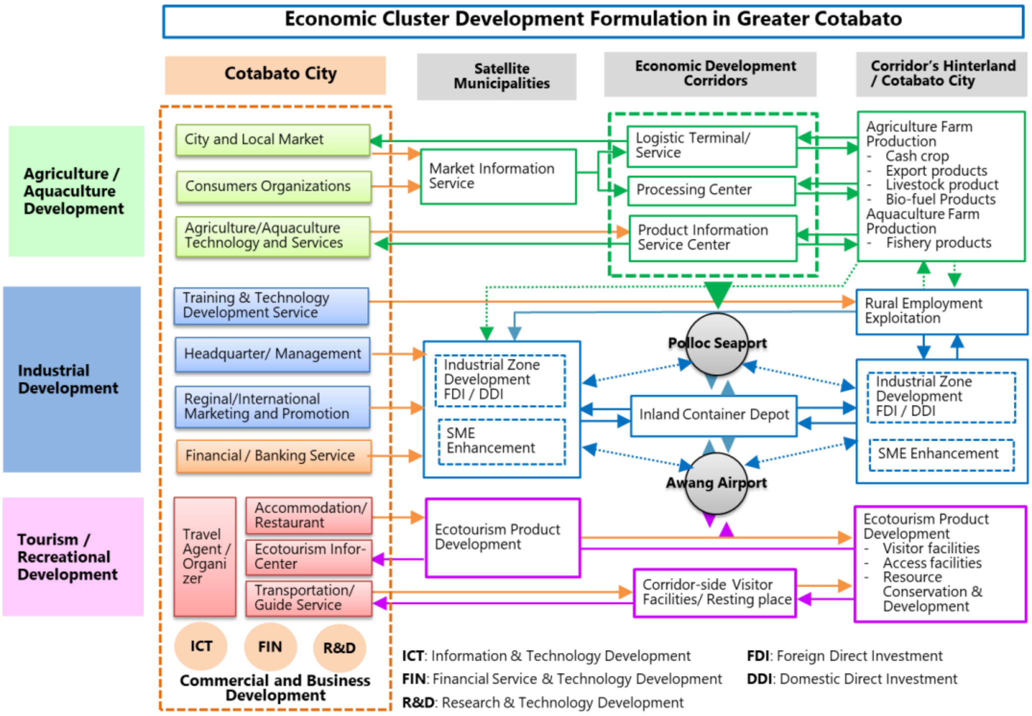
To achieve the development goals set, cluster development stakeholders' effort and resources should be consolidated and rationally integrated among prime movers in the private sector, while also venturing into a public-private partnership.

- **Supply-chain enhancement:** One of the challenges for formulating cluster development is how to ensure the connection of the supply chain in economic development through linkage enhancement between product-market/distribution-consumer for aquaculture, agriculture, and tourism in the corridor (SCMDC). The supply chain consists of the following elements.

  Backward elements for production: The backward elements compose of suppliers of primary products or materials (e.g. agriculture or aquaculture farmers, small-medium industrial manufacturers) and equipment suppliers.

  Forward elements for products: This element consists of services linkage and business management system by distribution channel (market), marketing, business governance, capital and financing, technical assistance, or capacity development through business association or consortium and other support institutions.

- **Public and private partnership:** Relevant local, regional, and national institutions, including chambers of commerce, local governments, NGOs, producer associations, universities, training institutions, and regional as well as local economic development agencies should be organized to promote and support required activities through public-private partnership formulation.



Source: JICA Study Team

Figure 9.1-1 Economic Cluster Development Direction of Greater Cotabato and City

Table 9.1-2 Proposed Cluster Development in Greater Cotabato Area

Urban Centers Function	Name of Cluster	Cluster Level	Involving LGUs	Agro-Industrial Clustering			Supporting Infrastructure and Institution
				Backward System	Forward System	Typical Products	
Primary Regional Center	Metro Cotabato (Cotabato City)	GC	All MPs	AG/AQ-products suppliers in GC	Process/Export Processing System in GC	All products	• Integrated Process/Export Consortium • Financing & lending institution
	Cotabato City Process Center	Adjacent Area	BGYs	Production suppliers (SME) in CGC	Process/Export Processing Facilities in CGC	Food crop (banana, rice, etc)/ Industrial crop (oil palm, corn, etc)/ Aquaculture products	• MCRAI Center* as a Consortium
Secondary Regional Centers	Parang Logistic	GC	All MPs	Logistic / Processing in Parang	Process/Export in Parang		• SEZ institutional support • Training institution
	Sultan Mastura Logistic	Adjacent Area	BGYs	AG/AQ-products suppliers in Sultan Mastura	Logistic Facilities in Sultan Mastura		• Logistic service • Processing Consortium
	Sultan Kudarat Agro-industry	Adjacent Area	BGYs	AG/AQ-products suppliers in Sultan Kudarat	Process Facilities in Sultan Kudarat		• Processing Consortium
	Datu Odin Sinsuat Agro-industry	Adjacent Area	BGYs including ex-PIG	Agriculture-products suppliers in DOS	Process Consortium in DOS	Industrial crop (rubber), Food crop (fruits)	• Logistic service • Processing Consortium

Note1: GC: Greater Cotabato, CGC: Cotabato City, MPs: Municipalities, BGYs: Barangays, ex-PIG: barangays in the ex-Pigkawayan municipality, DOS: Datu Odin Sinsuat, AG/AQ-products: Agriculture and aquaculture products MCRAIC: Metro Cotabato Regional Agro-industrial Center (planned)

Source: JICA Study Team

(2) International Anchoring Posts

At present, the Greater Cotabato area - involving two important transportation nodes, the Polloc seaport (and Timako Port once completed) and Awang airport, is expected to be the gateway linking with neighboring countries of ASEAN. Also, there is a proposal to develop a new airport with two candidate sites in Greater Cotabato or one site in Lanao del Sur province. This strategic position gives opportunities for promoting economic development through international trade (export of regional products and imports). Specifically, the government policy based on the BIMP-EAGA Vision 2025 covering neighboring countries (Indonesia, Malaysia, and Brunei) has promoted trade and exchange of products and activities as Islamic countries transactions including Halal industries and tourism. The foregoing developments should be enhanced and promoted taking advantage of the two gate functions of the seaport and airport in Greater Cotabato.

- **Export/import hubs for international markets:** The agricultural or aquaculture products in the region have opportunities for export after being processed in the Greater Cotabato area that serves as the production center with the advantage of the proximity to the transportation nodes of the seaports and the airports. These hubs are expected to involve industrial and economic zones including a logistic center and inland container depot. This will facilitate international trade links through strategic investment in a multi-modal transportation system along with the promotion of value-added services as goods move through the supply chain.
- **Tourism hubs for travelers:** The tourism sector remains underdeveloped especially in terms of foreign tourists visiting Cotabato City, either through land routes or domestic and international air travel. Considering the expected increase in international trade or foreign investment business in Greater Cotabato, these business travelers could trigger the increase of international tourists. Therefore, a strategic tourism development program and the necessary tourism infrastructure (e.g., accommodation and food services, transport and tour services, tourism packages, tourist information, etc) may be necessary to promote the "business cum tourism" strategy and to realize Cotabato City as the tourism gateway to destinations in Greater Cotabato.

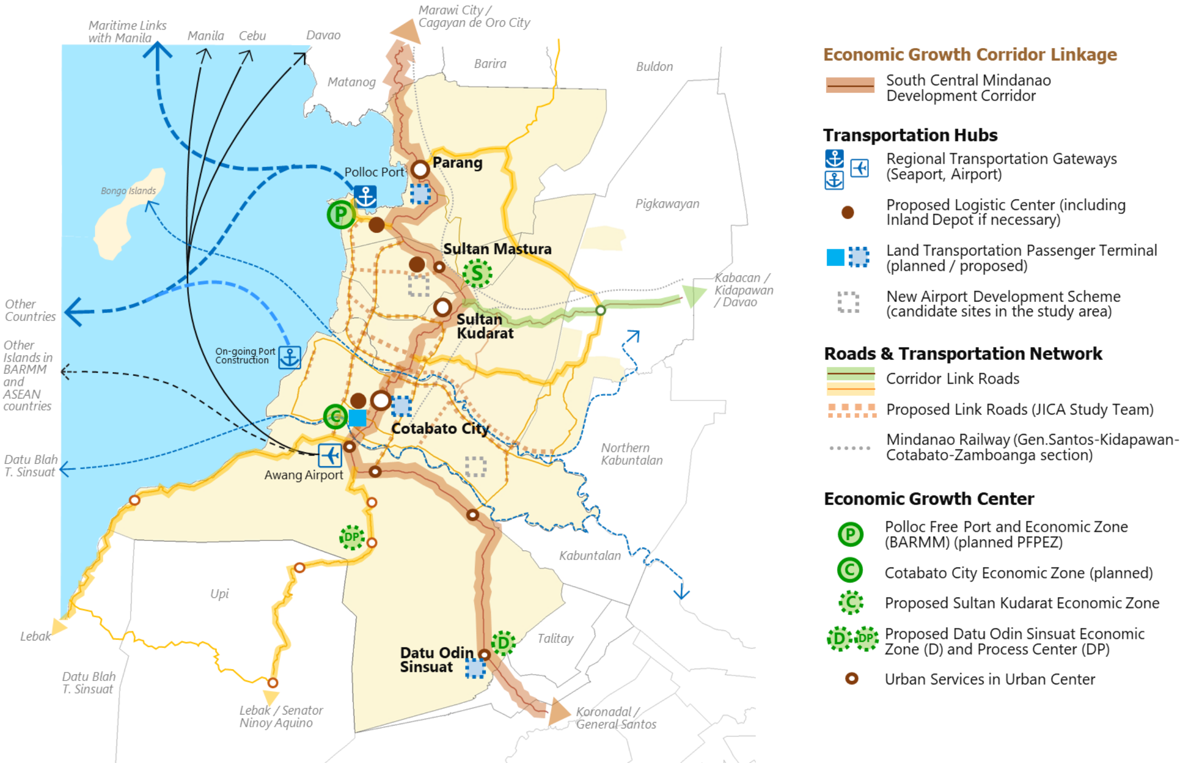
(3) Network and Linkage Formulation

1) Economic Growth Corridor Linkage

The South-Central Mindanao Development Corridor (SCMDC) is expected to be the trigger of the regional socio-economic development of the Greater Cotabato area influencing Maguindanao Province and BARMM development as well. The regional network and linkage in socio-economic development are one of the essential elements in formulating corridor development. To promote the corridor development effectively, the following key development components are expected to catalyze and enhance regional network and linkage.

- **Transportation hubs:** A transportation hub is an important support to the corridor development of the Greater Cotabato area in linking activities or information among relevant stakeholders as a part of the network. The hub provides a venue where people and products are exchanged between vehicles and/or between transport modes like bus terminals, ports, and the airport.

- **Road and transportation as links between the hubs:** National highways designated as SCMDC (Cotabato-General Santos Rd. and Cotabato-Zamboanga Rd.) should play roles in not only efficient and safe carriageways for expanding economic activities but also resilient route with redundant function coping with the vulnerable region with natural hazard risks and unsuitable through traffic in urban centers especially Cotabato City. Supplemental new routes taking account of the views above mentioned should strengthen the routes of SCMDC.
- **Economic growth centers:** The Polloc Free Port Economic Zone (PFPEZ) is envisioned as an essential hub in the SCMDC which would cater to the regional export and import of goods through its port services and processing facilities. Further, Cotabato City and the municipalities of Sultan Kudarat and Datu Odin Sinsuat are planning to establish economic zones within their respective areas and support the establishment of interrelated agro-industrial processing centers.



Source: JICA Study Team

Figure 9.1-2 Spatial Development Strategies for Greater Cotabato Area

2) Urban-Rural Linkage

For the regional development, the socio-economic linkage between the urban area and rural area has become one of the considerable challenges from both views of positive aspects (e.g. complementary service relationship) and negative aspects (one-way migration to the urban area). Taking account of this linkage, the urban-rural network should be enhanced complementarily in the Greater Cotabato area to address and improve these two aspects by the following.

- **Consolidation of mutual communication and partnership:** Cotabato City and key town centers of surrounding municipalities as nodes would offer urban services to the rural area, while rural villages offer products of agriculture and aquaculture and natural environment for recreation and tourism. These linkages should be enhanced by business communication and cooperative partnership through organizations' activities to foster a close relationship

- **Enhancement of effective physical linkage:** Both services between urban and rural areas should be supported physically by roads and transportation networks and effective ICT systems in terms of simultaneous data and information exchange and share such as business, market information, and emergency communication.

3) Inter-municipal Urban Services

Municipalities within a region have sometimes or periodical cooperative relationships such as wider urban services (e.g. waste management, water supply), especially emergency occasions for disaster. In this context, the cooperative system among municipalities could be enhanced by common regional urban services for mutual beneficiaries.

- **Regional urban service provider:** Cotabato City in which the regional functions for administration services (regional government, regional health, higher education) and business services (commercial-business including financial and banking services have played key roles in serving the Greater Cotabato area and surroundings. The city as the primary regional center should address expected needs for effective and attractive services in business, regional administration in the Greater Cotabato area.
- **Cooperative partnership:** In terms of less capability for quality of public services in surrounding municipalities, Cotabato City could offer regional public services based on the partnership among these municipalities through the new establishment of regional services or enhancement of existing organizations to expand regional-wide public service such as waste management cooperative with a common disposal site, water supply company, regional disaster risk management (preparedness and response) mentioned in a later section.

(4) Climate and Environment Resilience

1) Resilient Spatial Structure

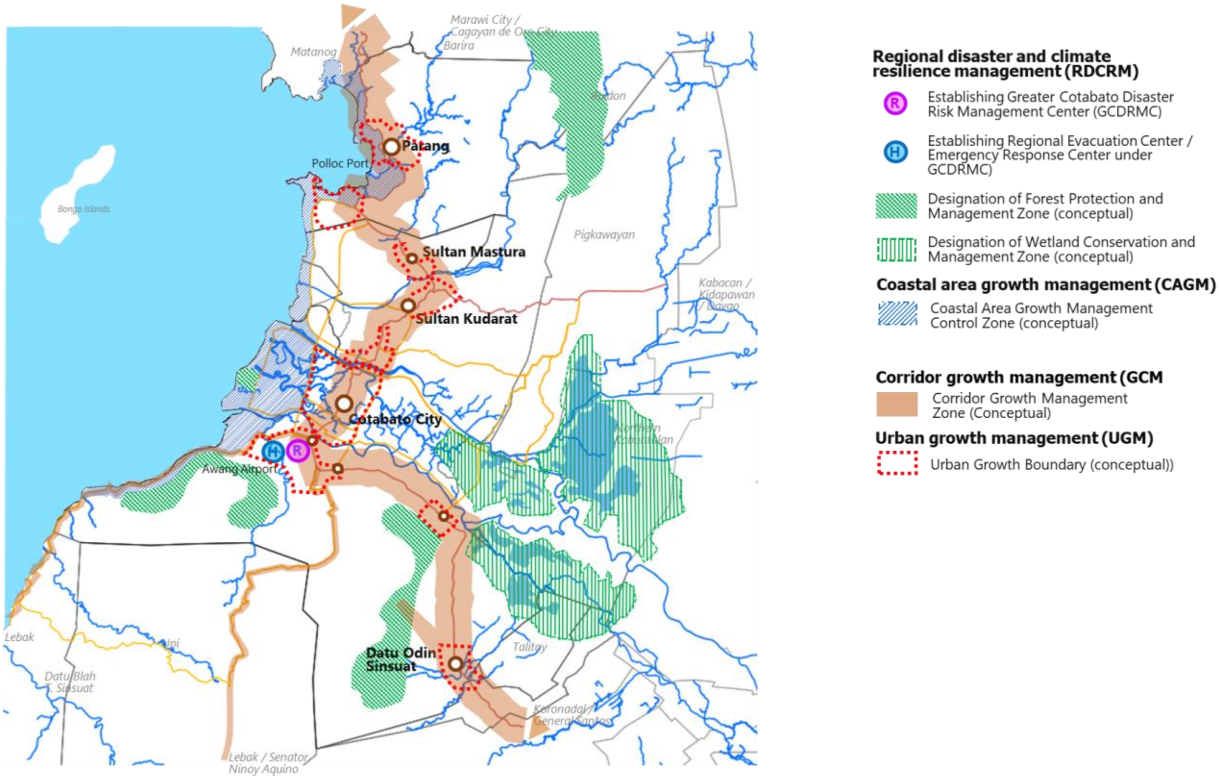
Although a single municipality should establish its prevention and mitigation measures against natural hazard risks (per RA 10121 series of 2010), the Greater Cotabato as a wider domain should also establish an effective resilient structure with cooperative mechanisms among municipalities, taking account of region-wide disaster risk reduction.

- **Disaster risk management center:** Cotabato City could contribute to wider area disaster risk management through the establishment of a disaster management center for leading and guiding activities for disaster preparedness and response, and serving the surrounding municipalities.
- **Cooperative partnership for urgent mutual service:** Partnership among LGUs for cooperative activities in case of emergency response against natural hazard events could be effective and beneficial for all municipalities in the Greater Cotabato area.

2) Sustainable Green Environment

Lowland as natural wetlands with large rivers and mangrove forests with biodiversity are the potential natural environment of the Greater Cotabato area. This natural or green environment including aquaculture and agriculture areas could be utilized wisely and sustainably for tourism and recreational services, while appropriate protection and conservation of the natural environment in the Greater Cotabato area are secured.

- **Activity center:** Activity center providing attractive services for recreation or tourism and management services for protection and conservation of the natural environment at convenient places.
- **Activity partnership:** Through a partnership mechanism, potential local human resources (e.g. community, knowledgeable persons) could be utilized as effective activity service providers for natural environment promotion, awareness, and tourism.

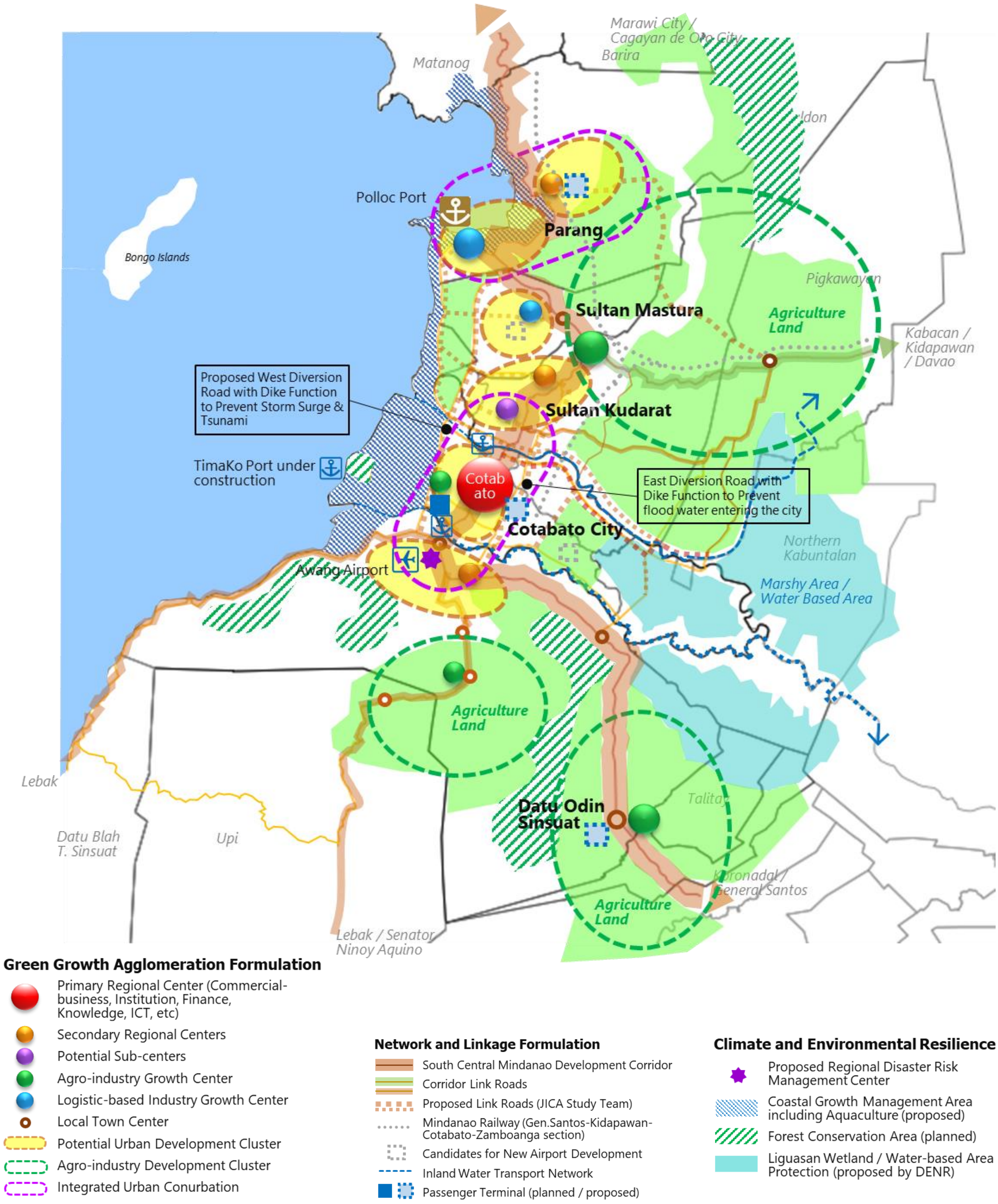


Source: JICA Study Team

Figure 9.1-3 Spatial Development Strategies for Climate and Environment Resilience

(5) Proposed Integrated Spatial Development Structure for Greater Cotabato Area

The spatial development structure for Greater Cotabato Area is formulated following the spatial development strategies described in the previous sections. Figure 9.1-4 illustrates a desirable spatial development structure as the general spatial framework for the Greater Cotabato area.

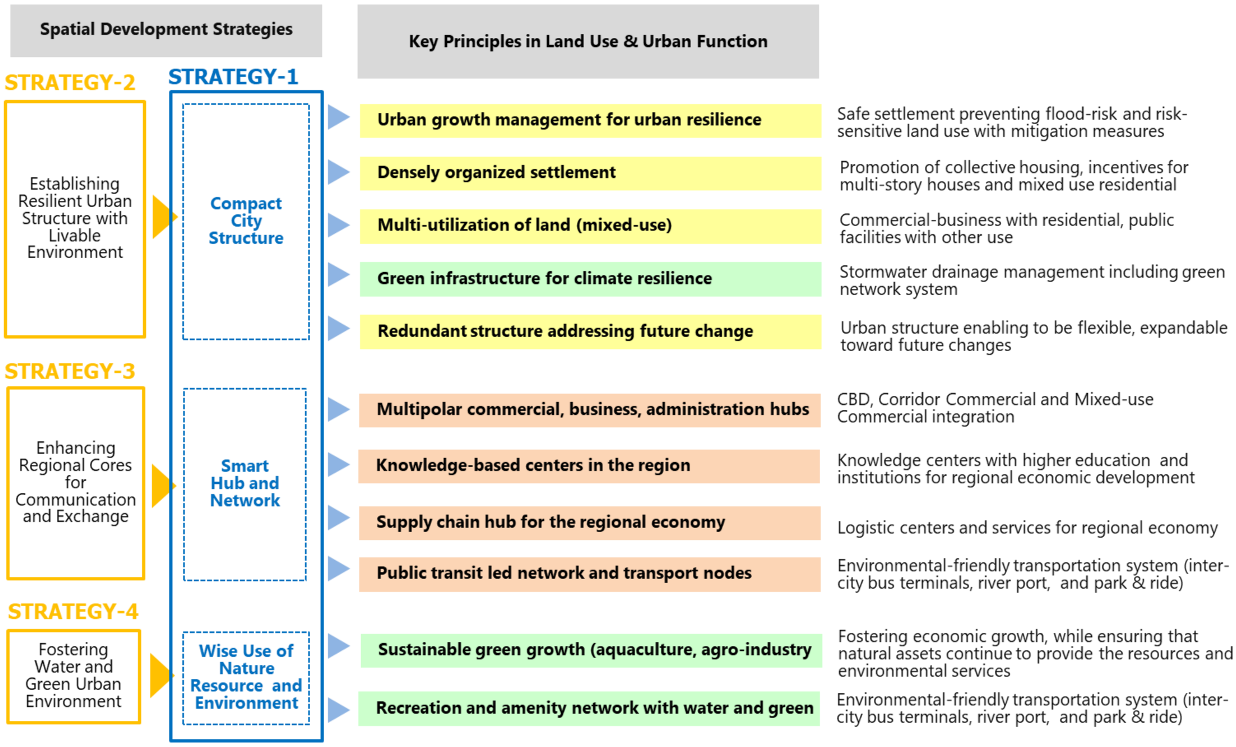


Source: JICA Study Team

Figure 9.1-4 Spatial Development Structure for Greater Cotabato Area

9.2 Guiding Spatial Development Principles Toward the Formulation of a Land Use Plan for Cotabato City

The principles for the spatial development of Cotabato City are set out to shape the four spatial development strategies mentioned previously. Figure 9.2-1 illustrates the structured diagram for key principles for land use and urban function in line with the spatial development strategies, in which smart solutions are the levers to accelerate the strategies toward their achievements.



Source: JICA Study Team

Figure 9.2-1 Key Principles in Land Use and Urban Function in line with the Spatial Development Strategies for Cotabato City

9.2.1 Strategies and Principles in Land Use and Urban Function for Cotabato City

In line with the spatial development strategies, key principles of land use, and urban function for the land use plan formulation are described as follows.

1) Compact City to Establish a Resilient Urban Structure with a Livable Environment

The concept of a compact city would be an essential element to achieve a resilient urban structure of Cotabato City, considering its land use constraints due to risks from natural hazards (flooding and storm surges, etc). To realize this concept, key tools in urban planning should be applied as shown below.

- **Urban growth management for urban resilience:**

To prevent illegal settlement in hazardous/high-risk areas and to guide efficient infrastructure provision, urban growth management becomes an inevitable requirement to control and guide development and building construction. A safe and secure settlement could be established by the physical fortification of dike roads and should be managed by a risk-sensitive land use plan. Control measures shall be imposed not only for urban activities but also for rural settlements on their compliance with the resilient building structure.

- **Organized dense settlement:**

  Densification of settlement for the compact city is one of the prerequisite elements. An appropriate level of density (e.g. medium) could be achieved through organized residential areas such as collective housing provision, incentives for appropriate multi-story house construction in consideration with weak soil foundation, and mixed land uses (residential with other uses) in certain designated areas.

- **Multi-utilization of land (mixed-use):**

  For the realization of a compact city, land use efficiency to maximize land value is also another important element within the limited land supply condition of Cotabato City. Land use classification and zoning of “mixed-use” can be applied to the land use plan and zoning. The mixed-use category allows a different type of use within one property such as commercial and business or cottage industries with the residential area to achieve efficient conditions of proximity to living and working places. This type of use could be applied to public facilities and spaces (e.g. public administration with commercial facilities or other purposes of public facilities- a library, cultural hall, etc).

- **Green infrastructure for climate resilience:**

  Small rivers and streams and greens cause floods or inundation unless these are managed properly. The stormwater drainage system should be managed by efficient water channels and retention areas by green spaces. Green infrastructure by networks of parks, open spaces, other green areas with water bodies (streams, channels, ponds) should be organized to mitigate water hazards as retention areas of flood mitigation.

- **Redundant structure addressing a future change:**

  Although the compact city concept requires efficient land utilization, the urban structure should consider some flexible land arrangements addressing some future changes.

2) Smart Hub and Network to Enhancing Regional Cores for Communication and Exchange

- **Multipolar commercial, business, administration hubs in the City center:**

  Cotabato City as the regional center is expected to play a key role in serving and promoting socio-economic development in BARMM and other influenced areas by providing important functions for communication and exchange of “human resource, goods and information services”. In land use planning, the urban function of the regional center such as regional administration and regional commercial and business center should be organized by efficient locations and sufficient spaces by a multipolar structure without negative impacts such as traffic congestion. Also, three types of commercial and business of CBD, corridor commercial, and mixed-use areas newly formulated in Cotabato City should be managed carefully to promote and improve an attractive and competitive business environment without inconvenient traffic conditions.

- **Knowledge-based centers in the region:**

  Higher education such as universities, colleges, professional schools, and institutions in Cotabato City played a key role in producing human resources to contribute to regional economic development in terms of numbers and various professions. These educational amenities and resources should be enhanced to stimulate the knowledge-based industry (e.g. ICT solution to sector industry).

- **A supply-chain hub for the regional economy:**

  Cotabato City has also played an important role in supporting and contributing to hinterland economic production (e.g. agriculture, aquaculture, and other resource-based economies) by providing services from production to delivery. This function of the supply chain should be strengthened by formulating efficient hub functions including logistic center formulation.

- **Public transit-led network and transportation nodes:**

  Public transport with certain capacity could play an inevitable role in serving travelers, commuters between living and working places with less emission, and without traffic congestion. Commercial and business areas as one of the destinations of Cotabato City and surroundings should be organized by convenient and efficient access to public transportation (bus and mini-bus system) in combination with walkway system and terminals (e.g. inter-city bus terminals); while other traffic such as heavy industrial traffic or through traffic in the region can take outside routes of the city center areas.

3) The Wise Use of Natural Resources and Management of the Environment for Fostering Water and Green Urban Environment

- **Sustainable green growth economy:**

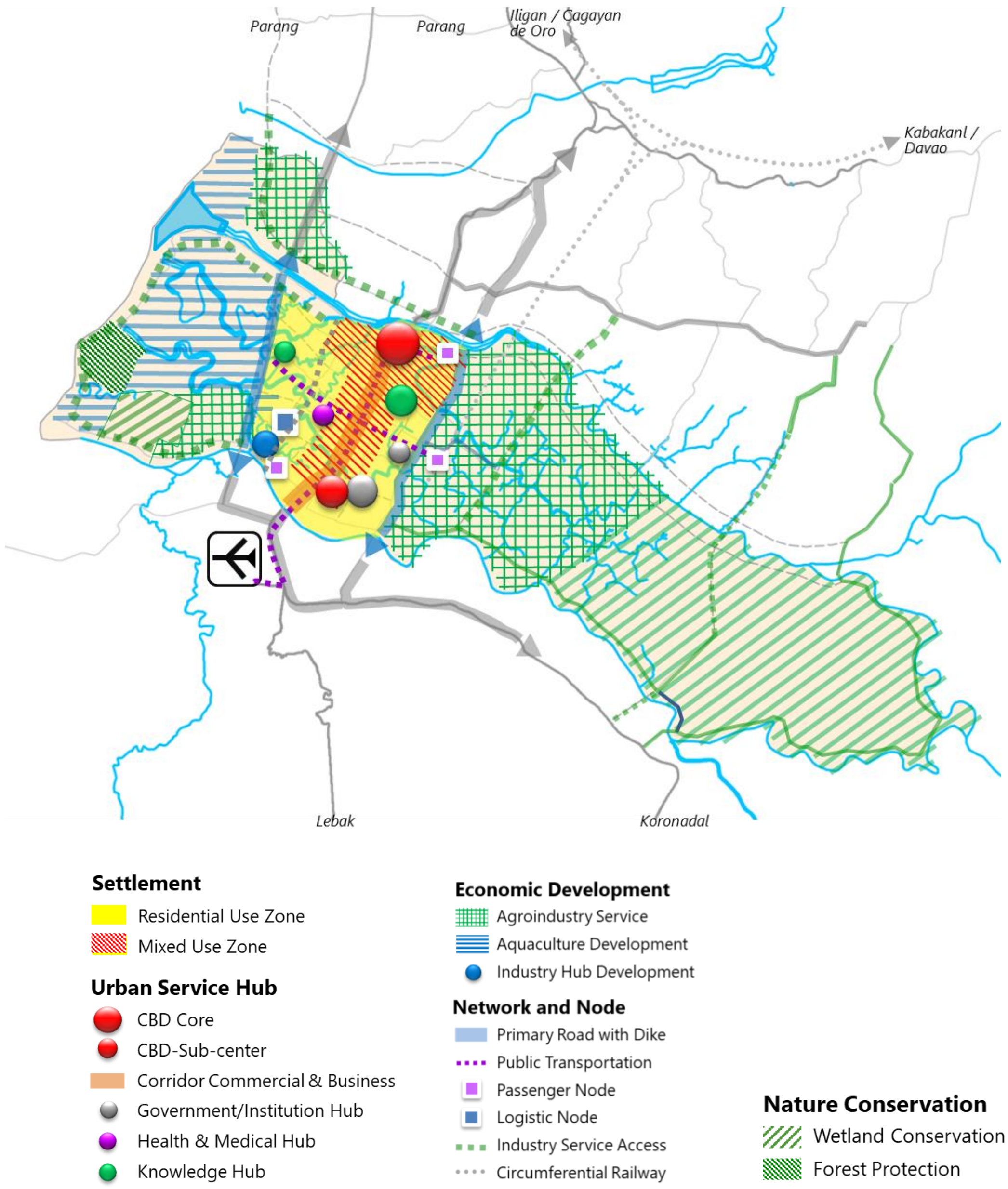
  In line with the policies of Mindanao's economic development focusing on agriculture and fishery sectors, Cotabato City is expected to be a regional center to support and promote innovative agro-industrial and aquaculture development in a sustainable manner. Taking account of large potential areas in the city, land use should consider retaining and utilizing those green and water areas to promote sustainable resource-based economic development and natural environment protection, also as a part of the climate change adaptation.

- **Recreation and amenity network with water and green:**

  As one of the economic developments utilizing water and green resources and managing for climate resilience, these are potentially valuable resources for recreation and amenity elements in network formulation. These resources are also potential for ecotourism which the regional development plans have proposed.

9.2.2 Spatial Development Framework for Cotabato City

The spatial development structure for Cotabato City is formulated following the spatial development strategies described in the previous sections. Figure 9.2-2 illustrates a desirable spatial development structure as the general spatial framework for the Greater Cotabato area.



Source: JICA Study Team

Figure 9.2-2 Spatial Development Structure for Greater Cotabato Area

9.3 Implementation Guidance for Greater Cotabato Development

9.3.1 Development Staging for Spatial Development

Implementation guidance to direct desired actions to concretize the spatial development strategies for the Greater Cotabato area has outlined activities to be done in stages. This guidance is divided into three stages that include uncertainties surrounding the political process for project schemes publicized at present. The following are principles of the implementation guidance of Greater Cotabato spatial development. Table 9.3-1 illustrates the overall implementation guidance including sector development.

1) Stage-I (2021-2025): as Take-off Phase for Cotabato City and Northern Greater Cotabato

Stage-I (2021–2025) will serve as implementing the trigger projects for considerable physical improvements of the area concerning Cotabato City and the northern part of Greater Cotabato. This is in terms of disaster risk reduction and economic development promotion for the area by the Ambal-Simuay River and Rio Grande de Mindanao River Flood Control Projects, West Diversion Road (tsunami barrier) mainly and the Road Network Development Project in Conflict-affected Areas in Mindanao Project (road network project) the first five years' phase of the 10-year project term. Especially, the West Diversion Road is proposed as the highest priority project to be implemented within the first five year's stage in Stage-I.

A priority for Stage-I requires incorporating suitable programs and projects through maximization of benefits from the trigger projects taking account of opportunities of inhabitable land development for Cotabato City and other relevant areas and socio-economic development taking the advantages of accessibility improvement in the northern part of Greater Cotabato area.

2) Stage-II (2026-2030): as Expanding Phase for Cotabato City and Southern Greater Cotabato

Stage-II (2026–2030) will reflect the expectations of completion of the trigger projects mainly by the road network project (the last half term). The projects are expected to contribute to socio-economic developments as a part of the South Central Mindanao Development Corridor linking with Polloc Port, the northern and southern part of the Greater Cotabato area, and major cities in Central Mindanao.

A priority for Stage-II is proposed to lead to the completion of the urban development of Cotabato City to enhance urban functions (residential, commercial & business and agro-industry services) under the condition of the completion of the West Diversion Road (tsunami barrier) in Stage-I, with the urban and economic enhancement of Datu Odin Sinsuat and surroundings in the southern part of Greater Cotabato area. Necessary urban services in the area are expected to expand not only for the settlement but also for agro-industrial development as a part of cluster development.

3) Stage III (2030-2040): Establishing Phase for Whole Greater Cotabato Area

Stage-III (2031–2040) will reflect the expectations of the completion stage including a considerable key transport network and hub (new airport and railway) as other trigger projects with greater impacts on the socio-economic development for Greater Cotabato. Although the candidate location for new airport development is not fixed yet, and the railway project is expected to begin the development in this stage.

A priority for Stage-III is proposed to provide for the acceleration of urban and socio-economic development of Cotabato City to maximize the foundation of infrastructure and its opportunities provided in Stage-I and II to extend the capacity of international trade markets utilizing regional gateway functions by inland, sea, and air transport hubs. On the other hand, further expansion, and development on the economic corridor in other municipalities are realized by the enhancement of cluster development in combination with urban services for the development of settlements and agriculture development by process and distribution improvement projects and programs in the agro-industry promotion.

Table 9.3-1 Implementation Guidance on Spatial Development for Greater Cotabato Area

Item		STAGE-I (2021~2025)	STAGE-II (2026~2030)	STAGE-III (2031~2040)
Stage		Taking off	Expanding	Establishing
Development Policy		• Implementing the initial stage for resilient Cotabato City as the primary Regional Center • Clustering key secondary Regional Centers	• Establishing Cotabato Regional Center • Clustering other secondary regional centers	• Full-scale development for all relevant local governments to establish functions of Greater Cotabato as the Regional Center
Key Initiatives for Development	Focused Area	• Cotabato City and Northern Greater Cotabato	• Cotabato City and Southern Greater Cotabato	• Remained areas to complete Greater Cotabato
	Flood Project			
	Corridor Dev			
	Transport Hubs			
Guidance for Priority Sector Program	Key Urban Centers Enhancement	• Cotabato City: ensuring settlement programs concerning the ASR-RGMR Flood Control Project, West Diversion Road (tsunami barrier). • Parang and Sultan Kudarat: expanding settlement areas with basic urban service provision	• Cotabato City: complementing settlement programs together under the condition of the completion of the West Diversion Road in Stage-I. • Datu Odin Sinsuat: expanding settlement areas with basic urban service provision	• Completing all required settlement and urban service developments in the Greater Cotabato area. • Expanding necessary urban functions based on the role and function of each urban center
	Key Economic Clusters Development	• MCRAIC development in Cotabato City for agro-industry including Halal products • Parang SEZ enhancement by the establishment of the supply chain development	• MCRAIC enhancement of business ties with material suppliers of agriculture and aquaculture. • Development food crop process and industrial crop process centers with hinterland agriculture lands in the southern Greater Cotabato	• Product development and improvement through the establishment of Research & Marketing Promotion Center for domestic and international markets. • Diversify economic activities to maximize agriculture and aquaculture production
	Key Regional Infrastructure Development	• Completing the ASR-RGMR Flood Control project. • Completing key relevant road projects including the West Diversion Road in the first five year's stage. • Implementing regional trunk and local distribution utilities development studies addressing urbanization • Establishing drainage master plans for Greater Cotabato	• Completing Polloc Port expansion. • Implementing new regional roads and transportation hubs in Greater Cotabato • Developing a new airport in Greater Cotabato • Implementing trunk utilities station project (water, energy, telecommunication)	• Completing and operating major infrastructure developments for Greater Cotabato • Implementing technical studies for Mindanao Railway in Greater Cotabato

Item		STAGE-I (2021~2025)	STAGE-II (2026~2030)	STAGE-III (2031~2040)
	Resilient Environment Program	• Redefining natural protected areas for wetlands in the coastal areas, marsh areas, riversides including retarding areas for flood control • Defining green and open spaces for retention areas for flood control. • Product and regional network development for eco-tourism	• Legislating the natural protected areas or other areas to be restricted from developments in Greater Cotabato • Establishing an effective managing system including legislation, implementation bodies, controls for green and open space in each urban area. • Promoting ecotourism in combination with competitive tourism facilities and products for both domestic and international markets.	• Fostering public and private partnerships for sustainable natural environment protection and utilization of wetlands in the coastal area, eastern marshy areas, riparian areas.

Reference: MCRAIC: Metro Cotabato Regional Agro-industrial Cente, SEZ: Special Economic Zone, ASR-RGMR: Ambal-Simuay River and Rio de Grande Mindanao River
Source: JICA Study Team.

9.3.2 Institutional Arrangement for Growth Management

(1) An Integrated Approach for Growth Management of the Greater Cotabato Area

Growth management for spatial development in the Greater Cotabato area will be one of the considerable challenges toward attractive and competitive development as one of the regional centers in Mindanao. The current development trend associated with government infrastructure development projects in the area suggests potentials to stimulate further growth despite several physical constraints and vulnerable conditions due to natural hazard risks and weak management capacity.

In this context, careful spatial growth management should be promoted and strengthened taking advantage of the strategic location and abundant natural resources in Greater Cotabato. Due to the physical characters of the Greater Cotabato area, the spatial growth management needs to consider four fields of development management to guide and achieve sustainable development in an integrated manner at the regional level shown below.

- **Regional disaster and climate resilience management** (RDCRM) is one of the indispensable tasks to achieve safe and appropriate urbanization in the Greater Cotabato area in an integrated manner. This will require regional-level activities against hazard risks, such as floods, earthquakes, etc. spreading beyond territorial boundaries of single local governments.
- **Corridor growth management** (CGM) in consideration with appropriate spatial development of the South-Central Mindanao Development Corridor involving Cotabato City and other five municipalities in the Greater Cotabato area should be introduced and promoted.
- **Urban growth management** (UGM) for Cotabato City and other municipalities toward sustainable and balanced urbanization as one regional center with an expectation of synergy development effects and inter-municipal cooperation and without impartial socio-economic development in the area.

- **Coastal area growth management** (CAGM) for appropriate utilization of the coastal area including fishery, aquaculture, and tourism development taking account of tsunami and storm surge risks and its management.

(2) Four Management Effects Assisting to the Spatial Development Strategies

On the other hand, these management themes for the spatial development of the Greater Cotabato area are expected to assist and strengthen effectively the spatial development strategies proposed in the previous section.

The regional disaster and climate resilience management are expected to design an implementation framework of the spatial strategy of "climate and environment resilience" as the foundation of all types of development in Greater Cotabato.

The corridor growth management is another fundamental measure to be a common pillar of the development management to all local governments in the Greater Cotabato area, where urban centers and economic cluster development are expected to be integrated under this management measure. Therefore, this management measure becomes a tool for two key spatial development strategies of "network and linkage formulation" primarily and "green growth agglomeration" strategy.

Urban growth management should play a key role in assisting the strategy of "green growth agglomeration" mainly through the formulation of harmonized urban centers and cluster formulation development in the Greater Cotabato area together with support by the corridor growth management to guide economic development along the corridor.

The coastal growth management is another required measure for the Greater Cotabato area involving the local governments along with the coastal municipalities of Parang, Sultan Mastura, Sultan Kudarat, Cotabato City, and Datu Odin Sinsuat. This measure is expected to contribute to concretizing the "climate and environment resilience" strategy. Table 9.3-2 shows the relationship between the spatial development strategies and the four applicable management measures.

Table 9.3-2 Four Management Effects Assisting in Spatial Development Strategies

Spatial Development Strategy		Management Measures			
		RDCRM	CGM	UGM	CAGM
1. Green Growth Agglomeration (concentration)	1.1 Cluster development for resource-based economic development	○	●	●	--
	1.2 International anchoring posts	--	○	●	--
2. Network and linkage formulation (connectivity)	2.1 Economic growth corridor linkage	○	●	○	○
	2.2 Urban and rural linkage	○	●	○	●
	2.3 Inter-municipal urban services	○	○	●	○
3. Climate and environment resilience (vulnerability reduction)	3.1 Resilient spatial structure	●	●	●	●
	3.2 Sustainable green environment	●	○	○	●

Legend: ● = Main role or the most desirable, ○ = supportive or supplementary, -- = not applicable or suitable,
RDCRM: Regional Disaster Risk Reduction Management, CGM: Corridor Growth Management, UGM: Urban Growth Management, CAGM: Coastal Area Growth Management

(3) Three Key Legal Instruments for Development Management

Toward the implementation of that management, an effective instrument is required by three key legal measures of regulatory and promotion tools to control and manage development as shown below and in Table 9.3-3.

- **Relevant spatial development framework establishment:** Spatial development framework for each development management measure would take shape on the physical ground by certain mapping works to guide implementation by zoning regulation and sector projects. Various spatial frameworks should be formulated based on certain baseline information.
- **Regulation and control measures** for urban activities and desirable urban form to achieve appropriate spatial development taking account of vulnerability reduction, protection of the distinctive natural environment, urban characteristics, and values in the Greater Cotabato area.
- **Promotion measures** to guide spatial development for effective and efficient urban activities and services through appropriate provision of urban infrastructure (e.g. road and transport) and public services (e.g. education and health services).

(4) Priority Actions for Implementation of Management Measures

The priority in principle is to formulate and establish a spatial framework for each management at a regional level. Each framework could guide further actions such as the issuance of legal measures or other detailed plans for implementation of the strategies.

Table 9.3-3 Measures for Integrated Spatial Growth Management to Greater Cotabato Area

Key Challenges for Effective Growth Management	Regulative Control Measure for Growth				Promotive Measure to Guide Growth		
	Urbanization Growth Boundary Control	Land use and Building Control	Special Development Control	Environmental Protection	Infrastructure and Service Provision	Development Incentives	Special Development Zone
1. Regional Disaster and Climate Resilience Management for Greater Cotabato Area							
Regional-wide hazard assessment & designation	○	●	●	○	--	--	--
Key infrastructure protection from hazards	--	●	--	--	● (hazard resistance)	--	--
Key public facilities improvement or relocation for risk reduction	--	●	--	--	●	--	--
Appropriate regional stormwater management	○	●	●	●	●	--	--
Disaster prevention and mitigation program for land use and settlement	●	●	●	●	●	●	--
2. Corridor Growth Management for Greater Cotabato Area							
Ribbon development control along major roads and its right-of-way (ROW)	●	●	●	○	●	○	--
Appropriate transport and logistic center development	○	●	●	--	●	●	●
Traffic and access control for roadside development	--	●	●	--	--	--	--
Key function centers for Cluster Development along the corridor	--	●	--	--	●	●	○
Regional tourism circuit development and promotion	--	--	--	●	●	○	○
3. Urban Growth Management for Greater Cotabato Area							
Resilient urban structure against water hazard risks	●	●	●	●	● (structural measures)	○	--
Preventing urban sprawl	●	●	○	●	●	○	--
Compact urbanization for sustainable development	●	●	○	●	●	○	--
Compact urban function distribution	○	●	○	--	●	●	○
Public transport integration with adequate urbanization	--	●	●	--	●	●	○
Appropriate agricultural land and rural settlement	●	●	○	●	○	--	--
Securing green and open space	○	●	○	●	--	○	--
Protecting vulnerable natural environment and resources	●	●	○	●	--	--	--
4. Coastal Area Growth Management for Greater Cotabato Area							
Resilient coast area against storm surge and tsunami	●	●	○	●	● (structural measures)	--	--
Disaster risk mitigation by the non-structural provision	--	●	●	--	●(non-structural)	--	--
Sustainable aquaculture development	--	--	●	●	--	--	●
Appropriate rural settlement	●	●	○	●	●	--	--
Protecting vulnerable natural environment and resources	○	●	○	●	--	--	--

Legend: ● = Compulsory or most effective, ○ = supportive or supplementary, -- = not applicable or suitable

(5) Regional Disaster and Climate Resilience Management

Natural disaster risks in the Greater Cotabato area are one of the critical constraints toward favorable socio-economic development, especially water hazards in all local governments along the coast and rivers in the Greater Cotabato area. Water hazards such as flooding, storm surge, and tsunami could occur and spread widely beyond each administrative jurisdiction. With Executive Order No. 10121, local governments are capacitated and mandated to prepare their local disaster risk reduction and management plans (LDRRMP) to cope with hazards and incorporate them into CLUP formulation.

The formulation of the regional disaster reduction management spatial framework (RDRMSF) based on appropriate natural hazard risk assessment maps will play a pivotal role in guiding resilient spatial structure at a regional level in consideration with regional infrastructures such as trunk road network, water, power supply system and evacuation sites.

This framework could guide the formulation of Comprehensive Land Use Plans (CLUP) and other relevant spatial plans by every local government unit. The implementation of the CLUP is assured through a zoning ordinance for effective and appropriate control and regulations for development.

Table 9.3-4 Desirable Institutional Measures for Regional Disaster and Climate Resilience Management for Greater Cotabato Area

	Development Management Program	Responsible Organization				Development Stage		
		NA	RA	LGU	New	I	II	III
Planning & Framework Setting	1. Formulation of regional disaster risk reduction management spatial framework (RDRMSF) with regional risk assessment	○	●	○	--			
	2. Baseline key infrastructure survey and program on hazard-proof improvement	●	○	○	--			
	3. Baseline survey for public facilities resiliency and improvement program	●	○	○	--			
	4. Formulation of stormwater and drainage management plan	○	●	○	--			
	5. Promotion of CLUP update based on relevant water-based risk reduction frameworks	○	○	●	--			
Regulatory Measure	6. Land development regulations for under the disaster risk reduction management framework	○	●	●	--			
	7. Guidance or strengthening of building structure by hazard-proof measures and location focusing on public facilities (school, hospital, etc)	○ GL	○	●	--			
	8. Guidance or promotion of water retention function for public facilities and spaces	○ GL	○	●	--			
Promotive Measure	9. Promotion of hazard resilient settlement program including temporal re-settlement	○	○	●	--			
	10. Regional cooperative disaster response (regional evacuation and logistic facilities, etc)	○	●	○	●			

Legend: ● = Compulsory or main role or most effective, ○ = supportive or supplementary or coordination, -- = not applicable or suitable, NA: National Authority, RA: Regional Authority, LGU: Local Government Unit, New: Establishment of potential New Authority or private sector organization, ST: Stage, GL: Guidelines
Reference: RDRMSF/ Regional Disaster Risk Management Spatial Framework

(6) Corridor growth Management

The challenge of managing corridor development in the narrow sense lies mainly in the interaction between transportation and land use affected by ad-hoc socio-economic activities. The land use plan used to predict transportation needs inevitable changes by new highways stimulating urbanization and its growth. At the same time, competing demands on the corridor may damage long term transportation and development objectives. Therefore, corridor management promotes the orderly development of a transportation network and roadside development. On the other hand, in the broad term, economic corridor development requires effective management of the distribution of economic function and efficient spatial organization on the corridor. Roadside areas as the high accessible potential location could serve hinterland agriculture land development formulated by a cluster development involving various functional development such as process and distribution of agricultural products and transportation facilities (e.g., terminal, logistic center, workshop, inland depot, etc).

Institutional measures for the corridor growth management are applied to the South-Central Mindanao Economic Corridor encompassing Cotabato City and all other municipalities in the Greater Cotabato area. The regulatory and promotion measures for various development should be based on a higher spatial development framework to be formulated at the level of the Greater Cotabato area through necessary thematic baseline data. Table 9.3-5 indicates desirable institutional measures for corridor growth management in the Greater Cotabato area.

Table 9.3-5 Desirable Institutional Measures for Corrido Growth Management for Greater Cotabato Area

Proposed Development Management Program		Responsible Organization				Development Stage		
		NA	RA	LGU	New	I	II	III
Planning & Framework Setting	1. Formulation of corridor development framework and spatial plan for SCMDCSF*	○	●	○	○			
	2. Formulation of agriculture cluster development plan (process, distribution, market, quality control, etc)	○	●	○	--			
	3. Corridor transportation development (access, logistic, terminal, ports, etc) plan	●	●	○	--			
	4. CLUPs update following the corridor development framework	○	○	●	--			
Regulatory Measure	5. Zoning ordinance under the corridor development framework	○	○	●	--			
	6. ROW including roadside development and access traffic control	○ GL	●	--	--			
	7. Transport and logistic facilities or zone development guidelines (terminal, logistic, center, etc)	○ GL	●	--	--			
Promotive Measure	8. Cluster development program (material, process, distribution, marketing, etc)	○	○	●	--			
	9. Special development zone for agro-industry and logistic facilities formulation with incentive measures	○	○	○	●			
	10. Regional tourism circuit development and promotion program	●	●	●	--			

Legend: ● = Compulsory or main role or most effective, ○ = supportive or supplementary or coordination, -- = not applicable or suitable, NA: National Authority, RA: Regional Authority, LGU: Local Government Unit, New: Establishment of potential New Authority or private sector organization, ST: Stage, GL: Guidelines
Reference: SCMDCSF/ proposed South-Central Mindanao Development Corridor Spatial Framework

(7) Urban Growth Management

Several higher spatial frameworks for vulnerability reduction, corridor development at the regional level, urban centers considering shared urban functions and cooperative urban services, public transportation network and key trunk utility network and stations in the Greater Cotabato area should be formulated as a whole, to reflect statutory zoning plan in each local government unit.

Regulatory and promotion measures as institutional instruments for managing various development are listed as desirable measures in Table 9.3-6. The introduction of "growth boundary" is one of the considerable regulatory measures to prevent urban sprawls and to guide desirable limits of future urbanization in each urban center in line with higher spatial frameworks.

Table 9.3-6 Desirable Institutional Measures for Urban Growth Management for Greater Cotabato Area

	Development Management Program	Responsible Organization				Development Stage		
		NA	RA	LGU	New	I	II	III
Planning & Framework Setting	1. Formulation of integrated urban centers enhancement program (administration, regional health, higher education, institution, etc)	●	●	●	--			
	2. Promotion of CLUP update following all relevant regional spatial frameworks (RDRMSF, SCMDCSF, ICMSF)	○	○	●	--			
	3. Formulation of Greater Cotabato public transportation and logistics development plan	○	●	○	--			
	4. Promotion of CLUP update to meet public transit-oriented development (TOD) based on the public transportation plan	○ GL	--	●	--			
	5. Promotion of disaster risk resilient resettlement program in line with RDRMSF	○	○	●	--			
	6. Formulation of regional key utility network (power, water, sewerage, waste disposal, etc) development framework	○	●	○	--			
	7. Regional agriculture land management framework with rural settlement improvement	○	●	○	--			
	8. Formulation of "airport city" development plan in case of location in Greater Cotabato area	●	○	●	--			
	9. Formulation of the regional environmental resilient framework (nature protection, biodiversity, climate change adaptation, wetland, etc)	○	●	○	--			
Regulatory Measure	10. Promotion of introducing "growth boundary" to the zoning ordinance	○ GL	--	●	--			
	11. Strengthening of hazard-proof building structure design and standard in local codes	○ GL	○	●	--			
	12. Enhancement of legal measures for protecting and retaining green and open space	○ GL	●	●	--			
Promotive Measure	13.Program for settlement promotion n in desirable urban areas with financial incentives	○ GL	○	●	--			
	14. Program for utility provision in the desirable urban settlement area	--	○	●	--			
	15 Special area development for the industry, commercial business development with incentives	○ GL	○	●	--			

Legend: ● = Compulsory or main role or most effective, ○ = supportive or supplementary or coordination, -- = not applicable or suitable, NA: National Authority, RA: Regional Authority, LGU: Local Government Unit, New: Establishment of potential New Authority or private sector organization, ST: Stage, GL: Guidelines
Reference: RDRMSF/ Regional Disaster Risk Management Spatial Framework, ICMSF/ Integrated Coastal Management Spatial Framework, SCMDCSF/proposed South-Central Mindanao Development Corridor Spatial Framework

(8) Coastal Area Growth Management

Since coastal management for socio-economic activities (e.g. fishery, aquaculture, tourism), natural environment protection (e.g. mangrove forest, coral reef shore), and natural hazard risks (tsunami, storm surge, and coastal erosion), have become one of the considerable issues in the Philippines, the government undertook efforts to address the issues and improve the coastal environment through the Integrated Coastal Zone Management (ICZM) covering areas of marine, seashore, coastland. The coastal area of Greater Cotabato has rich marine resources and seaport utilization. While the share of the commercial fishery products (metric tonnage) in Maguindanao Province is low (0.4% of BARMM 2018), the opposite is reflected in the aquaculture products in the province posting a predominant share in the total production in BARMM. The high share of aquaculture is attributed to the mangrove forest areas along the coast where many fishponds have been put up.

On the other hand, local government units of coastal cities and municipalities in the Philippines have faced enormous challenges generally due to a lack of trained personnel, budget, and capability in planning and technical knowledge, since the local governments have had the primary legal mandate for managing municipal waters in the coastal area.

Table 9.3-7 indicates desirable institutional measures for the coastal area growth management in the Greater Cotabato area. To apply both regulatory and promotion measures to the coastal areas, the higher spatial framework should be formulated as an integrated coastal management spatial framework taking account of natural hazard risks and mangrove forest conservation, aquaculture activities, rural settlements, and other seashore socio-economic activities.

Table 9.3-7 Desirable Institutional Measures for Coastal Area Growth Management for Greater Cotabato Area

	Development Management Program	Responsible Organization				Development Stage		
		NA	RA	LGU	New	I	II	III
Planning & Framework Setting	1. Formulation of integrated coastal management spatial framework (ICMSF)	●	or ●	●	--			
	2. Formulation of aquaculture cluster development plan (process, distribution, market, quality control, etc)	○	●	●	--			
	3. Formulation of coastal area disaster risk prevention and mitigation program	●	●	○	--			
	4. Formulation of coastal area natural environment protection program	○ GL	○	●	--			
Regulatory Measure	5. Zoning ordinance update for coastal area land development under the ICMSF development framework	○	○	●	--			
	6. Special coastal area development control in consideration with natural hazards and natural environment protection	○ GL	●	--	--			
Promotive Measure	7. Special development zone for intensive aquaculture development with logistic facilities including incentive measures	○	○	●	--			
	8. Program for resettlement promotion n in high hazard risk areas with financial incentives	○	○	●	--			

Legend: ● = Compulsory or main role or most effective, ○ = supportive or supplementary or coordination, -- = not applicable or suitable, NA: National Authority, RA: Regional Authority, LGU: Local Government Unit, New: Establishment of potential New Authority or private sector organization, ST: Stage, GL: Guidelines
Reference: ICMSF/ Integrated Coastal Management Spatial Framework,

9.3.3 Further Considerations

Under rapidly changing social, economic and administrative environment, it is urgent for Cotabato City and Greater Cotabato to larger extent to maintain existing social cohesion and to strengthen the overall unity, through development of urban infrastructure and proper projects for the communities. The projects identified in this study shall not cause harm to any individual or group (Do No Harm) during the implementation. To avoid harming or putting into disadvantage any individual or group which may cause by the project, the following are recommended to be undertaken:

1) Transparency in land acquisition process for development projects:

For the infrastructure projects, land acquisition is needed to secure a place to install the facility (e.g. water treatment facility, roads and bridges, etc.). By law, land to be taken by the government has to be fully compensated. The assumption however is the landowner has land title and tax declaration which is the evidence that tax is diligently settled. There are cases however where the landowner is not in possession of required documents as indicated in Table 9.3-8. In the same table, the needed action by the law owner is indicated to receive full compensation from the government. For fair and amicable solution, this study suggests to apply the two implementation rules:

a. To make sure that accurate data and information are obtained and equally shared among the stakeholders (particularly the concerned land owner).

b. To maintain upmost transparency in the acquisition process, by following due process of law.

Table 9.3-8 Status of Land Ownership in BARMM and Recommendation

Land ownership classification	Recommendation for compensation	Legal basis	Further actions maybe taken by land owners/ claimants
a) Land with title and tax declaration	Full compensation from DPWH	Full compensation at replacement cost based on the current market value of land (R.A 10752) and DPWH Department Order 124, series of 2017	None
b) Land with title but without tax declaration	Full compensation (after deduction of accumulated tax)	DPWH will pay accumulated taxes to the LGU and the remaining compensation amount will be given to the land owner (DPWH D.O. 152, 2017)	Land owners shall settle their accumulated unpaid taxes at the LGU to receive full compensation from DPWH
c) Land without title but with tax declaration	Full compensation upon satisfying the check list in the next column	Per DPWH ROW Acquisition Manual - Main Guidelines, Dec 2017, full compensation to land claimant provided the land claimant shall present: • Tax Declaration showing his and his predecessors' open and continuous possession of the property for at least thirty (30) years. • Certification from the DENR that the land is alienable and disposable (land classified by DENR as timber and mineral lands can't be distributed). • Other documents that may show proof of Ownership.	None
d) Land without title and without land declaration	• Compensation for the structures (not for the land) made by the claimants • No compensation for land (perhaps the only way is by donation)	For the case of donation, JICA's Guidelines for Environmental and Social Consideration must be followed which is based on the WB Involuntary Resettlement Sourcebook. The operational words are "informed consent" and "power of choice" by the donors.	Land claimants may apply for land titling by filling for patent at DENR for issuance of land title.

Source: Preparatory Survey for Road Network Development Project in Conflict-Affected Areas in Mindanao, JICA-DPWH, 2018

<u>2) Development in accordance with the general will of the stakeholders:</u>

While armed conflicts were going on, it has been reported that consensus building among stakeholders for the development had been difficult. As the result, relationship between beneficiaries and the implementation agencies like Local Government Units (LGUs: municipality, city and provincial governments) became jeopardized and thus created extra causes of instability in the area. To avoid such confusion, this survey emphasizes the importance of the two practices by responsible public authorities:

a. To execute maximum dissemination of project data and information to the public.

b. To hold regular stakeholder meetings as preventive measure and hold an ad hoc meeting whenever there is request from stakeholders.

3) To design 'assurance of inclusiveness', in the development plan formulation

a. The collateral damages to the socially vulnerable people, such as Indigenous people (IPs), Internally displaced people (IDPs), Out of School Youth (OSYs), urban squatters, women, people with handicaps must be far more serious than that of ordinally people. Nevertheless, the actual contents and scale of those misfortune have been little known up, to present. Therefore, in addition to the basic principles of peacebuilding such as "do no harm" and "do maximum good", the concept of "inclusiveness" must be respected.

b. To make effective the concept of "inclusiveness" in practice, it is necessary to install preventive mechanism against deterioration of the general living conditions of socially vulnerable people as beneficiaries.

Towards balanced allocation of urban functions coping with competing for various activities' demands, balanced allocation with strategic spatial policies and appropriate standards based on the demands of the urban function to formulate appropriate "Greater Cotabato Area" development becomes one of the key challenges for land use planning in consideration with land demands of various urban functions to be enhanced in future within a limited inhabitable land. The following alternative institutional arrangement becomes further considerations to be taken:

Alternative 1: Utilization of current coordination function by regional authorities:

Taking into account the need for integrated regional development, concerned regional development body could play a key role in promoting and coordinating the harmonized development on the proposed Urban Development for Greater Cotabato City or as a primary urban center.

Alternative 2: Establishing a regional coordination organization involving relevant neighboring local Government Units for Greater Cotabato:

Taking into account the need for integrated regional development, it could be effective or efficient to engage nearby local government units for Greater Cotabato by establishing a coordination unit under the relevant regional development body for the proposed Urban Development for Greater Cotabato City or as a primary urban center.

CHAPTER 10
LAND USE PLAN FOR COTABATO CITY

10.1 Current Land Use Situation of Cotabato City for the Last Ten Years

10.1.1 Features of the Function of Cotabato City

- Cotabato City has been playing a significant role in the area of public governance. Aside from being the principal center of management for the local government, the city had been the regional center of the former Autonomous Region in Muslim Mindanao (ARMM) since its creation despite that the city had never been part of the ARMM. Upon the establishment of BARMM in 2019 replacing the ARMM, Cotabato City continued to function as socio-economic center of the newly created region. As such, Cotabato City is host to different government ministries and agencies under the BARMM. To mention a few, these include the following.
  - Offices of the Interim Chief Minister and Deputy Chief Ministers;
  - Office of the Bangsamoro Transition Authority;
  - Regional Offices of different ministries, such as Ministry of Interior and Local Government (MILG), Ministry of Public Works (MPW), Ministry of Transportation and Communication (MOTC), Ministry of Basic, Higher, and Technical Education (MBHTE), Ministry of Environment, Natural Resources and Energy (MENRE), Ministry of Finance, Budget and Management (MFBM), and others.
- Cotabato City ranked 32nd among 112 component cities evaluated nationwide in the 2019 category of “economic dynamism” under the National Competitiveness Council of the Philippines. In Mindanao, Cotabato City ranked 3rd place among component cities under the same category.
- Cotabato City has a Bangko Sentral ng Pilipinas branch that functions as a clearing office of all government and private commercial banks in the city. This is an indication that financial transactions in the city are considered substantial. There are nineteen (19) government and private commercial banks that operate in the city to serve the banking requirements of government offices (City Government of Cotabato and BARMM offices) and of the business sector which primarily supported the city to attain a very satisfactory rating on economic dynamism.
- The presence of several tertiary schools offering various courses, such as business, law, accounting, arts and sciences, agriculture, engineering, and others, made Cotabato City become a higher education hub in the areas of Maguindanao, Sultan Kudarat, parts of North Cotabato and Lanao del Sur provinces. In terms of number, there are thirteen (13) institutions of higher learning in the city, representing 16.25% of the total eighty (80) tertiary schools in the entire BARMM.

10.1.2 Trends in Land Use

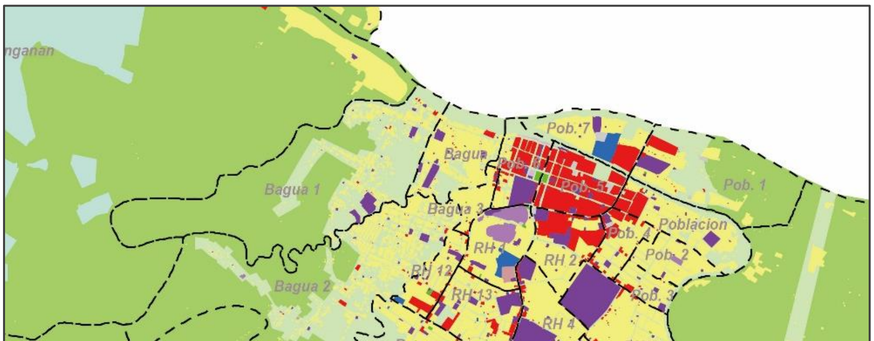
The City of Cotabato conducted a land use survey in 2020, and some of the result data were provided. The comparison of land uses in 2020 and 2011 in Table 10.1-1, shows that the significant growth in residential and commercial areas is remarkable, reflecting the growth in population. Along with this, Institutional and Industrial land use have expanded significantly, while Agriculture has decreased slightly.

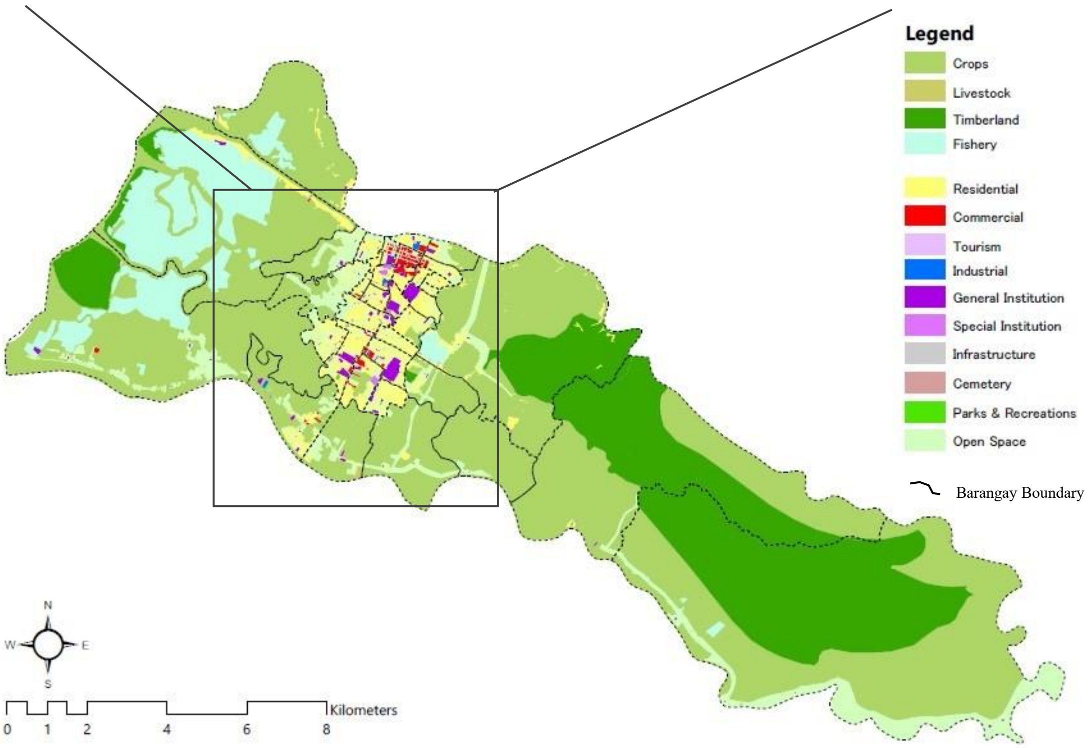
Table 10.1-1 Changes in Land Use between 2011 and 2020

Land Use	2011 (ha)	2020 (ha)	2020／2011
Urban Use Areas			
Residential	796.1475	913.5169	115
Commercial*	64.9095	93.1577	144
Industrial	6.6813	8.5370	128
Parks and Open Spaces -	3.3700	3.8028	113
Institutional	106.5858	136.8943	128
Roads	14.4720	6.1562	
Agriculture	8,638.8700	8,573.0838	99
Forest	148.0000	3,499.4494	
Agro-industrial	0.8250	5.2790	
Marshland	3,300.6247		
OTHER USES (SPECIAL)			
Cemeteries	7.0000	5.1084	
Military/Police Reservation- other use	15.5752		
Controlled dumpsite	1.5000		
Idle lands	4.9560		
WATER USES			
Mangrove forest	408.6438		
Fishpond (brackish water)	1,667.8400	1,219.6118	
Rivers and Creeks	2,413.0000		
TOTAL	17,599.0000		

＊：The total area of Commercial I and II of 2011

Source: Office of City Planning and Development Office (CPDO), Cotabato City





Source: Office of City Planning and Development Office (CPDO), Cotabato City

Figure 10.1-1 Current Land Use in 2020

10.1.3 Trends by Land Use Category

Using the results of the land use status survey and partial satellite images, changes in land use reflected in the CLUPs of 2011 and 2020 are shown below.

(1) Residential Use

As for the location of residential areas, housing is beginning to be built along the road with the development of Cotabato East Diversion Road and its branch road (A in Figure 10.1-2).

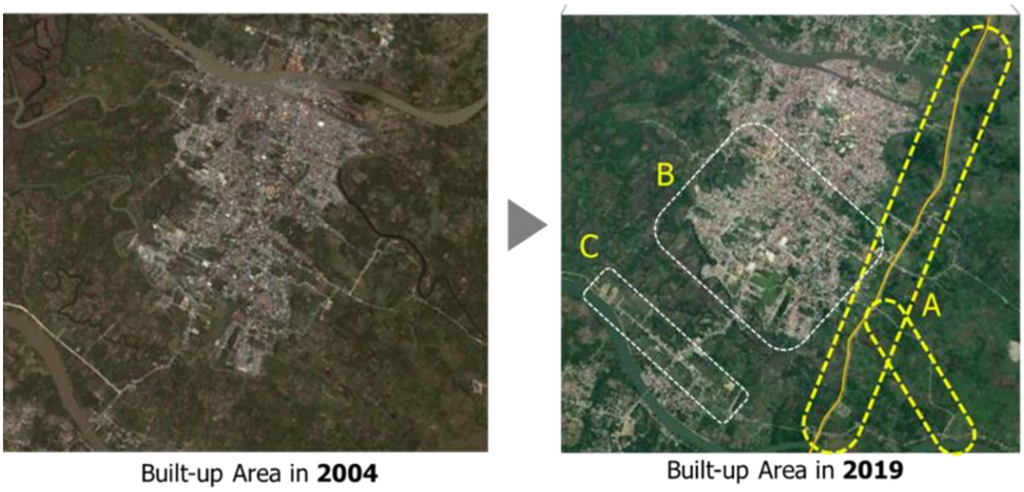


Figure 10.1-2 Development Changes in Cotabato City between 2011 and 2019

Regarding the expansion of urbanized areas, some expansion can be seen in the eastern part of Rosary Heights 5, along the Tarbeng Creek in the eastern part of Rosary Heights 8, and in the southern part of Rosary Heights 9 and 10 (box B). Similarly, expansion of urbanized area is also observed in the western part of barangay Tamontaka Mother (box C) which was triggered by the construction of a new road leading to the Grand Mosque. It seems the observed pattern is whenever a new road is developed, urbanization follows through.

(2) Commercial Use

There are eleven (11) shopping centers currently doing business in the city. While two new shopping malls are now under construction and will soon join the commercial trade. The entry of these big establishments is a manifestation of a booming business climate in the area. One example is the City Mall located along Gov. Gutierrez Avenue of Rosary Heights 7. Its location that leads to the BARMM complex, induced the putting up of restaurants and eateries nearby.

Table 10.1-2 Key Land Use Changes from Existing Land Use 2010 in the CLUP 2020

Development	Opening Year	Shopping Center/Mall	Location (Barangay)
Recent Year	2013	3. Kutawato Diamond Township	Poblacion 5
	2015	5. El Manuel Walk	Poblacion 5
	2015	6. Mall of Alnor	Rosary Heights 9
	2016	7. City Mall Cotabato	Rosary Heights 7
	2016	8. Fiesta Mall	Poblacion 5
	2017	9. Puregold	Rosary Heights 10
	2017	10. Superama Hypermarket	Rosary Heights 10
	2019	11. Superama (new)	RH Mother
Future Plan	2022	12. KCC Mall of Cotabato	Rosary Heights 2
	n.a.	13. New City Commercial Center Mall	Rosary Heights 9

Source: Wikipedia "Cotabato City"

According to the 2020 Current Land Use, roadside commercial located along Sinsuat Avenue did not appear to have expanded much while other commercial areas were located in different locations. One such example is the Mall of Alnor that is located north of Notre Dame Hospital, which is almost along Sinsuat Avenue in Rosary Heights 9.

The area between Tabunaway Boulevard and Jose Lim Sr. Street of Poblacion 6 is also filled with Commercial uses though this area was classified as Institutional use in the CLUP 2020. While still classified as Institutional use, there is an increasing number of new commercial establishments, such as appliance and clothing stores visible in the area. Although the postal office and a university still remained located there.

(3) Industrial Use

Industrial Use has increased due to the location of several workshops and warehouses in Rosary Heights 10 and along Tamontaka - Bubong Road in Tamontaka Mother. On the other hand, in Poblatioon 7, which was intended to be an Industrial Zone, the conversion to Industrial Use has not progressed, but instead, the Residential Use of the area has been expanding.

(4) Institutional Use

Cotabato City was the designated regional center of Region XII or SOCCSKSARGEN Region for many years until 2004 when Executive Order No. 304 issued by former President Gloria Macapagal-Arroyo which transferred the seat of Region XII from Cotabato City to Koronadal City, South Cotabato. Thus, almost all regional government agencies under Region XII have transferred their offices to Koronadal City.

However, there are still some Region XII Offices that remain in the City. These include the following.

- Department of Health (DOH);
- Population Commission (Pop Com);
- Philippine Statistics Authority (PSA);
- Department of Science and Technology (DOST) Laboratory Facility.

There are also other institutions of higher education located within the city that are being maintained and strengthened. These are:

- Cotabato State University (formerly Cotabato State Polytechnic College);
- Notre Dame University, a private university established in 1948 as Notre Dame College and became a university in 1969;
- Eleven (11) private colleges and institutions (STI Colleges, St. Benedict College, RVM College, AMA Computer College, Coland Systems Technology College, Antonio Pacheco College, Dr. P. Ocampo College, Dela Vida College, Mindanao Capitol Colleges, Shariff Kabunsuan College, Kutawato Darusallam College).

Other Institutional Uses include schools and administrative/private offices located in Bagua 1, in Tamontka 1, and along Tamontaka- Bubong Road in Tamontaka Mother of the suburbs.

10.2 Basic Consideration to the Policy Making

10.2.1 Assessment of Hazard

(1) Referable Classification of Lands in Combination with Density and Flood Risk

This analysis refers to identifying appropriate land development for the purpose of land use planning. An analysis was based on the level of vulnerability against development capacity. Factors used for vulnerability are population density (2015 actual data discussed in Chapter 2.3) and the level of risk using the Flood Risk Hazard Map (100 years return period discussed in Chapter 4.2). The classification used is categorized by the threshold of 50 persons/hectare and 200 persons/hectare as population density, over the level of Flood Risk by the Flood Water Depth was used in the identification of inhabitable land (< 0.5 m flood water depth on the Hazard map), respectively. The result of classification is expressed as the criteria code from I to VI as shown in Table 10.2-1 below. Land in the target area was identified in this category.

The target area of the analysis will be the UPA-1 area, which was designated as the area for development as discussed in Chapter 4.2.

Table 10.2-1 Classification of Land Use

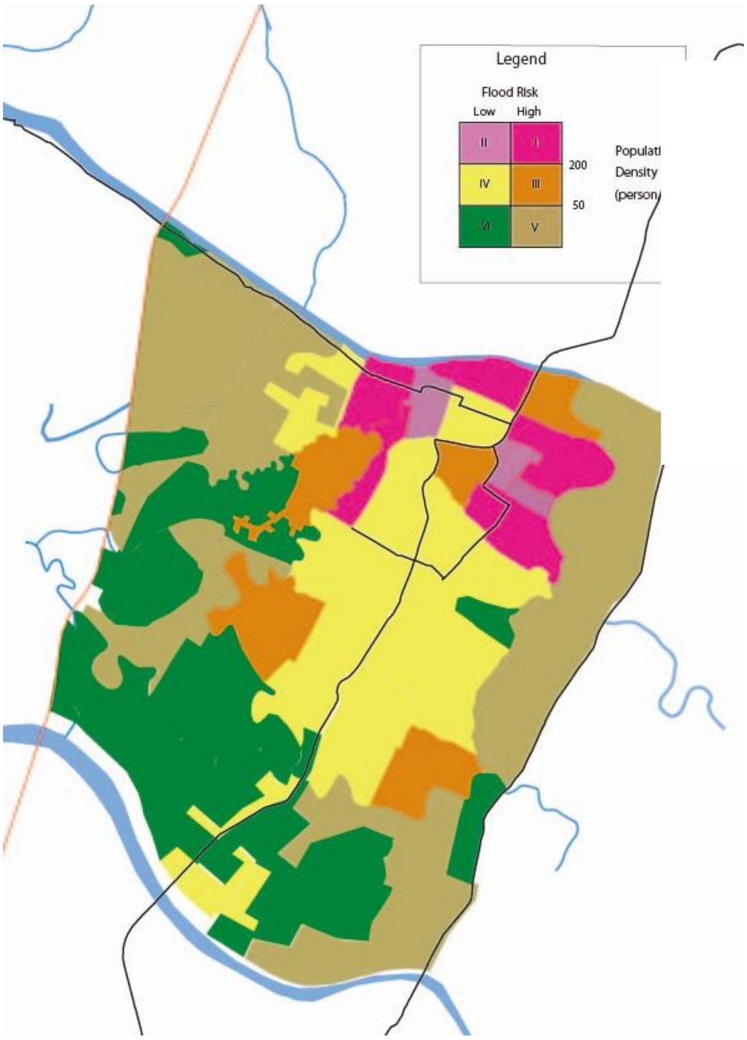
Flood Risk Factor by Flood Water Dept			
< 0.5 m dominant	>0.5 m dominant		
II	I		Population Density
IV	III	200	
VI	V	50	

Source: JICA Study Team based on Flood hazard geo-data (2017) distributed by LiDAR Portal for Archiving and population data from Cotabato City

(2) The Result of the Area Assessment

Figure 10.2-1 shows the result of the classification. The results are:

- As for Category I and II, there seems to be no room for land development apart from the redevelopment project.
- As for Category III, although development may be possible by implementing the flood countermeasures, it seems difficult to implement as the area is mostly built-up area already.
- As for Category IV, although development may be possible, it seems difficult as the area is mostly built-up areas.
- As for Category V, it seems possible to implement land development if the countermeasures of flood control are implemented.
- As for Category VI, although it is an area where land development can be induced, the condition of infrastructure facilities is crucial.



Category	Area (ha)
I	201.09
II	50.38
III	259.31
IV	670.86
V	957.69
VI	747.88
Total	2,887.00

Source: JICA Study Team

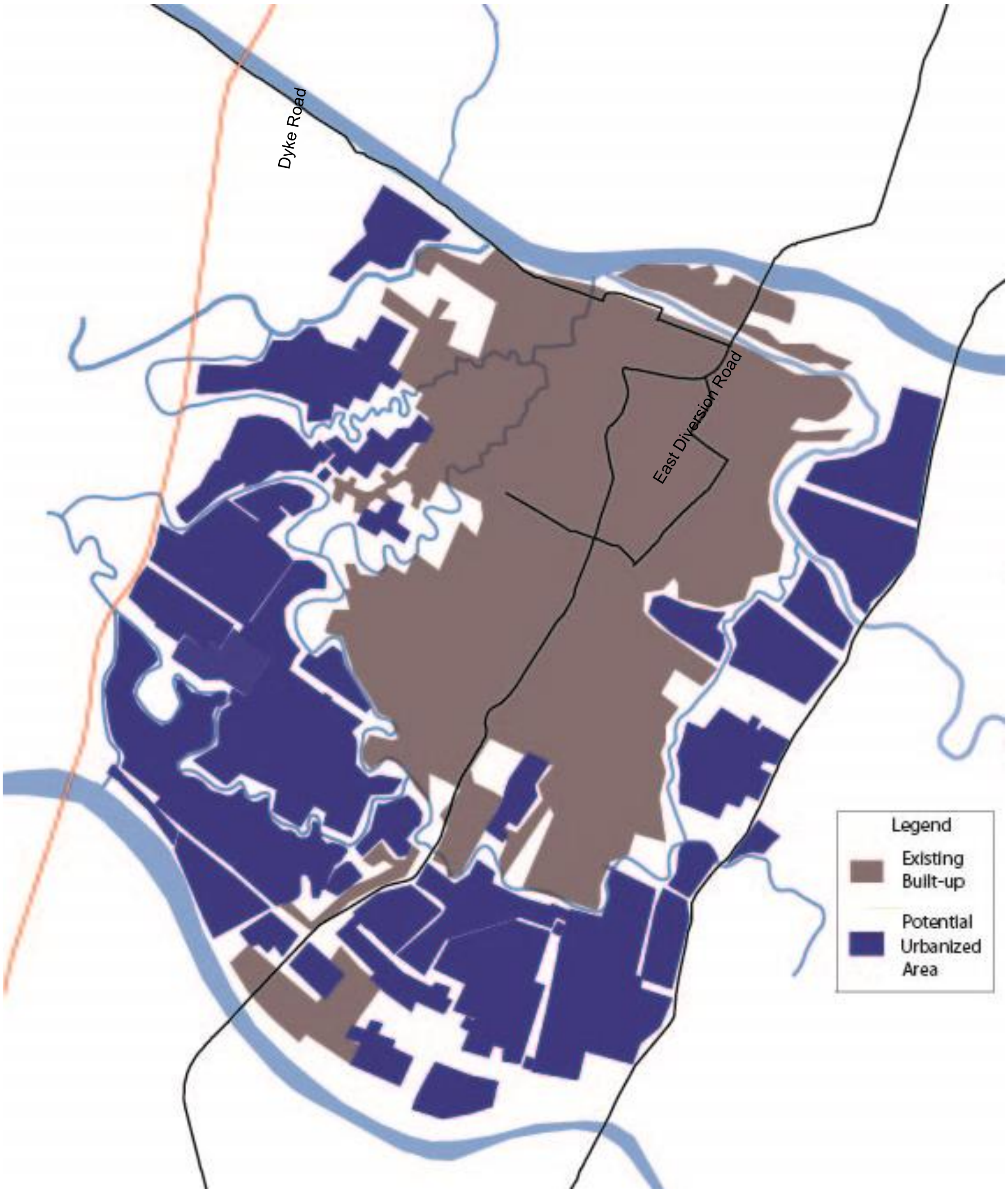
Figure 10.2-1 **Classification of Land Use**

10.2.2 Setting up Resilience Land Use Planning

The City of Cotabato is exposed to the risk of inundation since it is located at the exit of the Mindanao River Basin; and the coastal side is also at risk of storm surges, which poses a threat for both east and west directions. Therefore, protecting these areas through physical barrier becomes necessary. Although there is a small highland (PC Hill) along the Sinsuat Avenue of the existing urban area, it is expected, however that expansion of the urban areas will extend to the lowland areas.

Physical barrier like dike roads to hazard risk areas is effective to protect these areas from inundation.

From the viewpoint of the wide-area road network development, it is recommended that improvement of Cotabato East Diversion Road (to block flood water) in the east and the Dike Road/West Diversion Road (to block storm surge and tsunami) which will connect Bagua 1 and Tamontaka Mother in the west must be undertaken. These road networks can act as defense lines that prevent the effects of flood damage from the eastern side, and storm surges from the western side. Further, it is proposed that raising the road through an embankment can protect Cotabato City urban zone from the inundation. These countermeasures can expand the area for urban land use and expected to contribute to urban development while protecting the area from disasters. According to the result of a preliminary survey that identified inhabitable land in the PUA , there is a capacity to accommodate around 220,000 population with 180 persons/hectare in 1,225 hectares if the flood risk countermeasures are implemented (Figure 10.2-2).



Source: JICA Study Team

Figure 10.2-2 Assumed inhabitable land

10.2.3 A consideration of Urban Forms

(1) Distribution Plan on the Population Density of Urban Areas

When considering land use, it is necessary to estimate the population density, which is the basis for determining the perspective of a city in consideration of an appropriate living environment and sustainable settlement. The ideal way of estimating population density has been discussed a lot in the past, and features in Table 10.2-2 have been pointed out.

Based on the current population density of Cotabato City, the target population density is assumed as follows. Referring to the 2015 population, a 182 persons/ha was obtained by taking the average of 17 barangays in the range of 100 persons/ha to 300 persons/ha as shown in Table 10.2-2. This number is assumed to be appropriate considering the future population projection of Cotabato City. Therefore, the density of the new urban area expected for expansion is set at <u>180 persons/hectare</u> in consideration of the living environment.

Table 10.2-2 Example of Relationship between population density and urban environment

Index category	Condition of area				
	~40	40~100	100~200	200~300	300~
Population Density (population / hectare)	Low density	Appropriate to the detached housing area	Limitation to a detached housing area	Overcrowded except in multi-family dwelling area	A level that can be realized in the multifamily dwelling area

Source: Methodology for Residential Environment Development

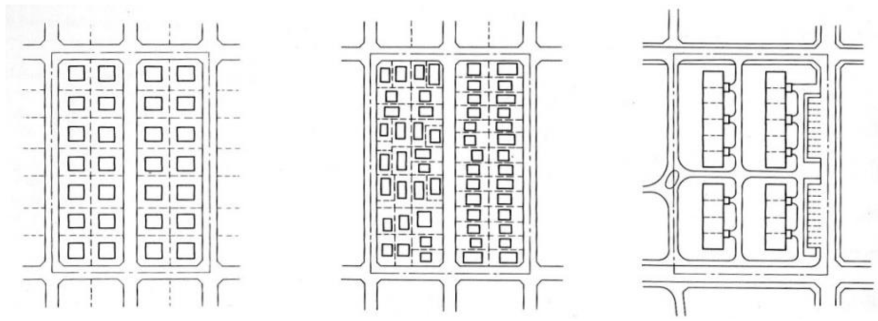
(2) Challenging Sustainable Urban Structure without Effective Transport System

<u>Formulating attractive urbanization with an effective transportation system:</u> An attractive compact city with effective transportation systems such as good road network and public transport, pedestrian-based amenity, convenient parking system and efficient bypass roads and controls would generate a healthy living environment and competitive working atmosphere through the efficient and systematic flow of traffic and reduction of traffic emissions. The formulation of an effective transportation system would become a key element to formulation of a sustainable compact city for Cotabato City.

<u>Introduction of functional land use allocation in harmony with infrastructure development</u>: Infrastructure development is essential in the formulation of a new urban land use. The current plan does not specify the relationship between land use expansion and infrastructure development. Expansion of land use should be carried out in conjunction with the development of efficient infrastructure.

(3) Physical Distribution of Residential Land Use

The expansion area for land use area is not uniform, and it is perceived that urban expansion will be higher or lower for residential use. The expansion of residential use may either be in a high-density with middle- to high-rise buildings around the commercial area or in a low density with low-rise housing units in the peripheral residential area. Considerations can be based on the spatial images shown below.



a b c

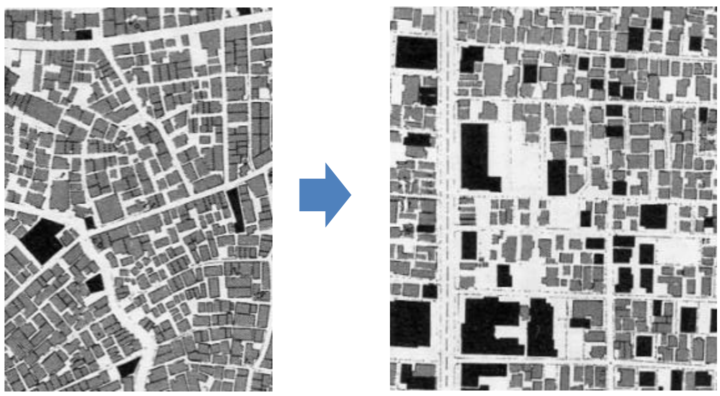
a: Detached housing, 30HH b: Detached housing, 60HH c: Multifamily Dwelling, 80HH (4 stories)

Source: Urban Development in Architecture System

Figure 10.2-3 Model of Residential Area

(4) Land Use Settings Linked to Infrastructure Development

Land use in the new city area will be carried out together with infrastructure development, especially access roads linked to existing (Sinsuat Avenue) or new arterial roads (East Diversion Road and West Diversion Road). Residential land development should be promoted not by individual development but by area development as much as possible. Moreover, since the lifeline facilities, such as water supply and drainage systems are vulnerable, the land use will be expanded in tandem with infrastructure improvement.



Source: Urban Development in Architecture System

Figure 10.2-4 Example of land use with good road network

(5) Introduction of Land Use to Secure Productivity Improvement of Agriculture and Industry Sectors

The current CLUP has shown its intention to actively promote land use that secures industrial development policy. However, the demand for land use is not quantitative and is highly voluntary. The allocation of land for projected expansion of industrial production is required and can be based on the industrial frame estimated on the prediction of industrial productivity.

The projected increase of industries should consider its impact on the urban function and the increase in the population as well as its implication on the land uses of Cotabato City.

(6) Optimal Best-Mix Land Use among Competing Uses and Demand

One weak characteristic of the existing land use of Cotabato City is the insufficient open space necessary for public and higher education facilities expansion in the future. The City is home to higher education facilities with a total of 26 schools and this will prove challenging for land use expansion.

A university or a college campus with larger sites logically will require expansion area to house their facilities as well as additional classrooms to accommodate additional students brought by the increase in population. This future demand will compete with other land uses that the City will incur like for industrial uses that will also require a larger area for expansion. The City Government will have to decide how to approach future population increase in relation to the development of the land for education facilities and other land uses.

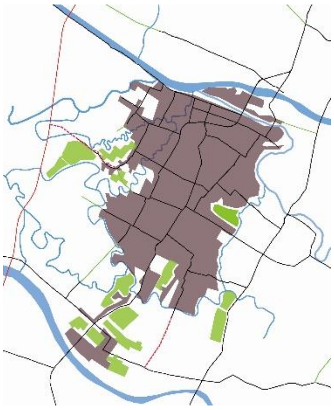
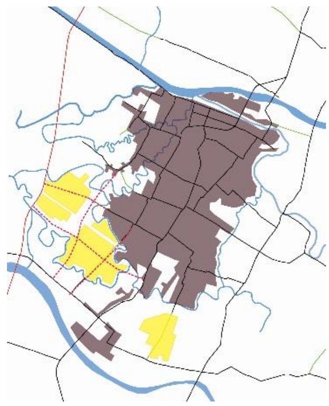
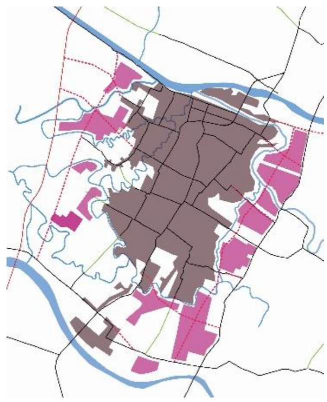
10.3 Demand of Land Use to Supply for Development

This section examines the potential supply of Land Use in some categories through new development to achieve the Population Framework of Cotabato City that was set in Table 8.2-4 in Chapter 8. The area targeted for residential development, which will be set inside of the “Settlement” in the Spatial Development Framework of Cotabato City: Figure 9.2-2 of Chapter 9.

10.3.1 Setting Up New Urbanized Area to Accommodate Residential Demand

- Based on the Population Framework in Chapter 9, it should be assumed that a residential area will be developed to accommodate the population expansion of around 150,000 people by 2040.
- For appropriate sites of first Phase, based on the land classification set in Figure 10.2-1 in the previous section, the area with low risk (Category VI, green color) is the first candidate site for the residential development.
- Residential area development in this phase can proceed without installation of countermeasures of Disaster Risk Reduction (DRR).
- Considering the area of Category VI, 160.66 hectares candidate areas were identified as shown in Figure 10.3-1 (A) was selected in total, including the area around Sinsuat Avenue, between Cotabato East Diversion Road, and the very highlands of Bagua 3.
- As the second Phase, the area to be established along with the development of infrastructure after taking certain countermeasures against inundation such as raising the ground level was set as the second candidate site. The candidate site is 337.59 hectares ((B) in Figure 10.3-1) at the eastern end of Kalanganan 2.
- As the third Phase, 290.88 hectares ((C) in Figure 10.3-1) was chosen with the premise that the West Diversion road will be constructed (to reduce storm surge and tsunami threat from the seaside) and improvement of East Diversion (to block flood water).

- The Development Population which is generated by this residential development for each Phase is calculated using the density of 180 persons/hectare described in 10.2.3, and the results are shown at the bottom of the table of Figure 10.3-1.

(A) Development without any countermeasures of DRR First Phase : ~2028	(B) Development with certain countermeasures of DRR Second Phase : ~2035	(C) Development with countermeasures of DRR Third Phase : ~2040
		
Area for Development: 160.66 hectares	Area for Development: 213.86 hectares	Area for Development: 415.96 hectares
Development Population : 28,919	Development Population : 38,495	Development Population : 74,873

Source: JICA Study Team

Figure 10.3-1 Setting Up the Development Area

10.3.2 Prospect of Land Use Demand Related to Industries Use

For industrial land use, future land use will be calculated on the assumption that the increase in the Employment by sector estimated in Table 8.2-7 of Chapter 8 is proportional to the land use demand. Table 10.3-1 shows the result of the calculation of the Land Use Demand derived in proportion to the future growth of the working population.

Table 10.3-1 Setting up Industrial Land Requirements

	Base	Growth Rate		
Target Framework	2020	2028	2035	2040
Agricultural Sector	1.00	0.91	0.83	0.77
Industrial Sector	1.00	1.17	1.33	1.44
Service Sector	1.00	1.24	1.50	1.71

	Base	Required Amount		
(ha)	2020	2028	2035	2040
Agriculture	8,573.0838	7,790.39	7,091.8129	6,612.6858
Increase/Decrease→		-782.6962	-698.5747	-479.1271
Industrial	8.5370	10.0261	11.3354	12.2682
Increase/Decrease→		1.4891	1.3093	0.9328
Commercial	93.1577	115.9680	139.6039	159.0523
Increase/Decrease→		22.8102	23.6359	19.4484

10.3.3 Prospect of Land Use along with Institutional Use

As a representative of Institutional Use, future demand is expected for schools on the assumption that demand will surely occur as the population increases in the future. The area of the school is assumed to be 0.4110 hectares per school, assuming that the average number of classes is 30 for the average site area (137 ㎡) per class room.

Table 10.3-2 Assuming the Required Amount of School Location

	Base	Required Amount		
	2020	2028	2035	2040
Institutional (School): Number	27 Elementary 10 High School	3	5	5
Area (in hectare)		1.2330	2.0550	2.0550

10.4 Urban Land Use Policy and Strategy

10.4.1 Current Trend of Land Use

The current development status of Greater Cotabato area is characterized by one predominant urban center of Cotabato City leading the socio-economic development. The current several regional infrastructure projects and relevant schemes in the Greater Cotabato area are expected to go through a new Phase of regional development in line with the South-Central Mindanao Development Corridor's thrust. On the other hand, Cotabato City has a considerable issue on the vulnerable land as a physical limit to lands to expand its urbanization for enhancement of roles and functions as the primary regional center of the Greater Cotabato area. In this context, the promising development of the Greater Cotabato area would require enhancement of the area as a whole involving all municipalities in an integrated manner.

The following are set as the overall spatial development strategy.

10.4.2 Spatial Development Strategy

- **Harmonious and collaborative development as the regional center of Greater Cotabato**
  Cotabato City would play a key role in serving regional urban services as the center for the institution, education, health, financial and trade development, and other economic activities. In order to take on the role of a regional center, Cotabato City needs to promote land use by taking into account urban services with neighboring municipalities and providing for economic development utilizing the resources of hinterland farmlands and coastal areas.
- **Driving BARMM and neighboring areas through productive and innovative development by Greater Cotabato**

  Greater Cotabato area should play an essential role in leading and promoting productive and innovative socio-economic development in BARMM and neighboring areas. Cotabato City has to consider an important function to promote innovation in productive resource-based development for the industries providing urban services, agriculture and fishery for the Greater Cotabato area.

- **Realization of a compact city suitable for a wide area base**

Cotabato City expects a population growth of around 140,000, commensurate with its function as the regional center. Since it is also a vulnerable area to disasters, the formation of an urban area as a compact city will be promoted with a reduction in environmental load so that the development effect can be improved with a minimum investment for disaster prevention measures.

- **Development phasing for spatial promotion of Land Use**

Implementation guidelines to direct desirable actions to efficiently and effectively carry out the spatial development strategies for the Greater Cotabato area shall be undertaken by Phase through stage-wise activities. This guideline is divided into three phases including uncertainties surrounding the political process for project schemes publicized at present. The followings are principles of the implementation guidelines of Cotabato in the development phase. This phase is synonymous with the residential area development phase of 10.3.1.

<u>Phase-I (2021-2028): as an initial phase for central city of the Greater Cotabato</u>

Phase-I (2021–2028) will be the period for developing a residential area that will accommodate a population of 360,100 as the first step towards the promotion of spatial development.

Regarding infrastructure development, the dike road (East Diversion Road) and the flood wall along the Rio Grande River by the DPWH is under construction. The West dike road (West Diversion Road) is under construction but is not yet fully functional so that low-risk areas will be selectively developed.

<u>Phase-II (2029-2035): Expanding phase for residential development</u>

Phase-II (2029–2035) will reflect the expectations of expansion of residential development with the implementation of infrastructure such as Major Local Roads (roads branching out from the three arterial roads – Sinsuat Avenue, East Diversion Road and West Diversion Road) to accommodate the projected population. Along with the development of residential land use, urban functions (commercial, business and agro-industry services) as the regional base of the Greater Cotabato will be enhanced and necessary schools will be developed. The flood control project in Rio Grande de Mindanao, the West Dike Roads and East Diversion Road will be completed, leading to the subsequent full-fledged expansion of residential development.

<u>Phase III (2035-2040): Establishing phase for whole Greater Cotabato area</u>

Phase III (2035-2040) will be the completion phase to realize a compact city and achieve a population projection of 474,700 in the situation where DRR countermeasures are implemented with the full construction of infrastructure, flood control and drainage projects.

In line with the development of residential land use, commercial and business functions will steadily accumulate as the core of Greater Cotabato in the center of the Economic Corridor.

In addition, the living environment of the existing urbanized area will be improved by relocating from the densely populated area of the urbanized barangay to the new residential area.

10.5 The Land Use Plan

10.5.1 Setting Up Development Population

This section clarifies the relationship between the development population generated by the new residential area development set in 10.3.1 and the realization of future population projections.

[Phase I]: As shown in Table 10.5-1, it is expected the population to increase by 52,100 from 2020 to 2028 based on the population projection. While the development population is 20,919 (population generated by the new residential area development), there is a shortage of 23,181 to reach the population projection. This shortage is expected to be filled by the growing population of existing urbanized barangays and suburbs of the city.

[Phase II]: As of 2035, the target population needs to be increased by 52,400 from that of 2028, but the development population is 213,86, which is still a shortage of 13,905. This shortage will also be able to be covered by an increase of population in the existing urbanized area or the suburbs of the city.

[Phase III]: As of 2040, the target population needs to be increased by 41,800 from that of 2035, while the development population is 74,873, which exceeded by 33,073.

This excess can be regarded as the population that accepts relocation mainly from the densely populated barangay.

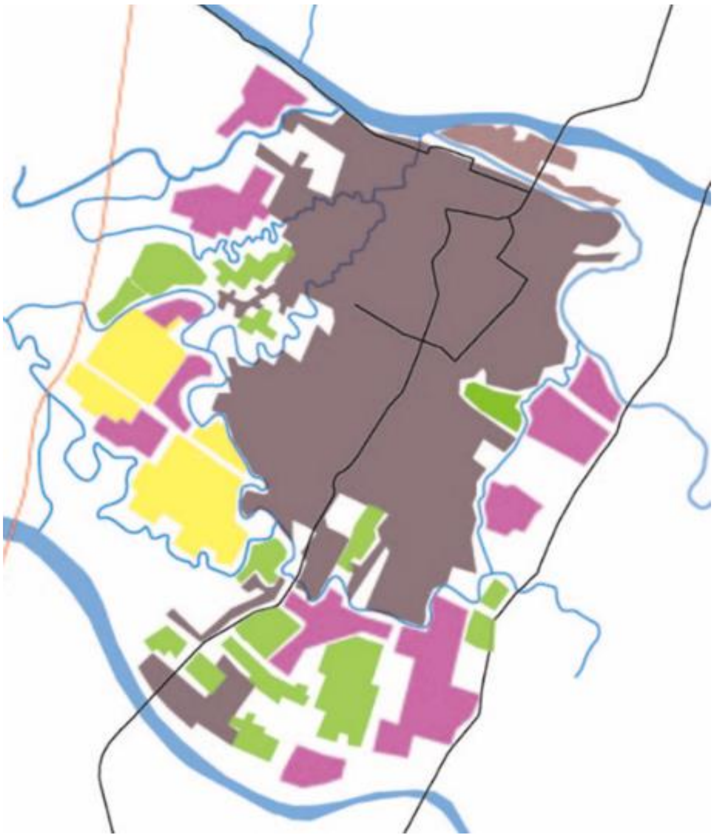
Total amount of the residential development is to be set at 790.48ha, which is the amount of urban expansion or the so called "Socialized Housing Area" (Figure 10.5-1).

Table 10.5-1 Balance between Population Growth and Development Population

		2020	2025	2028	2035	2040	Total
Projection of Population Growth	Population	328,400	360,100	380,500	432,900	474,700	
	Population Growth (a)			52,100	52,400	41,800	146,300
Development Population in the New Residential Area	Phase			I	II	III	
	Development Area(hectares)			160.66	213.86	415.96	790.48
	Developed Population (b)			28,919	38,495	74,873	142,287
Deference between (a) and (b)				-23,181	-13,905	33,073	

10.5.2 Setting Up Land Use Area

In light of the future land demand shown in 10.5.1 above, the prospect for future land use demand in 2040 will be examined below based on the developed population in the previous section.

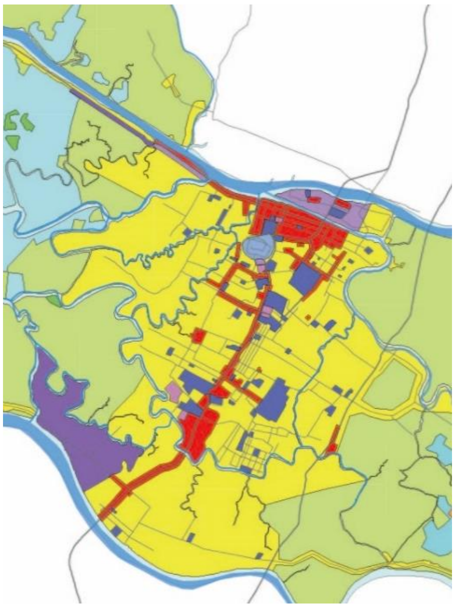


Target Year	2028	2035	2040	Total
Development Area				
Socialized Housing Area (ha)	160.66	213.86	415.96	790.48

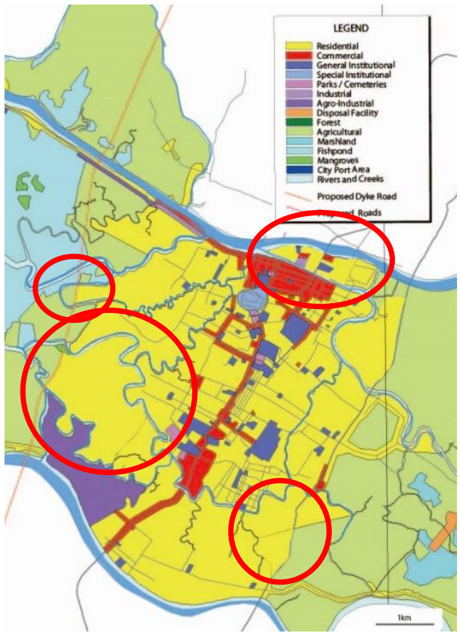
Figure 10.5-1 Residential Development Area

(1) Residential Use

The development area of new residential use envisioned in Figure 10.5-1 is compared with the land use area of the residential area in the CLUP 2011-2020 in order to find the expansion area of the Land Use of Residential located between the proposed Dike Road (West Diversion Road) and East Diversion Road. To cover the extension area, as shown in Figure 10.5-2, it is necessary to convert the planned value of 913.5169 ha. in CLUP 2011-2020 to 328.61 ha. from agricultural land to residential land in order to include the expanded area (Table 10.5-2). The expansion area is located at the eastern end of Kalanganan 2, west of East Diversion Road at the western end of Tamontaka 2 and Poblacion 9 (marked with circles in Figure 10.5-2). The 6.46 ha. at the westernmost area of Bagua 1 divided by Dike Road (West Diversion Road), is to be changed from Residential Use to Agricultural Use, which is the current land use.



Proposed Land Use Plan in CLUP 2011-2020



Proposed Land Use Plan

Figure 10.5-2 Expansion Area of Residential Use

Table 10.5-2 Prospect of Residential Land Use

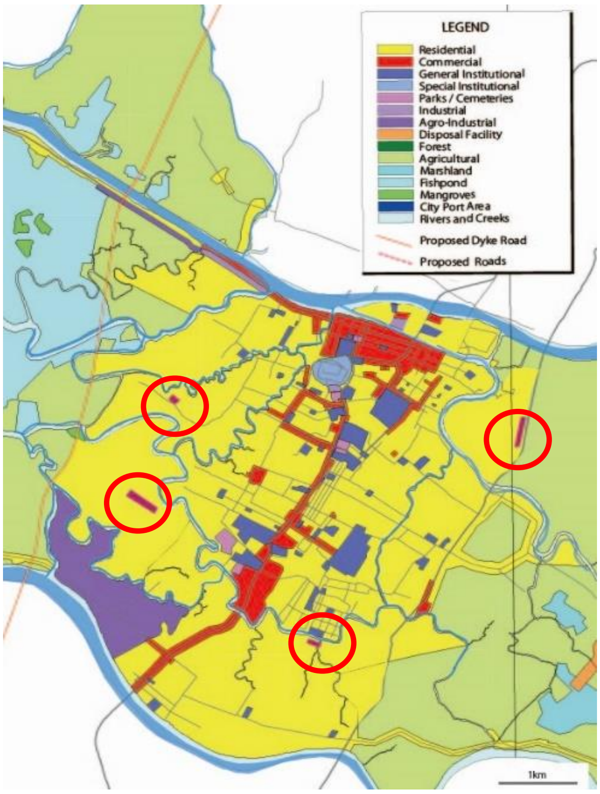
	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Residential Use	796.1500	1360.39	913.5169	328.61	1,689.00

(2) Commercial Use

Commercial use is required to be 159.05 ha. in the study in Section 10.3.2, but the CLUP 2011-2020 is expected to be 227.01 ha. for Commercial I, Commercial II and General Commercial, which meets the land use demand in the target year, 2040. Considering this situation, it can be said that sufficient land use is secured to fulfill the commercial function of Greater Cotabato as a Regional Center. On the other hand, it is necessary to secure the neighboring commercial use that is indispensable for living in the residential development area. For this reason, a total of 8.93 hectares of commercial use will be placed at the four locations in the expansion area of Residential Use as shown in Figure 10.5-3 to ensure convenience of living (marked with circle in Figure 10.5-3).

Table 10.5-3 Prospect of Commercial Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Commercial Use	64.9095	227.01	93.1577	8.93	235.94



Proposed Land Use Plan

Figure 10.5-3　Location of Local Commercial Areas

(3) Industrial Use

Industrial use is expected to expand mainly for light industry uses, which the CLUP 2011-2020 assumed to cover 7.82 hectares; however, the result of the 2020 survey shows an expansion to 8.54 hectares.

Since the industrial use of Poblacion 7, designated as an industrial use in CLUP 2011-2020, is not expected to progress in the future, instead it will be converted to residential area with 33.63 hectares (refer to Figure 10.5-4).

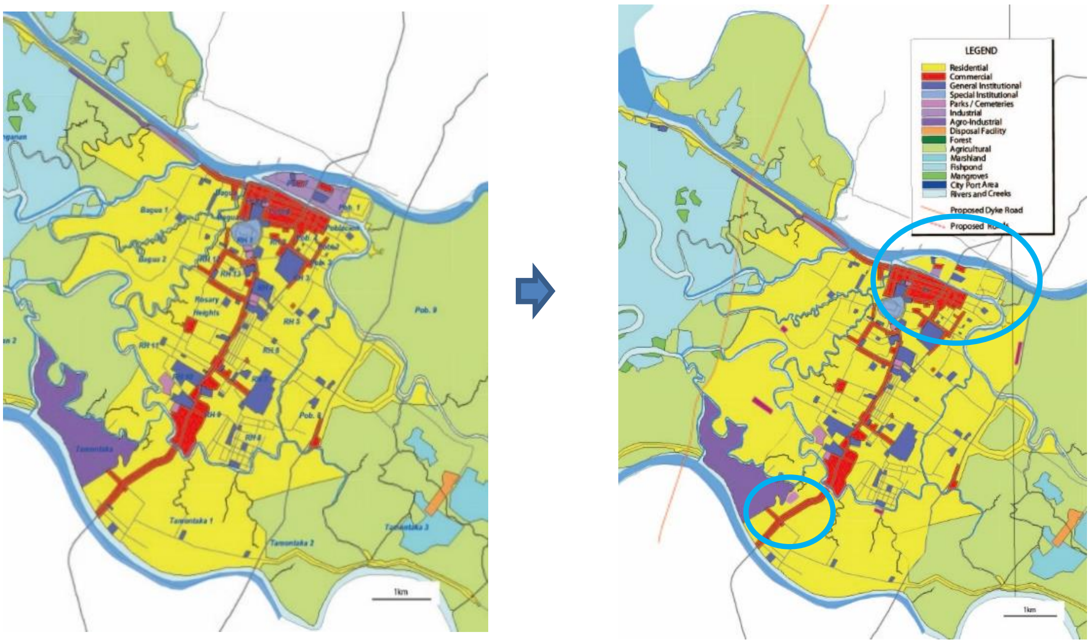
As a result, the industrial use planned for 2011 became to be 10.18 hectares. The growth of the light industry, which was expected to expand in 2011, is not that large, but will be expanding slightly to reach 12.27 hectares in 2040 with an estimate of 10.3.2 hectares set as a reasonable target.

In order to achieve the target area of 12.27 hectares, it is assumed that 2.09 hectares of the industrial land will be secured in the area adjacent to Tamontaka Mother's Agro-Industrial land.

In addition, the residential area for this number: 2.09 ha. will be deducted from the Residential Use (Table 10.5-4).

Table 10.5-4 Prospect of Industrial Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Industrial Use	6.6813	7.82	8.5370	2.09	12.27



Proposed Land Use Plan in CLUP 2011-2020 **Proposed Land Use Plan**

Figure 10.5-4 Change of Industrial Use

(4) Parks and Open Spaces Use

Parks and Open Spaces have been one of the perennial issues confronting the city. With an area of 3.37 hectares in 2011, the CLUP 2011-2020 designated 10.50 hectares for Parks and Open Spaces. The result of the 2020 survey indicates an increase to 3.8028 hectares that shows gradual increase in the comforting land use function.

For the future development of residential areas, securing parks and open spaces is important for comfortable urban living. Following Presidential Decree No. 957 which provides that 3.5% of the housing development area shall be allocated for parks and open spaces, therefore, an area of 27.67 hectares shall be reserved for parks and open spaces for the 790.4 hectares of housing development area.

Please see Figure 10.5-5, and assuming a total of 38.17 hectares (Table 10.5-5)

Table 10.5-5 Prospect of Parks and Open Spaces Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Parks/Open space Use	3.37	10.50	3.8028	27.67	38.17

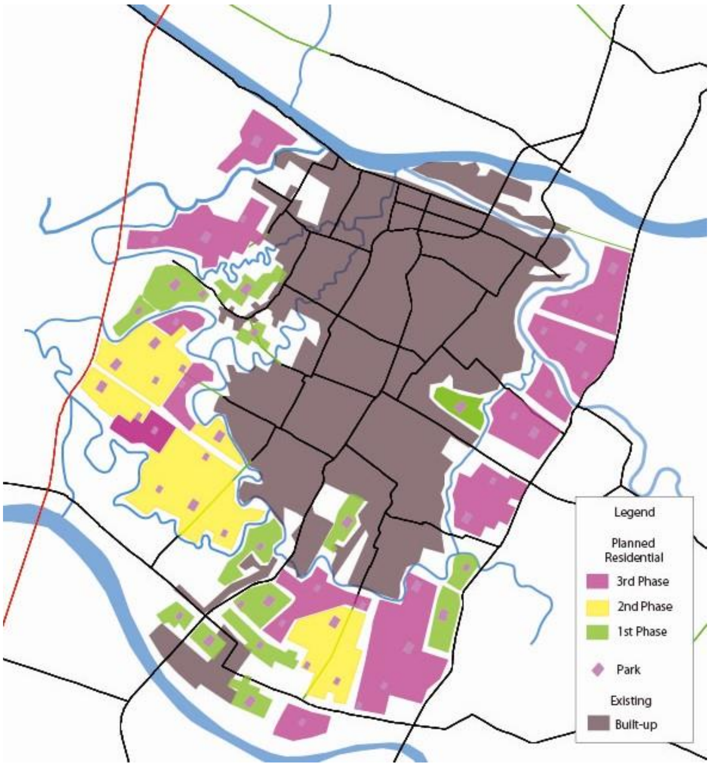


Figure 10.5-5 Location of Parks for the Residential Development Area

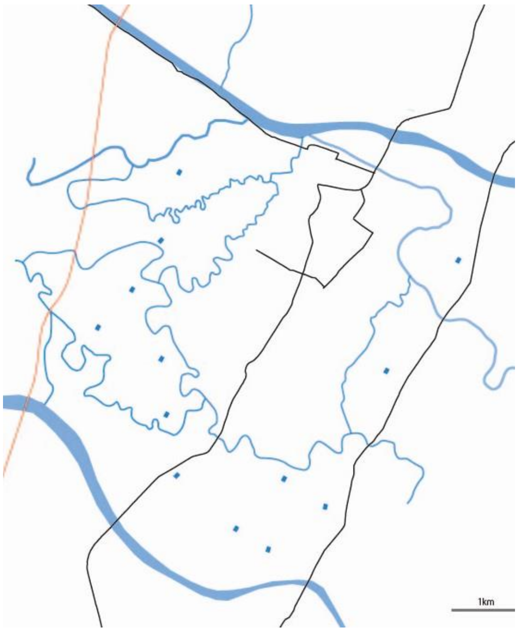
(5) Institutional Use

Considering the existing capacity of institutional entities, the current institutional land use areas are being used for the administration and heath care service purposes.

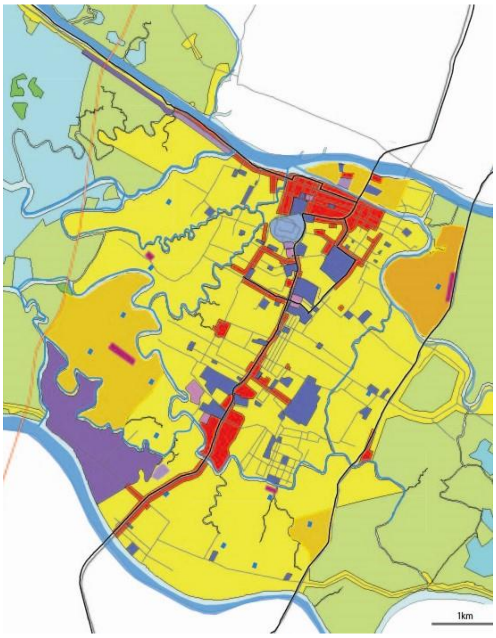
Although the expansion demand for higher education institutions is not urgently expected, it is however clear that the demand for schools will increase in proportion to the population growth.

It is envisioned that 13 new schools expected in section 10.3.3 will be set up in the residential development areas of Bagua1, Bagua 2, Kalanganan 2, Tamontaka 1, Poblacion 8 and Poblacion 9.

The Institutional use for the 2020 survey is 136.8943 hectares, but since it is due to the location of small-scale administrative facilities, etc., the planned area becomes 124.59 hectares, which is the sum of 119.25 hectares set in 2011 and 5.34 hectares for new school uses (Table 10.5-6).



Proposed Location of the School



Proposed Land Use Plan

Figure 10.5-6 Location of School for the Institutional Uses

Table 10.5-6 Prospect of Institutional Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Institutional Use	106.5858	119.25	136.8943	5.3430	124.59

(6) Agricultural Use

Agricultural land use with a surveyed area of 8,638.8700 hectares in 2011 decreased to 7,360.32 hectares as indicated in the plan. However, in the 2020 survey, it decreased to 8,573.0338 hectares.

On the other hand, the projected estimate from the agricultural working population in section 10.3.2 is 6612.6858 hectares in 2040.

In this plan, the conversion from agricultural use to residential development area is expected to be 328.61 hectares, 16 hectares for Dumpsite, and 6.46 hectares from Residential Use. As a result, if that amount is subtracted from the 2011 plan, it will be 7,022.16 hectares.

Considering that Road Use will be expanded due to infrastructure development, the previous estimate of 6612.6858 hectares is a reasonable prediction.

Table 10.5-7 Prospect of Agricultural Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Agricultural Use	8,638.8700	7,360.32	8,573.0838	-	6,612.69

(7) Agro-Industrial Use

As for Agro-Industrial use, 129 hectares of the Regional Agro-industrial Center (RAIC) zone is under planning which is located in the eastern end of Kalanganan 2. The CLUP planned to introduce indigenous handicraft in the area. Around 50 hectares out of 129 hectares of the Agri-industrial area was approved as the Special Economic Zone by the Philippine Economic Zones Authority (PEZA) in 2015, which is expected to be the promoted land use in the future.

Table 10.5-8 Prospect of Agro-industrial Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Agro-industrial	0.8250	132.5	5.2790		132.5

(8) Controlled Dumpsite Use

The Controlled Dumpsite covers 10 hectares as indicated in the CLUP 2011-2020. However, a new Dumpsite that covers 16 hectares in Poblacion 9 will be proposed tentatively, so it is assumed that the City dumpsite shall cover a total of 26 hectares in the future.

Table 10.5-9 Prospect of Controlled Dumpsite Land Use

	2011 Existing (ha)	Proposed in 2011 (ha)	2020 Existing (ha)	Requirement Area (ha)	Adapted Area (ha) in 2040
Controlled Dumpsite	1.5000	10.00		16.00	26.00

10.5.3 Summary of Land Use Plan

Residential use is 1,689.00 hectares but will slightly increase to 1690.15 hectares, an addition of 1.15 hectares due to the conversion from industrial use (refer to 10.5.2(3)).

Table 10.5-10 shows the corresponding increase of land uses for the next twenty years up to 2040.

Figure 10.5-7 shows the integrated Land Use Plan in the central area focusing on UPA I set in Chapter 4.

Infrastructure development is required in accordance with the progress of residential development. The Land Use Map presents the proposed routes of Dike Road and the neighboring roads included in the project in the proposed development area.

Table 10.5-10 Proposed and Existing Land Use

	2011		2020	Planned for 2040	Increased/ (Decreased)
	Existing	Planned	Existing		
Residential	796.1475	1,360.39	913.5169	1,663.12	302.73
(Socialized housing)		42.97		790.48	
Commercial (I and II)	64.9095	227.01	93.1577	235.94	8.93
Industrial	6.6813	7.82	8.537	12.27	4.45
Parks and Open Spaces	3.3700	10.50	3.8028	38.17	27.67
Institutional	106.5858	119.25	136.8943	124.59	5.34
Agriculture	8,638.8700	7,360.32	8,573.08	7,013.92	-747.63
Agro-Industrial	0.8250	132.50	5.279	132.50	0
Controlled dumpsite	1.5000	10.00		26.00	16.00
Forest	148.0000	148.00	3,499.45	8,378.48	
Tourism			1.3402		
Marshland	3,300.6247	3,300.62			
Cemeteries	7.0000	17.00	5.1084		
Military Police Reservation	15.5752	15.58			
Ide/Vacant lands	4.9560				
Mangrove forest	408.6400	667.40	408.6438		
Fishpond (brackish water)	1,667.8400	1,667.8400	1,667.84		
Rivers and Creaks	2,413.0000	2,413.0000	2,413.00		
Roads	14.4720	98.79	6.1562		
Total	17,598.9970	17,598.99		17,598.99	

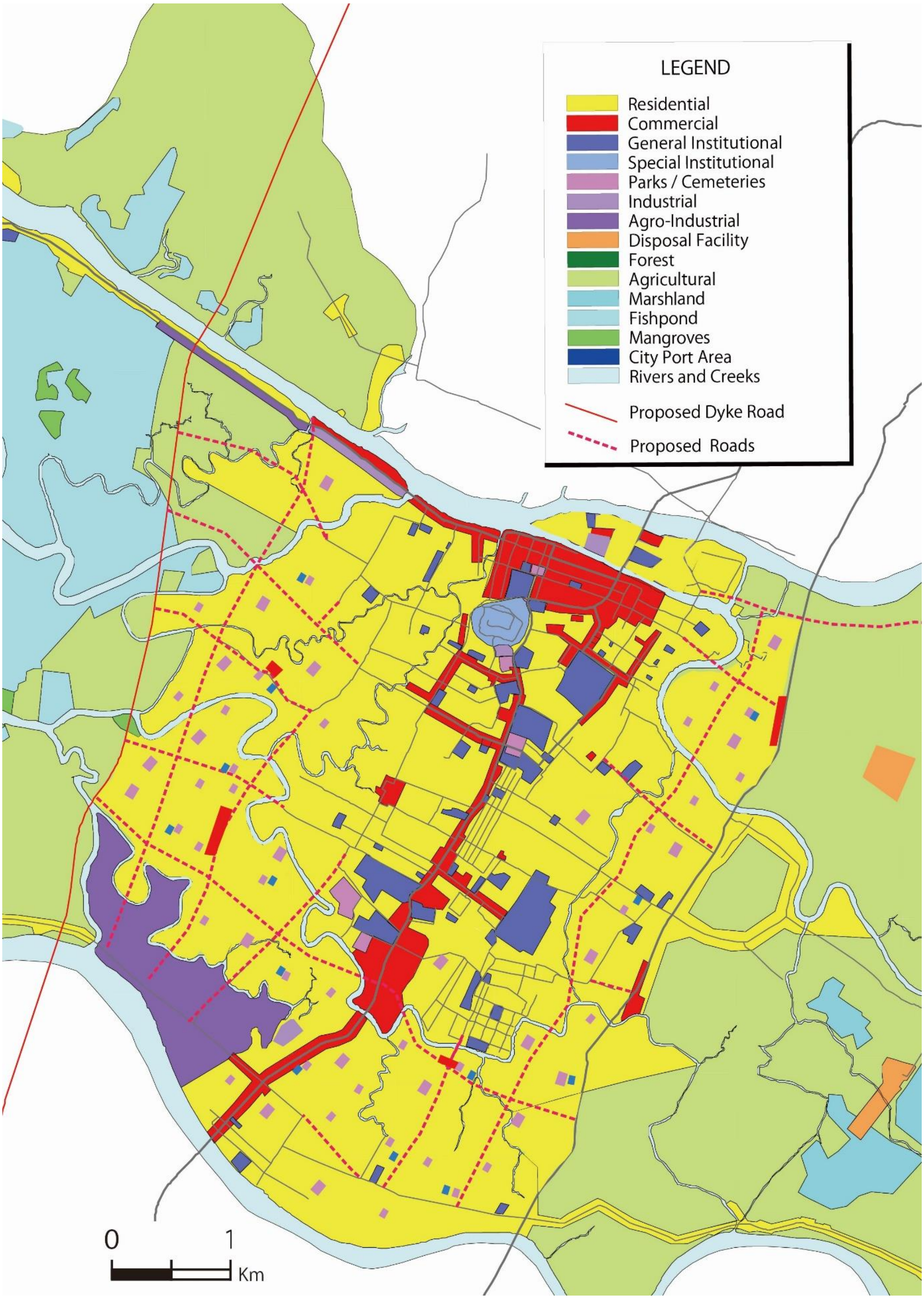


Figure 10.5-7 Proposed Land Use Map (Central Area) (2040)

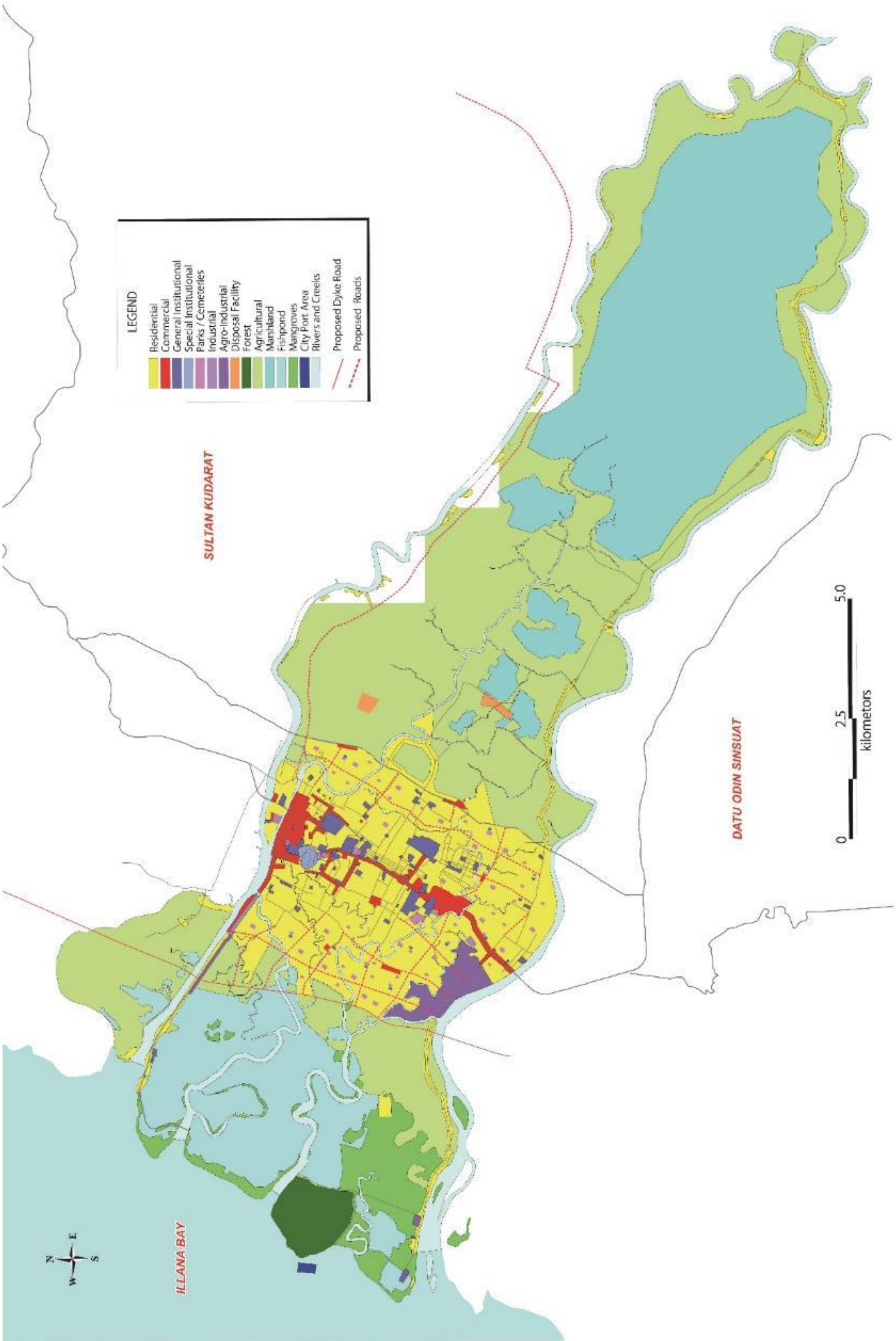


Figure 10.5-8 Proposed Land Use Map (2040)

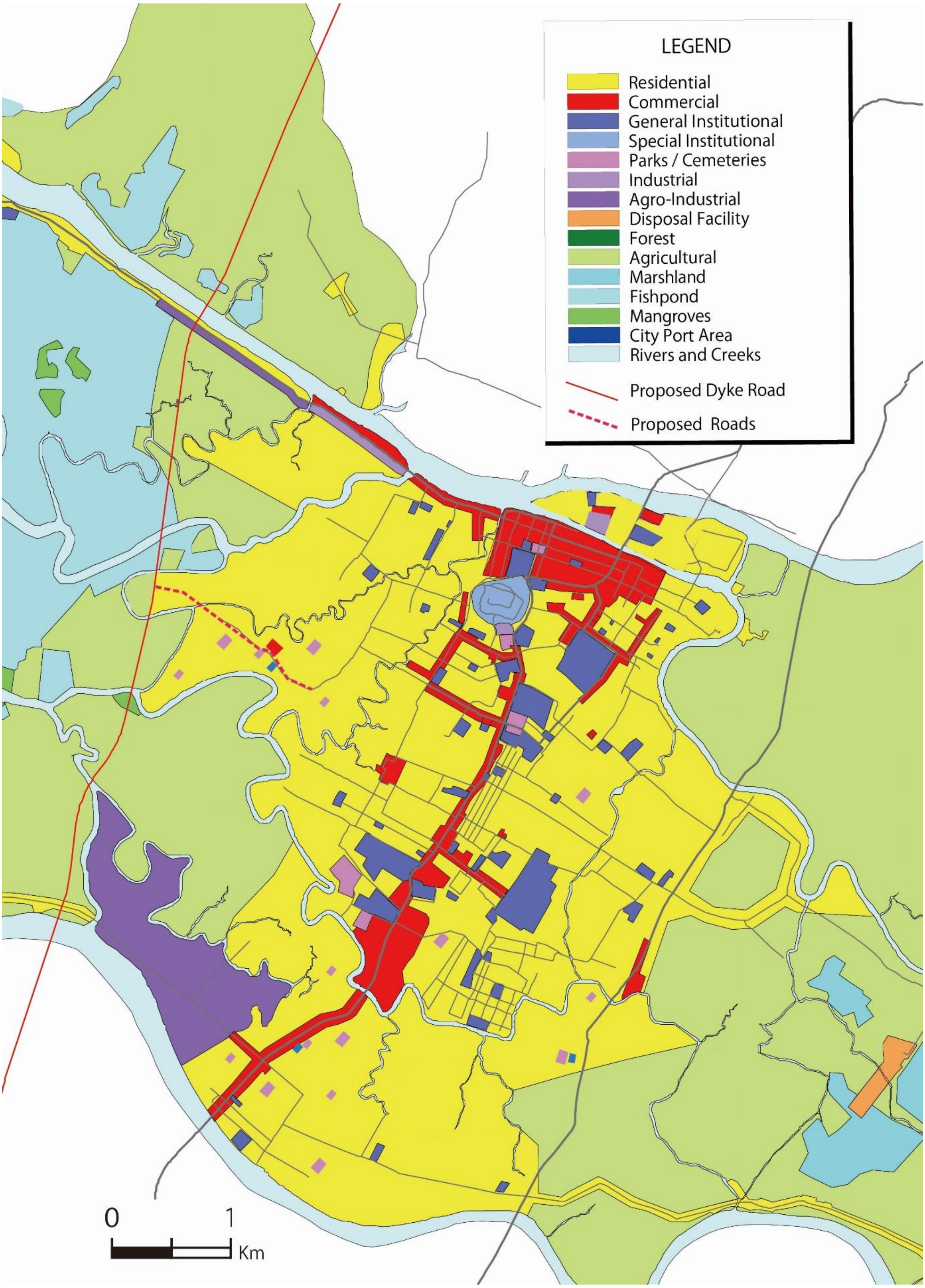


Figure 10.5-9 **Land Use Map in Phase I (~2028)**

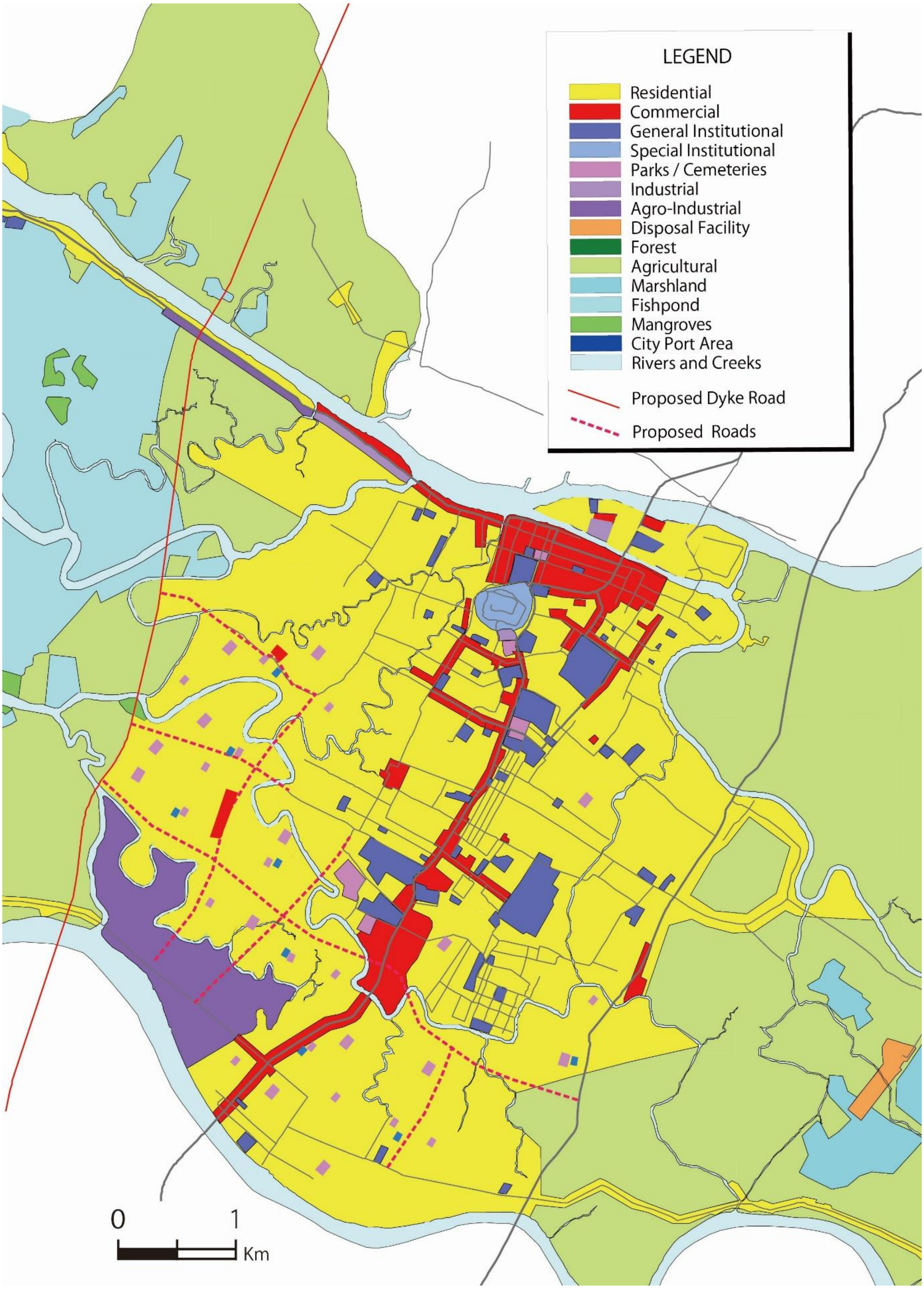


Figure 10.5-10 **Land Use Map in Phase II (~2035)**

CHAPTER 11
TRANSPORT DEVELOPMENT PLAN

11.1 Background on Transportation Development Plan

Road Network

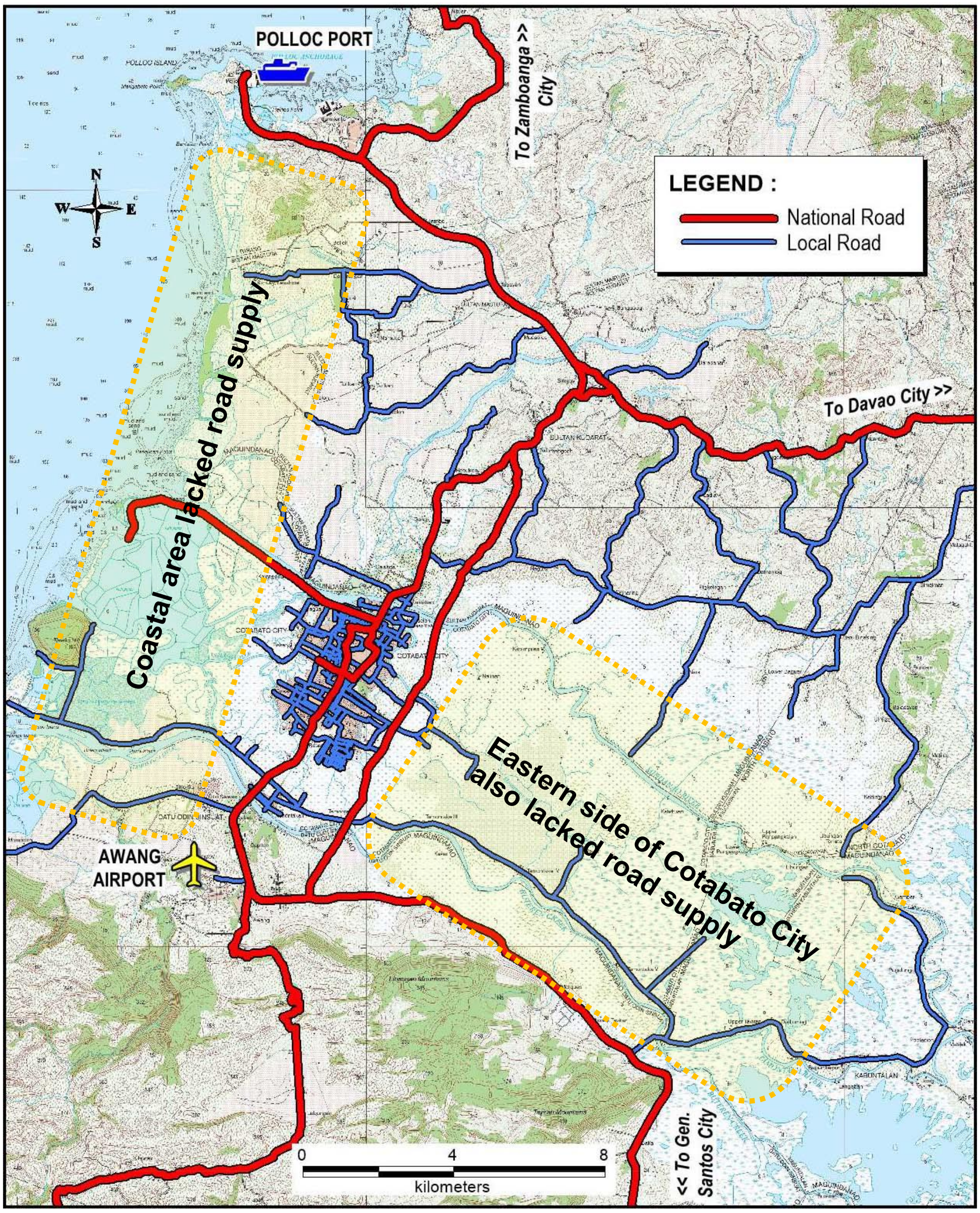
As noted in Chapter 5, the road network of Greater Cotabato City is less developed which hampers the development of the surrounding areas and limits communities' mobility. This is evident by the lack of roads in many areas, such as along the 18-km coast spanning from Datu Odin Sinsuat Municipality to Polloc Port in Parang Municipality (Figure 11.1-1). A similar need for adequate road infrastructure is observed on the eastern part of Cotabato City which extends to the areas of Sultan Kudarat Municipality and Pigcawayan Municipality along the Mindanao River. The absence of roads in these areas leaves inhabitants no better option, but to use river transport which are generally less secure. In particular, passengers are exposed to adverse weather conditions (e.g., heat and rain) during commute due to the structure of boats which lacked top cover.

Inside Cotabato City, the weak formation (or lack of strong structure) of the road network is apparent, and this tends to cause inefficient flow of traffic. For example, road functional hierarchy (i.e., arterial, collector, local road) which could be one of the bases for road improvement (e.g., priority for road repair may follow the road functional hierarchy) and formulation of policy measures (e.g., traffic circulation, parking management, route planning among others) has not been established. Similarly, the current network has substantial number of roads where the width is less than the prescribed standard of the DPWH for a city road (6.10 m carriageway). The poor condition of carriageway pavement is also revealed by the road surface condition survey undertaken by the JICA Study Team.

Public Transport Operation

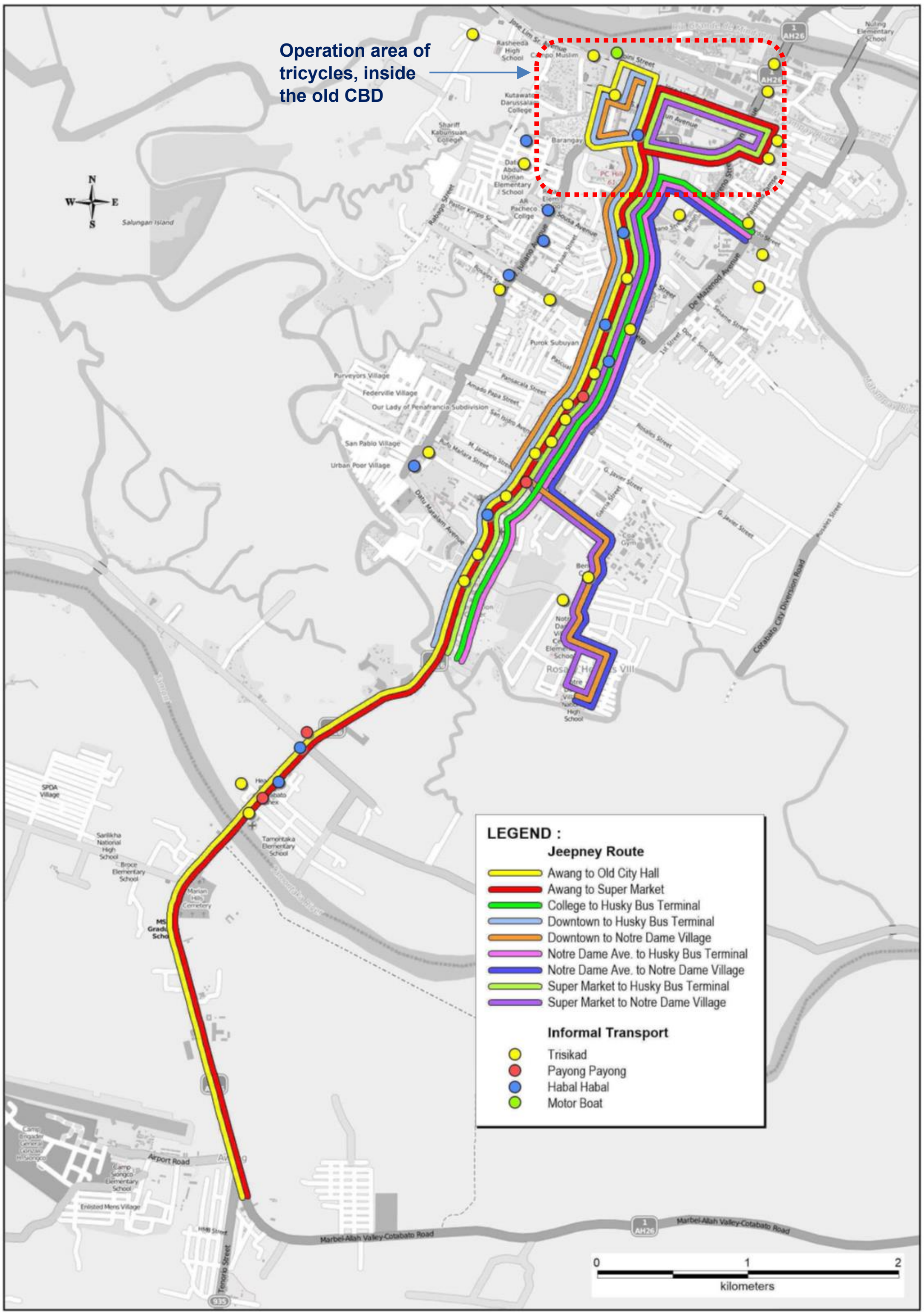
In general, barangay settlements along the outskirts of Cotabato City are served by tricycles, except those barangays without road link to/from Cotabato City such as barangays Katuli, Bulibod in Sultan Kudarat Municipality (these areas are served by water transport). As the distance from Cotabato City increases, the transport mode shifted to faster type of vehicles with higher capacity such as jeepneys, vans and other public utility vehicles (PUV). Commuters travelling from Cotabato City to other major cities in Mindanao such as Davao City, General Santos City and major cities between them are served by large buses and vans. The exceptions to this include travel to/from Zamboanga City and Pagadian City, which are currently solely serviced by vans, due to the poor road alignment (not suitable for large buses). Similarly, a single motorcycle locally known as the 'habal-habal' serves as an alternative mode of transport to other destinations with poor road conditions (e.g., barangays Matuber, Pinansaran and Nalkan in Datu Blah Sinsuat Municipality).

Inside Cotabato City, the backbone of public transportation is comprised of jeepneys and tricycles. According to the Business and Licensing Department of the City Government of Cotabato, there are currently 1,325 PUVs and 571 tricycles operating in Cotabato City. The old CBD is the service area of tricycles (Figure 11.1-2). Jeepneys and other PUVs, on the other hand, are concentrated along the national highway (Sinsuat Avenue). In recent years, however, the continuous expansion of the city led to a new demand for public transportation services. This additional demand is supplemented by various informal transportation modes such as trisikad (pedicabs), habal-habal (single motorcycle-for-hire), and payong-payong (single motorcycle with detachable side car and umbrella as roofing). A few years ago, taxi service was introduced in the city by one company, but its number of units in operation remains limited.



Source: Prepared by the JICA Study Team

Figure 11.1-1 Current Road Network of Greater Cotabato

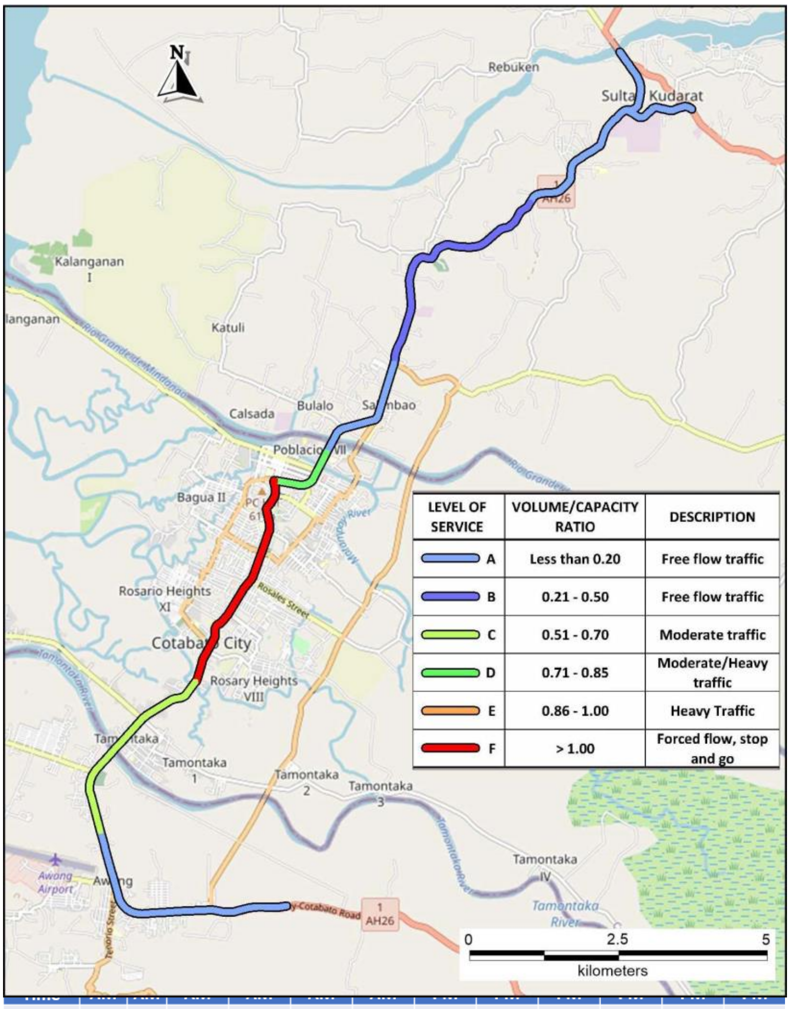


Source: Prepared by the JICA Study Team

Figure 11.1-2 Jeepney Routes and Tricycle Routes

Traffic Management and Traffic Condition

Traffic congestion is serious due to the increasing volume of vehicles, lack of traffic discipline, poor formation of the road network, among others. For example, the traffic survey conducted under this study revealed that Sinsuat Avenue, the lone arterial road of the City, is carrying between 32 to 40 thousand vehicles (PCU- Passenger Capacity Unit) per day and over 2,000 PCU/hr. This volume results to a level of service (LOS) "F" which indicates that the said road is carrying vehicular volume higher than its intended capacity (Figure 11.1-3). Based on the 2004 AASHTO guideline titled "A Policy on Geometric Design of Highways and Streets", the recommended LOS for an arterial road in an urban area like the Sinsuat Avenue is "C". Therefore, there is a need to divert some of the traffic away from Sinsuat Avenue (or widen the road although difficult due to road ROW) to allow the road to recover its function (to improve its LOS from "F" to "C" or "D"). However, under the current configuration of the network, there is no other link with high capacity to absorb the diverted traffic. The Cotabato City East Diversion Road (CCEDR) has this potential to serve as the alternative arterial road to complement Sinsuat Avenue. However, unless its entire section is surfaced with concrete or asphalt and its access roads are improved, the CCEDR will continue to attract less traffic. Assuming CCEDR will be completed in the near future, an additional arterial road would still be needed to provide high-capacity corridor at the western portion of Cotabato City since the city is expanding in this direction.



Total PCU	1,631	2,522	2,924	2,812	2,717	2,469	1,808	2,741	2,809	2,755	2,624	2,625
Capacity	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
V/C Ratio	0.68	1.05	1.22	1.17	1.13	1.03	0.75	1.14	1.17	1.15	1.09	1.09
LOS	C	F	F	F	F	F	D	F	F	F	F	F

Note: E and F indicate that the road is handling vehicular volume beyond its capacity.

Figure 11.1-3 Level of Service of the Arterial Road in Cotabato City

11.2 Issues of Transport Sector

The following are the summary of issues confronting the transport sector:

- **Road network** – There are still wide areas in Greater Cotabato without supply of roads hence social and economic development is affected. Similarly, the road network expansion is not coping up with the growth of the city, leading to some settlements without roads. In some cases where road has been built, roads are usually very narrow and/or are of poor quality (i.e., poor road surface, narrow, no road ROW for further expansion). In general, the road network is not yet fully developed hence, the presence of missing road links often leads to poor traffic circulation.
- **Road surface condition** – Out of the 101.13km surveyed roads, 12.2% are still surfaced with gravel/earth which needs improvement (upgrading of surface from gravel/earth to concrete). The remaining roads surface with concrete have the following conditions: 5.9% in very bad condition, 15.5% in bad condition, 29.1% in fair condition and only 38.7% in good condition. This indicates that at least 21.1% (bad + very bad condition) of the existing road network needs improvement.
- **Road carriageway** – The minimum design width of carriageway for local roads is 6.10 m, according to the DPWH Design Manual (2015). The survey conducted under this study however revealed the following: 11.7 km with less than 5 m carriageway, 17.6 km with 5 m to 6 m carriageway. In total, about 30 km of the road must be widened to meet the 6.10 m carriageway standard for local roads. This is one of the factors which contributes to the serious traffic congestion since narrow roads have less capacity.
- **Road right-of-way** – Securing 15 m road ROW for city roads as stated in the 2015 DPWH Design Manual is difficult. However, it is possible for most city roads to secure at least 10 m of road ROW. Of the 101.13 km surveyed roads, only 15 km of road has a ROW less than 10m. Based on experience with other cities in the Philippines like Marawi City, it is possible to secure the 6.10 m carriageway and the 3m road shoulder requirement within the 10m road ROW.
- **Roadside drainage** – Of the 64.22 km surveyed drainage along the 101.13 km road, 12% of the drainage or 7.58 km are non-functional. The water is either stagnant or the drainage is blocked by debris. This problem contributes to flooding which affects the road function.
- **Traffic congestion** – Traffic congestion is becoming a serious problem in the city. Travel speed is observed to be less than 20 km/hr in most of the major roads such as sections of Sinsuat Avenue, Notre Dame Avenue, Don Rufino Alonzo St., S.K. Pendatun St., Mabini St., Don Teodoro V. Juliano St. among others. In Sinsuat Avenue, the level of service during morning and afternoon rush hour is “F” which indicates that the road is carrying vehicular volume above its capacity. The causes of traffic congestion are as follows: incomplete road network, narrow roads and roads with poor surface, increasing volume of vehicles, lack of traffic discipline for both drivers and pedestrian users, pedestrian space occupied for different purposes, inability of traffic personnel to enforce traffic rules among others.

- **Public Transport Terminal condition –** a survey of five (5) public transport terminals revealed that their current level of service is very low. Among the common problems include the lack of sufficient chairs for waiting passengers, poor ventilation, insufficient security measures, inappropriate trip information board, and non-functional restrooms.
- **Water Transport Terminal condition –** field survey revealed that almost all river terminals (except for the river terminal along Tamontaka River for Datu Blah Sinsuat Municipality) in Cotabato City are in poor condition. In particular, the embarkment and disembarkment area were observed to be in poor condition, and access to terminals is likewise poor.

11.3 Goal for Transport Development Plan (TDP)

The Transport Development Plan (TDP) aims to establish an efficient transportation system (upgrading/improving both infrastructure and operational aspect) that contributes to the realization of the **Development Vision of Greater Cotabato City**. In particular, the plan seeks to: a.) contribute to achieving a smart city which was envisioned by Cotabato City; b.) contribute to making the city resilient against natural disasters and support uninterrupted flow of goods and people during such occurrences and c.) contribute to social and economic development of the study area through strengthening links (or creating a new link) of various nodes (growth center, port, airport, etc.).

Similarly, it shall support the formation of **Multi-polar Urban Centers** in the Greater Cotabato Area envisioned in the Spatial Development Scenario (Chapter 7). This calls for the strengthening of the road network among the potential future urban centers such Campo Islam/ Landasan in Parang Municipality, Darapanan/Crossing Simuay/ Poblacion in Sultan Kudarat Municipality, Salimbao/ Calsada in Sultan Kudarat Municipality, Kalanganan 1 and Tamontaka 1 in Cotabato City among others. The following summarizes the basic consideration of formulating the TDP:

- Shall support the Vision of Cotabato City
- Shall support the Future Land Use of Cotabato City
- Shall support the formation of Multi-polar Urban Centers in the Greater Cotabato Area which was envisioned in the Spatial Development Scenario
- Shall be responsive to the current and future transport requirements of Cotabato City and Greater Cotabato area

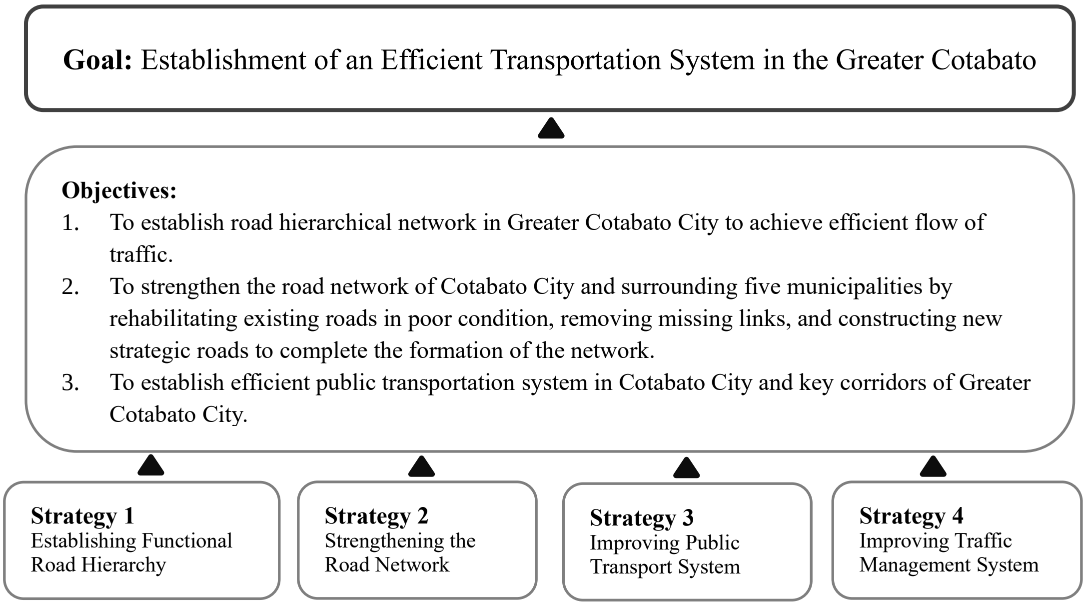


Figure 11.3-1 Framework of Transport Development Plan

11.4 Objectives for Transport Development Plan

The objectives of the Transport Development Plan are as follows:

- To establish road hierarchical network to facilitate efficient flow of traffic through good traffic distribution in the network
- To strengthen the road network of Cotabato City and its linkage to surrounding municipalities (Greater Cotabato City area) by rehabilitating/improving existing roads in poor condition and constructing missing links and new strategic roads
- To establish an efficient public transportation system within Cotabato City and along the key corridors of Greater Cotabato City.

11.5 Strategies for Transport Development Plan

To achieve the objectives of the Transport Development Plan listed above, it is important to come up with a set of strategies complementary to each other. These strategies are listed as follows and are discussed in the succeeding section:

- Strategy to Establish Functional Hierarchical Road Network
- Strategy to Strengthen the Road Network
- Strategy to Improve Public Transport System
- Strategy to Improve Traffic Management System

11.5.1 Strategy to Establish Functional Hierarchical Road Network

The road network of the Greater Cotabato City is classified by administration. This means that the road is either under the operation and maintenance of the national government through the DPWH, or under the local government units (i.e., provincial LGU, city LGU, municipal LGU). Functional classification, however, is not assigned on the roads in the network to recognize the importance of some roads over the others (even though falling under the same administrative category).

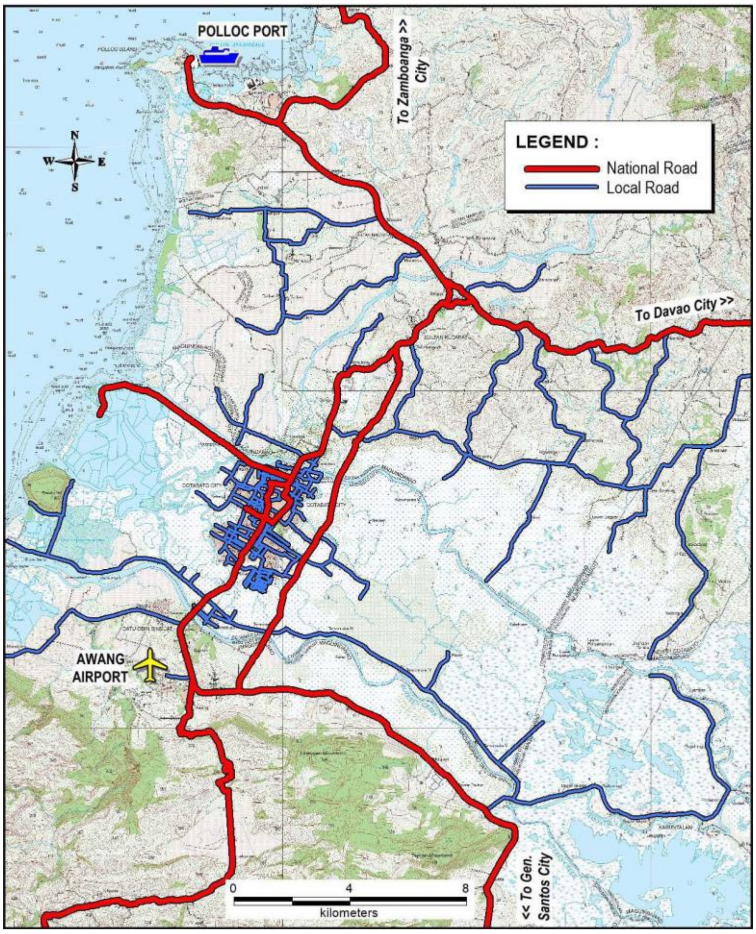


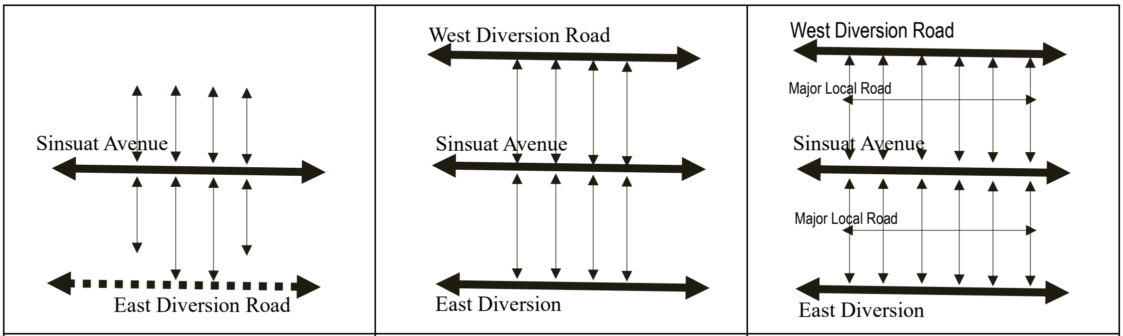
Figure 11.5-1 Administrative Classification of the Greater Cotabato's Road Network

In preparing the road network masterplan of the Greater Cotabato, the importance of some roads over the others will be proposed. This can be done in two ways: (i) by upgrading the administrative category (example from local road to national road) to increase the road capacity or (ii) by improving the road - e.g. widening with shoulder – although it is classified as local road.

11.5.2 Strategy to Strengthen the Road Network

The form/shape of the road network of Cotabato City is incomplete hence traffic circulation is not efficient. Its current shape is called a “fishbone” network where a single arterial road (Sinsuat Avenue) is carrying most of the north-south traffic due to the lack of a parallel arterial road to handle some of the traffic. The conceptual image of transforming the network from “fishbone” type to “ladder-type” network is illustrated in Figure 11.5-2. This transformation requires the completion of both the East Diversion Road (CCEDR) and West Diversion Road (CCWDR) along with their link roads.

Assuming this plan proceeds as envisioned, the network capacity for north-south traffic would expand to 6,000 PCU/hr by 2028 and to 8,700 PCU/hr (total capacity of the three arterial roads and two major local roads) by 2040. Currently, Sinsuat Avenue is carrying about 3,000 PCU/hr (ideally, it will only carry 2,000/PCU/hr) which is over its capacity hence serious traffic congestion is observed at extended periods. It should be noted that the link roads connecting the three arterial roads are equally important to complete the network. These links will give the network flexibility and allow for smooth circulation of traffic.



Present Network (2020)	Network in 2028	Network before 2040
Capacity: 2,000 PCU/Hr	Capacity: 6,000 PCU/Hr	Capacity: 8,700 PCU/Hr

Note 1: The real capacity of Sinsuat Avenue is 2,400 PCU/hr for LOS "E". However, to have a good traffic flow, capacity is set at 2,000 PCU/hr for LOS "D"
Note 2: Based on the result of the Traffic Count Survey, Sinsuat Avenue is currently carrying about 3,000 PCU/hour way beyond its capacity. East Diversion Road and West Diversion Road will support carrying a portion of the north-south traffic.

Figure 11.5-2 Transforming Fishbone-type Network of Cotabato City into Ladder-type Network to Expand its Capacity and Flexibility

The CCEDR has potential to become the second arterial road of Cotabato City. However, about 7 km of the road is still surfaced with earth/gravel, hence traffic is still limited. Similarly, the link between the two arterial roads (Sinsuat Avenue and CCEDR) is weak. To accelerate transforming the network of Greater Cotabato from a "fishbone type" of network to a "ladder type" of network, the following actions are needed:

- Completion of the CCEDR
- Strengthening of links between the two arterial roads (Sinsuat Avenue and CCEDR)
- Construction of an additional arterial road on the coastal side called "West Diversion Road"
- Further strengthening of links among the three arterial roads (East Diversion Road, Sinsuat Avenue and West Diversion Road)

Similarly, outside Cotabato City, the network is also weak due to the following as seen in Figure 11.5-3: (i) road surface of considerable length is still earth/gravel, and (ii) presence of many missing links hence network could not be formed. Therefore, it is important to upgrade the road surface of the road from earth/gravel surface to concrete surface. This effort should be complemented with the gradual removal of the missing links and construction of new strategic roads that will complete the network.

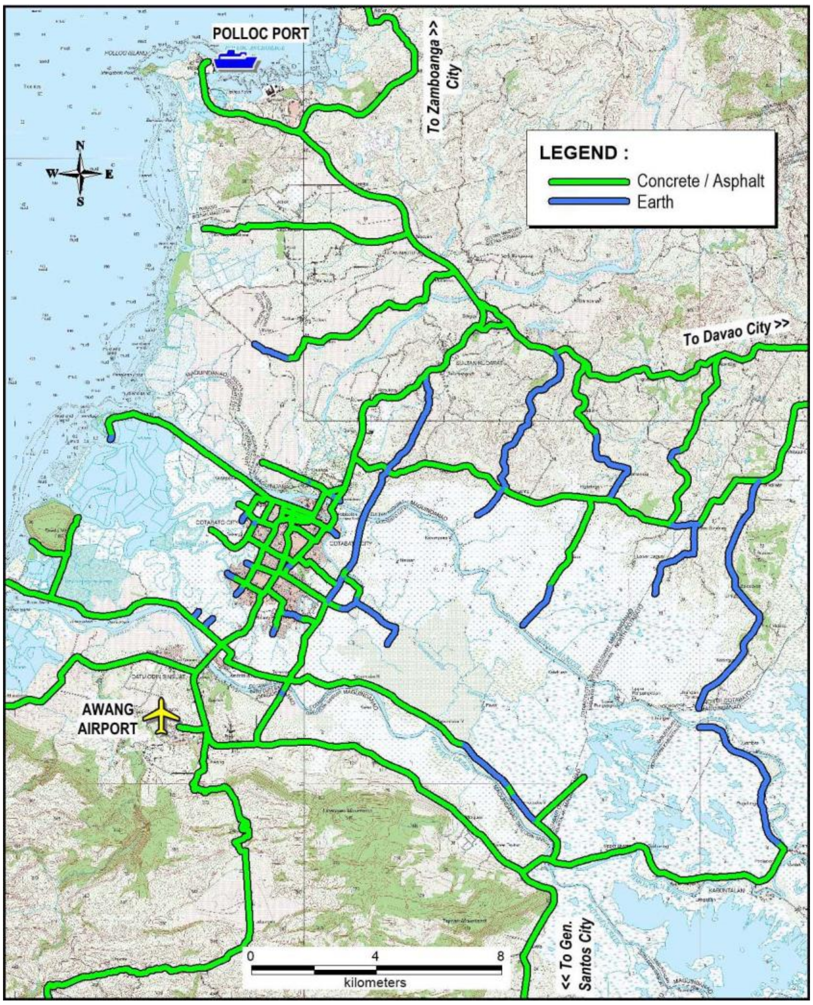


Figure 11.5-3 Road Pavement Type in Greater Cotabato

The CCEDR has potential to become the second arterial road of Cotabato City. However, about 7 km of the road is still surfaced with earth/gravel, hence traffic is still limited. Similarly, the link between the two arterial roads (Sinsuat Avenue and CCEDR) is weak. To accelerate transforming the network of Greater Cotabato from a "fishbone type" of network to a "ladder type" of network, the following actions are needed:

- Completion of the CCEDR
- Strengthening of links between the two arterial roads (Sinsuat Avenue and CCEDR)
- Construction of an additional arterial road on the coastal side called "West Diversion Road"
- Further strengthening of links among the three arterial roads (East Diversion Road, Sinsuat Avenue and West Diversion Road)

Similarly, outside Cotabato City, the network is also weak due to the following as seen in Figure 11.5-3: (i) road surface of considerable length is still earth/gravel, and (ii) presence of many missing links hence network could not be formed. Therefore, it is important to upgrade the road surface of the road from earth/gravel surface to concrete surface. This effort should be complemented with the gradual removal of the missing links and construction of new strategic roads that will complete the network.

11.5.3 Strategy to Improve Public Transport System

Majority of commuters in Greater Cotabato rely on public transport to meet their mobility needs. These can be in the form of buses for long distance trips, jeepneys and other PUVs for short and medium distance trips, tricycles for city trips, and even water transport. As discussed earlier, the current level of service offered by the system is very poor. Hence, upgrading the level of service of the current public transport system is a natural course of action to make it a truly public transport-oriented system. Similarly, the role of the public transport system is crucial to the realization of the preferred development scenario (Multi-polar urban centers) for Greater Cotabato. For example, an efficient transport system linking the different envisioned future urban centers would accelerate their development. Therefore, the following steps will be crucial:

- Upgrading of level of service (repair of toilet, increase number of benches, etc.) of the various public transport terminals (Short term).
- Development of an Integrated Public Terminal on the south side of Cotabato City to cater to PUVs serving the routes from Cotabato City to southern cities and municipalities (e.g., Gen. Santos, Koronadal, Tacurong, Datu Piang, Upi, Lebak, etc.) (Medium term)
- Initiation of a dialogue to consolidate various small terminals serving the same routes (Kutoco, COLIDO, A2Z) into one single terminal to upgrade their level of service (Long term).
- Promotion of a shift from low capacity (Jeepney and other PUVs) to higher capacity public transport (medium to large bus) along the key corridors (Cotabato→Awang→DOS route and Cotabato→Crossing Simuay→Landasan→Parang) as illustrated in Figure 11.5-4. To ensure higher success of bus-oriented transportation, PUVs should not compete with the bus routes. PUVs can instead operate as feeders to buses (Long term).
- Re-organization and expansion of public transport routes according to the progress of two arterial roads (East Diversion Road and West Diversion Road). Jeepneys and PUVs withdrawn from the key corridors above (Sinsuat Avenue) may shift to these new routes (Long term).
- Upgrading of the two (2) major water transport terminals (terminal to Liguasan marsh and terminal to Bongo island) in consideration of the DPWH's plan to install flood wall along the Matampay and Pulangi River.

Inside Cotabato City, the corridor from Awang to the City Plaza (or even to Mega Market) has potential for conversion from Jeepney-dominated corridor to bus route. This will upgrade the level of service (predictable trip frequency, predictable journey time, improved passenger comfort, etc.) of the public transport in Cotabato City. In general, majority of the residents should have access to a public transport terminal within 400 m to 800 m (or known as the 5 minutes to 10 minutes' walk to public terminal concept). According to walkability studies, people are generally willing to walk for 400 m up to a threshold of 800 m before choosing to drive (Untermann, 1984; Wibowo, 2005; Langford, et. al, 2012; Millward, et. al, 2013). This concept has been applied in various cities around world: Singapore (2011 Barrier Free Accessibility Programme by MOT), Sydney, Vancouver, Helsinki (Rhonda, D., Explaining walking distance to public transport: The dominance of public transport supply, The Journal of Land Use and Transport, Volume 6, No. 2, 2013) among others.

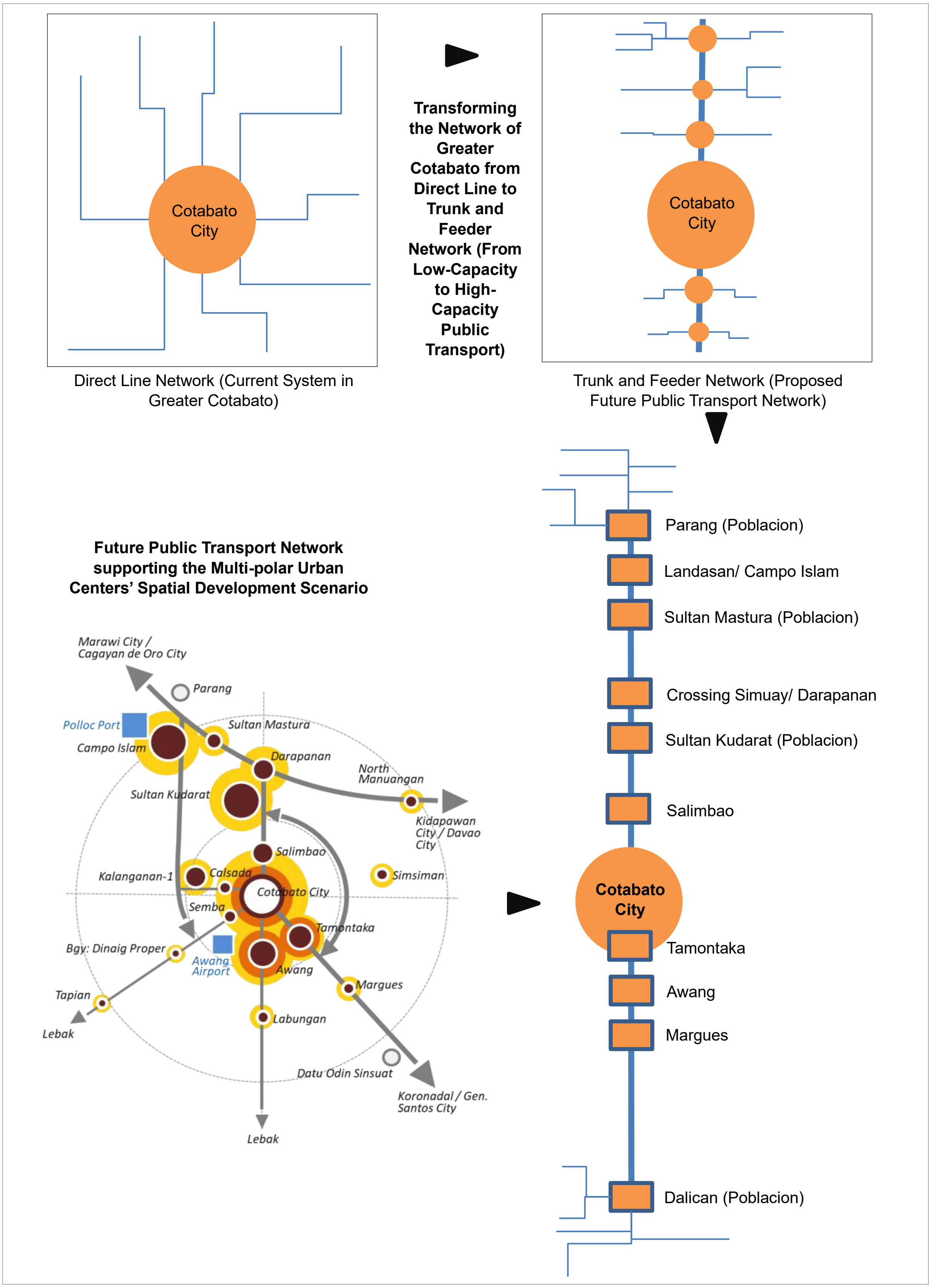


Figure 11.5-4 Shifting from Low-Capacity (Jeepney) to High-Capacity (Bus) Public Transport by Transforming the Network from Direct Line to Trunk and Feeder Network

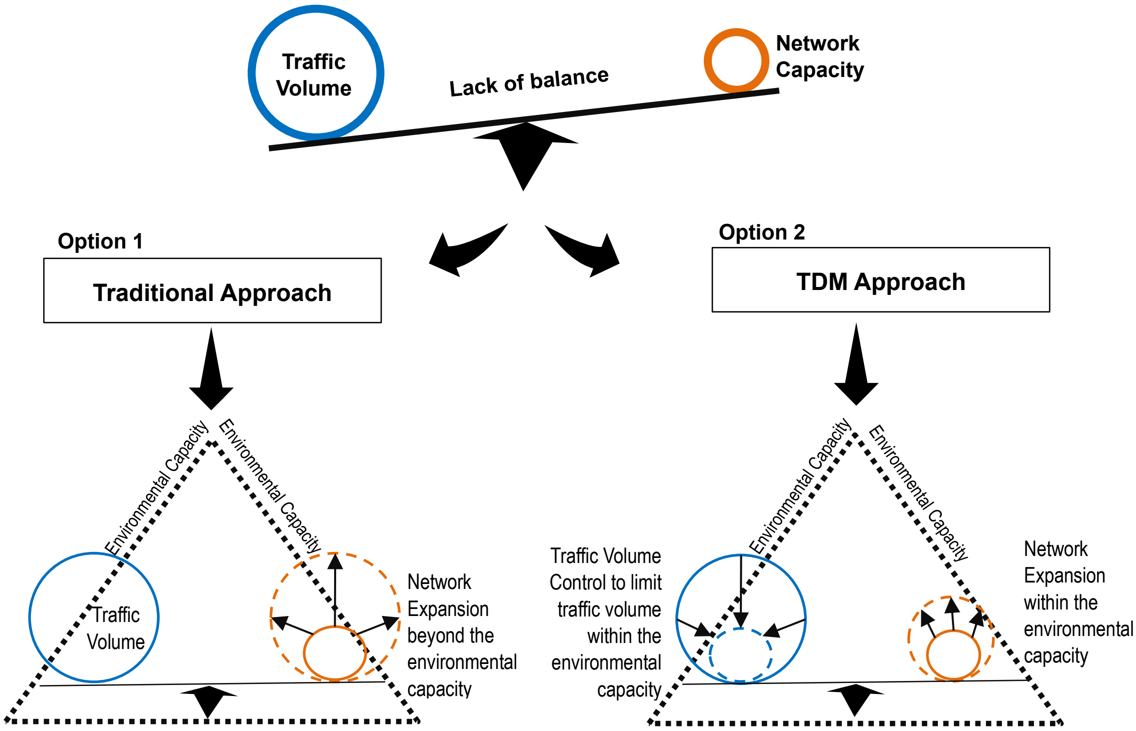
11.5.4 Strategy to Improve Traffic Management

Under this strategy, the focus is to combine list of measures that would contribute to achieving better flow of traffic through non-infrastructure measures known as Transportation Demand Management (TDM). TDM is a general term for strategies that result in more efficient use of existing transportation resources, as opposed to increasing transportation system supply by expanding roads, parking facilities, airports, and other motor vehicle facilities as illustrated in Figure 11.5-5 (Mobility Management, GTZ, 2003).

In the said figure, the TDM approach calls for reasonable expansion (without sacrificing both the social and natural environment) of the road to complete the formation of the road network (under Strategy 2: Strengthening of the Road Network). At the same time, it promotes measures that would reduce the volume (or improve traffic flow) of vehicles in the network. This approach is distinct from the old and traditional method, where the increasing volume of vehicles is addressed by widening of existing roads and/or construction of a new road.

Basically, the issue of traffic congestion in the road network of Cotabato City and other major roads leading to surrounding municipalities is a result of various factors that involves not only the condition of road infrastructure but also behavior of road users (drivers and pedestrians) and ability of traffic enforcers to implement road traffic rules.

In general, the following affects the smoothness of traffic flow in the road network: volume of traffic, quality of road infrastructure and completeness of the network, traffic rules and enforcement, behavior/discipline of roads users, capacity of traffic enforcers and budget dedicated for traffic management and improvement. Table 11.5-1 summarizes the issues and the corresponding strategies to improve traffic management in the city. Since there are many required actions which would entail substantial budget, there is a need to strategically distribute the programs over the years (short-term to long-term).



Source: Modified from various presentation materials of the TDM concept by Prof. Ota (Toyo University, Japan)

Figure 11.5-5 Traditional Approach (Infrastructure-based) vs TDM-based Approach

Table 11.5-1 Issues and Strategies to Improve Traffic Management

	Item		Strategy
Infra-structure issues	• Incomplete road network formation	▶	• Construction of new roads/missing links
	• Narrow roads and some roads are in poor condition	▶	• Rehabilitation of roads in poor condition and widening of narrow sections
	• Absence of pedestrian network in the CBD	▶	• Preparation of pedestrian network
	• Absence of traffic lights (traffic control system)	▶	• Installation of traffic lights
	• Absence of road markings	▶	• Installation of road/intersection markings
Operation al issues	• Increasing volume of vehicles	▶	• Improvement of public transport system to encourage car users to commute
	• Lack of traffic discipline (road users)	▶	• Traffic education
	• Pedestrian space is illegally occupied	▶	• Clearing of road/pedestrian lane
	• Illegal parking	▶	• Traffic enforcement/Installation of parking space
	• Poor traffic flow at the intersection	▶	• Enforcement and intersection improvement
	• Poor traffic flow operation/ management	▶	• Training of traffic enforcers
	• Poor education of road users on traffic rules	▶	• Traffic education

11.6 Transport Development Plan and Programmes

The Transport Development Plans and Programmes are designed to achieve the objectives and strategies identified earlier. These are divided into four sub-plans which cover both the infrastructure and operational aspects of the transportation system. These are: (i) Establishment of Road Functional Hierarchy Sub-programme, (ii) Road Network Development Sub-plan, (iii) Public Transport Improvement Sub-plan, and (iv) Traffic Management Sub-plan. The details of each sub-plan and sub-program are presented in Table 11.6-1.

Table 11.6-1 Summary of Transport Development Plan and Programme

11.6.1	**Establishment of Road Functional Hierarchy Sub-Programme**
a.	Proposed Functional Hierarchy of Roads
11.6.2	**Road Network Development Sub-Plan**
a.	Strengthening of Existing Roads (Asset Preservation_
b.	Road Improvement/Expansion to establish Hierarchical Road Network
c.	Capacity Building on Road Development to relevant agencies (City Engineering Office, MPW-BARMM)
11.6.3	**Public Transport Improvement Sub-Plan**
a.	Improvement of various existing Public Terminals (Road)
b.	Water Transport Terminal Improvement
c.	High-Capacity Public Transport Promotion and Route Improvement
11.6.4	**Traffic Management Sub-Plan**
a.	Strengthening of capacity of TMU, Traffic Police and relevant organizations
b.	Pedestrian Improvement Plan
c.	Parking Improvement Plan (including Parking Business Promotion)
d.	Intersection Improvement Plan
e.	Traffic Awareness and Safety Campaign

11.6.1 Establishment of Road Functional Hierarchy Sub-Programme

a. Proposed Functional Hierarchy of Roads in Greater Cotabato

The proposed road functional hierarchy for the Greater Cotabato City is illustrated in Figure 11.6-1. The proposed road names and numbering are available in Figure 11.6-2 and Figure 11.6-3. The total length of the road network which would serve as backbone of the area is about 335 km, of which 16% is classified as Primary Road, 27% as Secondary Road, and 57% as Tertiary Road. These roads should always be in good condition and free from obstruction (e.g. permanent parking, sidewalk vendors, crops dried on the road shoulder and other type of obstruction) to maintain its function as the backbone roads (i.e. to provide high mobility) of the area. The proposed design standard is indicated in

Table 11.6-3 which is based on the 2015 Highway Design Manual of the DPWH. Similarly, the proposed function of each road type is presented in Table 11.6-4.

Table 11.6-2 Length per Road Class (km)

	Concrete/ Asphalt	Gravel/ Earth	New Road	Total
Primary	52.846	-	-	52.846
Secondary	52.855	13.394	25.794	92.043
Tertiary	105.606	36.029	49.037	190.672
Total	211.307	49.422	74.832	335.561

Table 11.6-3 Proposed Road Design Standard

	Primary Road*	Secondary Road**	Tertiary Road***
Minimum Carriageway width (m)	6.70	6.70	6.10
Shoulder (m)	3.00	2.0	2.0
ROW (m)	30.0	20.0	15.0
Pavement thickness (mm)	280	280	230
Responsible agency	DPWH	DPWH	LGU

Source: Design Guidelines, Criteria and Standards: Volume 4 – Highway Design, DPWH, 2015

Note: *Follows the design standard of National Primary Road; **Follows design standard of National Tertiary Road (except West Diversion Road and East Diversion Road which follows design standard of National Secondary Road; ***Follows the design standard of provincial/city road except 2.0m shoulder (to accommodate on-street paid parking inside Cotabato City)

Table 11.6-4 Proposed Road Function (inside Cotabato City only)

	Primary (Arterial Road)	Secondary (Collector Road)	Tertiary (Major Local Road)
Function	• Emergency Road • Primary carrier of through traffic (inter-city traffic) hence obstruction should be minimal • Share of local traffic (city traffic) should be minimum	• Second emergency road (to be designated if needed) • Secondary carrier of through traffic • Secondary carrier of local traffic (city traffic)	• Primary carrier of local traffic (city traffic) due to its wider coverage
Access Policy	Priority is vehicular mobility over access to establishments	Balance between vehicular mobility and access to establishments	Access to establishments is priority over vehicular movement
Parking System	Roadside parking is not allowed all the time	Paid parallel parking is allowed (except at East Diversion Road and West Diversion Road)	Paid parallel parking is allowed
Public transport services	Corridor for high-capacity public transport (bus system)	Allowed for jeepney routes and other PUVs	Both jeepney and tricycle routes are allowed
Public transport trip distance	Long trip (10 km and above)	Medium trip (5 km and above)	Short trip (1 km and above)
Desired Network Speed	40 km/hr and above	20 km/hr and above	Less than 20 km/hr

Note: The above applies only to the road network inside Cotabato City

In preparing the future road network, although economic and social development were greatly factored in, the importance of having a road network resilient to natural disasters was equally given significant weight. Hence the following were considered:

- Distribution of important facilities (airport, port, government centers)
- Distribution of major settlements/populations
- Road resilience and redundancy to ensure that no community is isolated during disasters
- Balanced development of the land area
- Recognition of the needs to preserve the environmentally sensitive areas of Cotabato (coastal area and eastern part of the city) hence less road density
- [Inside the Cotabato City – area between East Diversion Road and West Diversion Road] Intersection is less than 1km to form a grid pattern of settlements that would be accessible by future public transport within the 400 m radius or so.

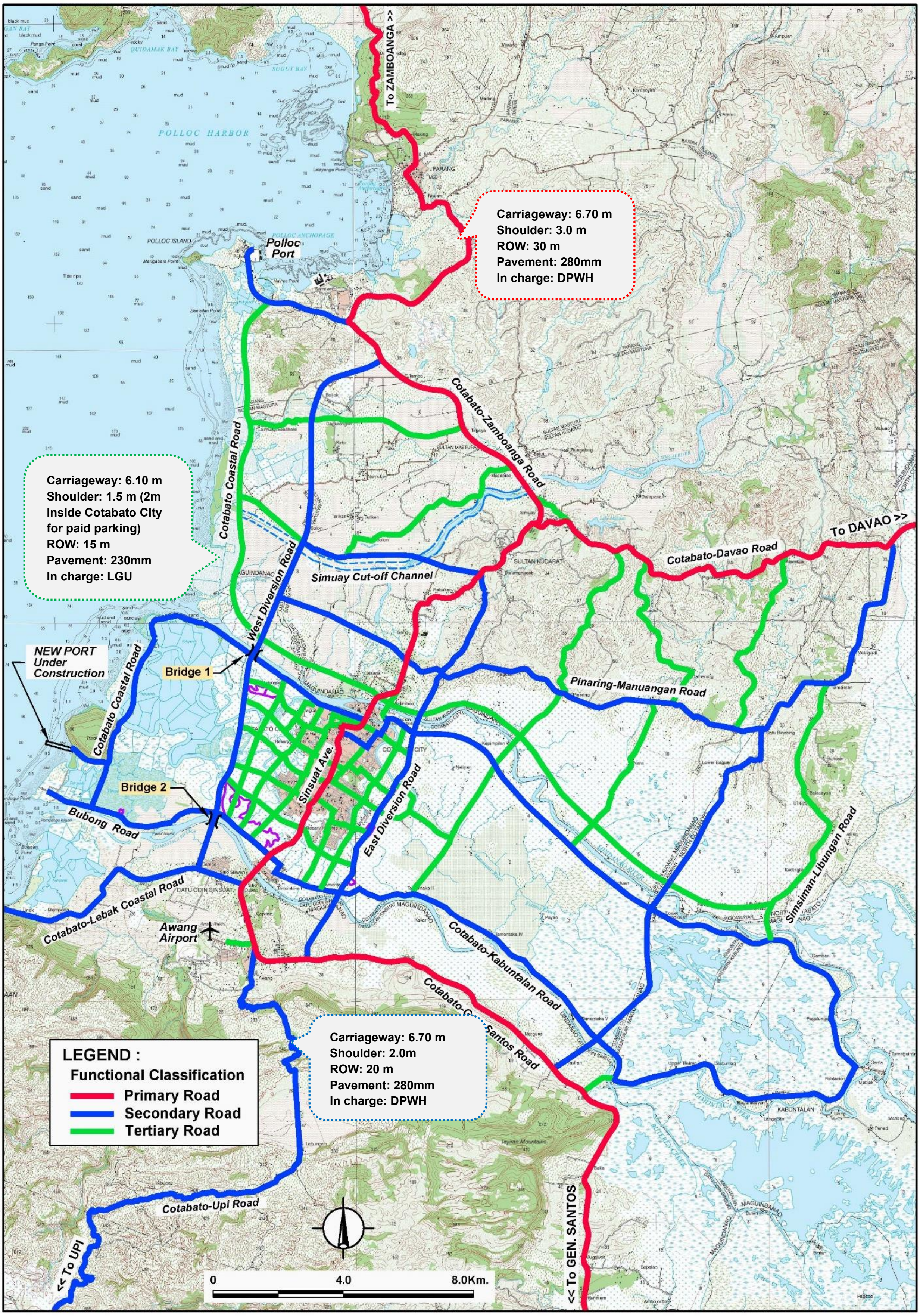
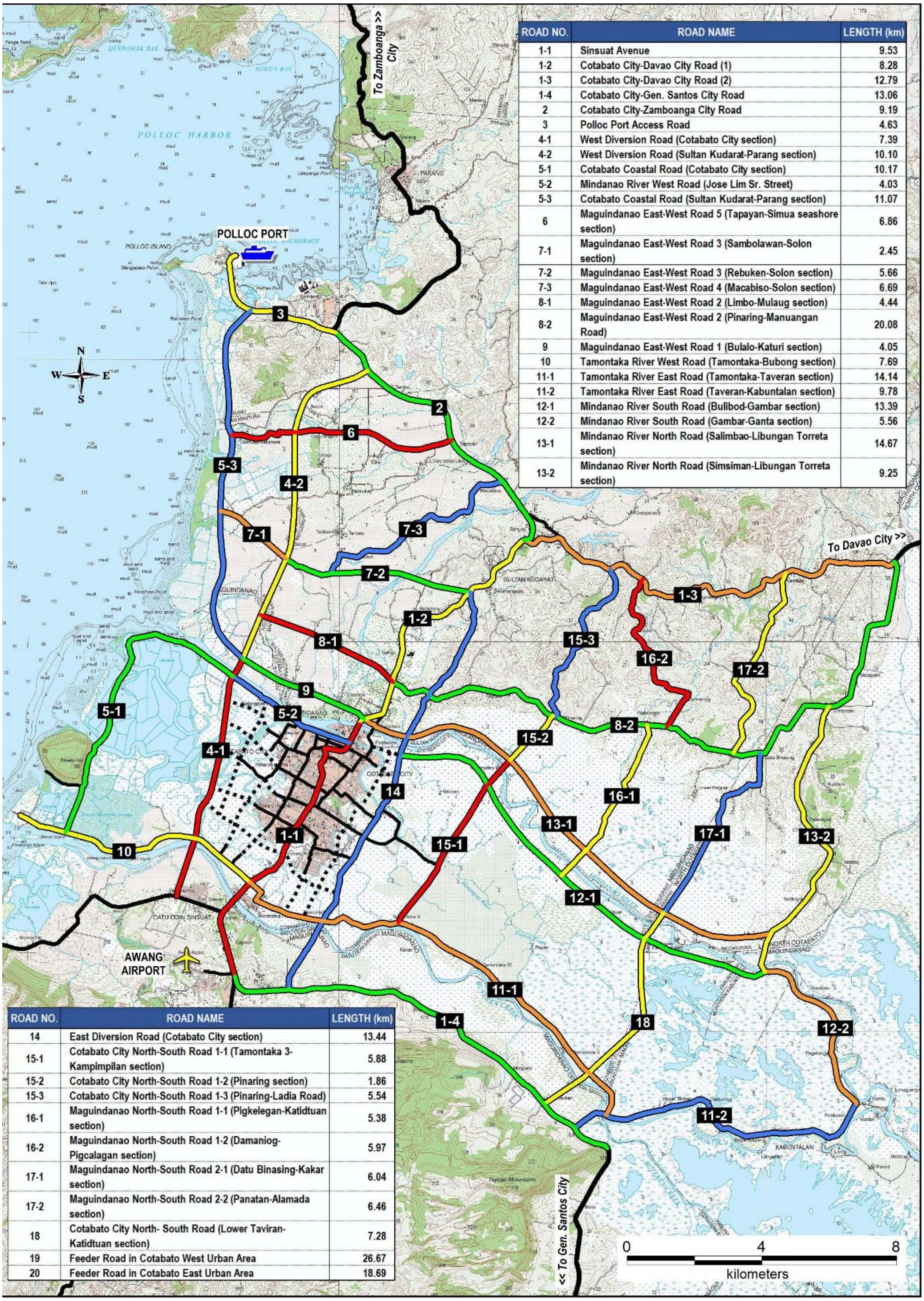


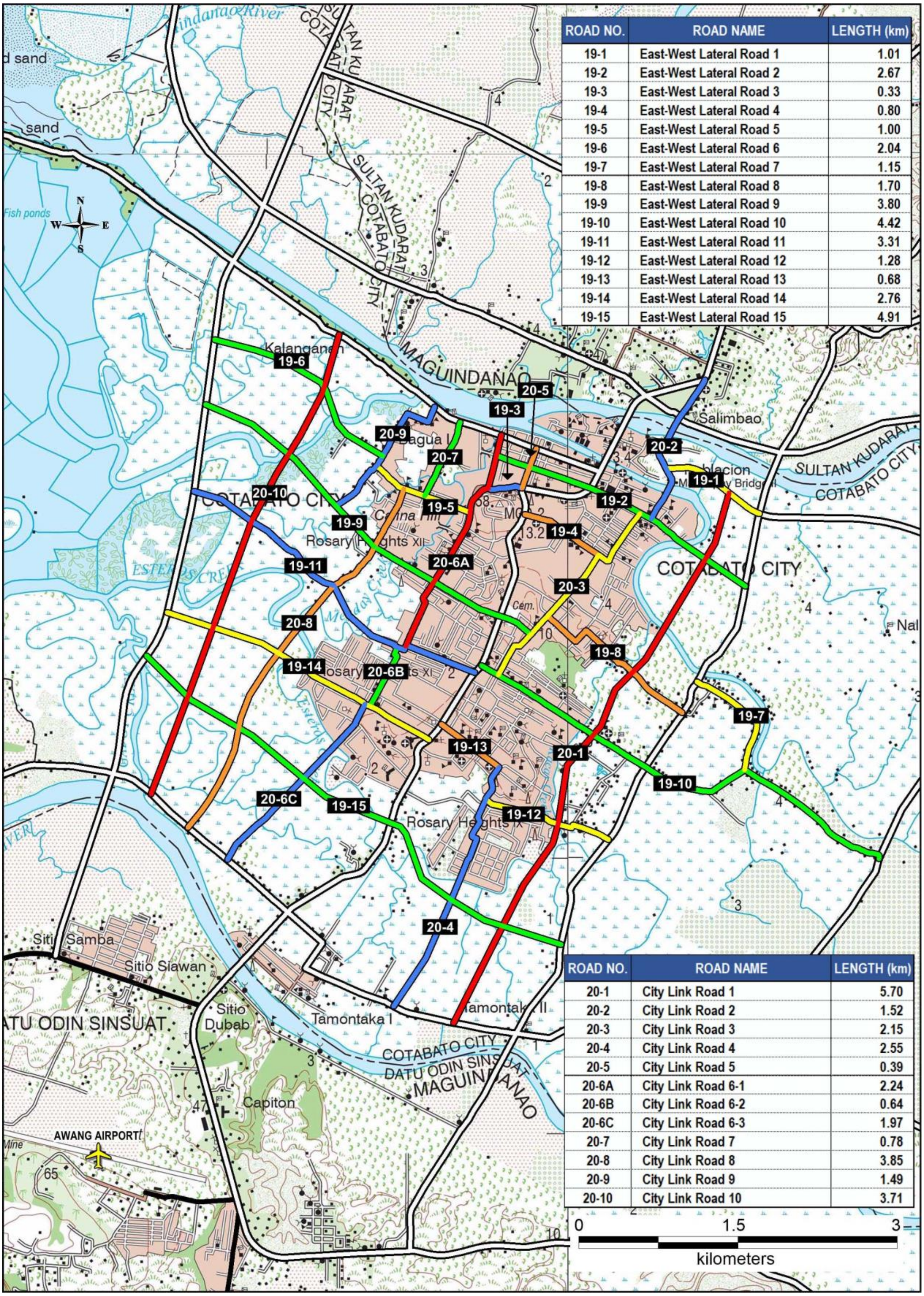
Figure 11.6-1 Proposed Road Functional Hierarchy in Greater Cotabato



ROAD NO.	ROAD NAME	LENGTH (km)
1-1	Sinsuat Avenue	9.53
1-2	Cotabato City-Davao City Road (1)	8.28
1-3	Cotabato City-Davao City Road (2)	12.79
1-4	Cotabato City-Gen. Santos City Road	13.06
2	Cotabato City-Zamboanga City Road	9.19
3	Polloc Port Access Road	4.63
4-1	West Diversion Road (Cotabato City section)	7.39
4-2	West Diversion Road (Sultan Kudarat-Parang section)	10.10
5-1	Cotabato Coastal Road (Cotabato City section)	10.17
5-2	Mindanao River West Road (Jose Lim Sr. Street)	4.03
5-3	Cotabato Coastal Road (Sultan Kudarat-Parang section)	11.07
6	Maguindanao East-West Road 5 (Tapayan-Simua seashore section)	6.86
7-1	Maguindanao East-West Road 3 (Sambolawan-Solon section)	2.45
7-2	Maguindanao East-West Road 3 (Rebuken-Solon section)	5.66
7-3	Maguindanao East-West Road 4 (Macabiso-Solon section)	6.69
8-1	Maguindanao East-West Road 2 (Limbo-Mulaug section)	4.44
8-2	Maguindanao East-West Road 2 (Pinaring-Manuangan Road)	20.08
9	Maguindanao East-West Road 1 (Bulalo-Katuri section)	4.05
10	Tamontaka River West Road (Tamontaka-Bubong section)	7.69
11-1	Tamontaka River East Road (Tamontaka-Taveran section)	14.14
11-2	Tamontaka River East Road (Taveran-Kabuntalan section)	9.78
12-1	Mindanao River South Road (Bulibod-Gambar section)	13.39
12-2	Mindanao River South Road (Gambar-Ganta section)	5.56
13-1	Mindanao River North Road (Salimbao-Libungan Torreta section)	14.67
13-2	Mindanao River North Road (Simsiman-Libungan Torreta section)	9.25

ROAD NO.	ROAD NAME	LENGTH (km)
14	East Diversion Road (Cotabato City section)	13.44
15-1	Cotabato City North-South Road 1-1 (Tamontaka 3-Kampimpilan section)	5.88
15-2	Cotabato City North-South Road 1-2 (Pinaring section)	1.86
15-3	Cotabato City North-South Road 1-3 (Pinaring-Ladia Road)	5.54
16-1	Maguindanao North-South Road 1-1 (Pigkelegan-Katidtuan section)	5.38
16-2	Maguindanao North-South Road 1-2 (Damaniog-Pigcalagan section)	5.97
17-1	Maguindanao North-South Road 2-1 (Datu Binasing-Kakar section)	6.04
17-2	Maguindanao North-South Road 2-2 (Panatan-Alamada section)	6.46
18	Cotabato City North- South Road (Lower Taviran-Katidtuan section)	7.28
19	Feeder Road in Cotabato West Urban Area	26.67
20	Feeder Road in Cotabato East Urban Area	18.69

Figure 11.6-2 Proposed Road Names and Length (1/2)



ROAD NO.	ROAD NAME	LENGTH (km)
19-1	East-West Lateral Road 1	1.01
19-2	East-West Lateral Road 2	2.67
19-3	East-West Lateral Road 3	0.33
19-4	East-West Lateral Road 4	0.80
19-5	East-West Lateral Road 5	1.00
19-6	East-West Lateral Road 6	2.04
19-7	East-West Lateral Road 7	1.15
19-8	East-West Lateral Road 8	1.70
19-9	East-West Lateral Road 9	3.80
19-10	East-West Lateral Road 10	4.42
19-11	East-West Lateral Road 11	3.31
19-12	East-West Lateral Road 12	1.28
19-13	East-West Lateral Road 13	0.68
19-14	East-West Lateral Road 14	2.76
19-15	East-West Lateral Road 15	4.91

ROAD NO.	ROAD NAME	LENGTH (km)
20-1	City Link Road 1	5.70
20-2	City Link Road 2	1.52
20-3	City Link Road 3	2.15
20-4	City Link Road 4	2.55
20-5	City Link Road 5	0.39
20-6A	City Link Road 6-1	2.24
20-6B	City Link Road 6-2	0.64
20-6C	City Link Road 6-3	1.97
20-7	City Link Road 7	0.78
20-8	City Link Road 8	3.85
20-9	City Link Road 9	1.49
20-10	City Link Road 10	3.71

Figure 11.6-3 Proposed Road Names and Length (2/2)

11.6.2 Road Network Development Sub-Plan

Background

In order to strengthen the road network of Greater Cotabato, the following tasks have to be carried out (Figure 11.6-4):

a. Rehabilitation of roads in poor condition (bad and very bad) to recover road function
b. Upgrading of roads with earth/gravel surface (earth/gravel to concrete)
c. Rehabilitation of Non-functional Roadside Drainage
d. Construction of missing links and new roads to complete the road network of Greater Cotabato
e. Capacity Building on Road Development to Relevant Agencies

<u>Rehabilitation of Roads in Poor Condition and Non-functional Roadside Drainage</u>

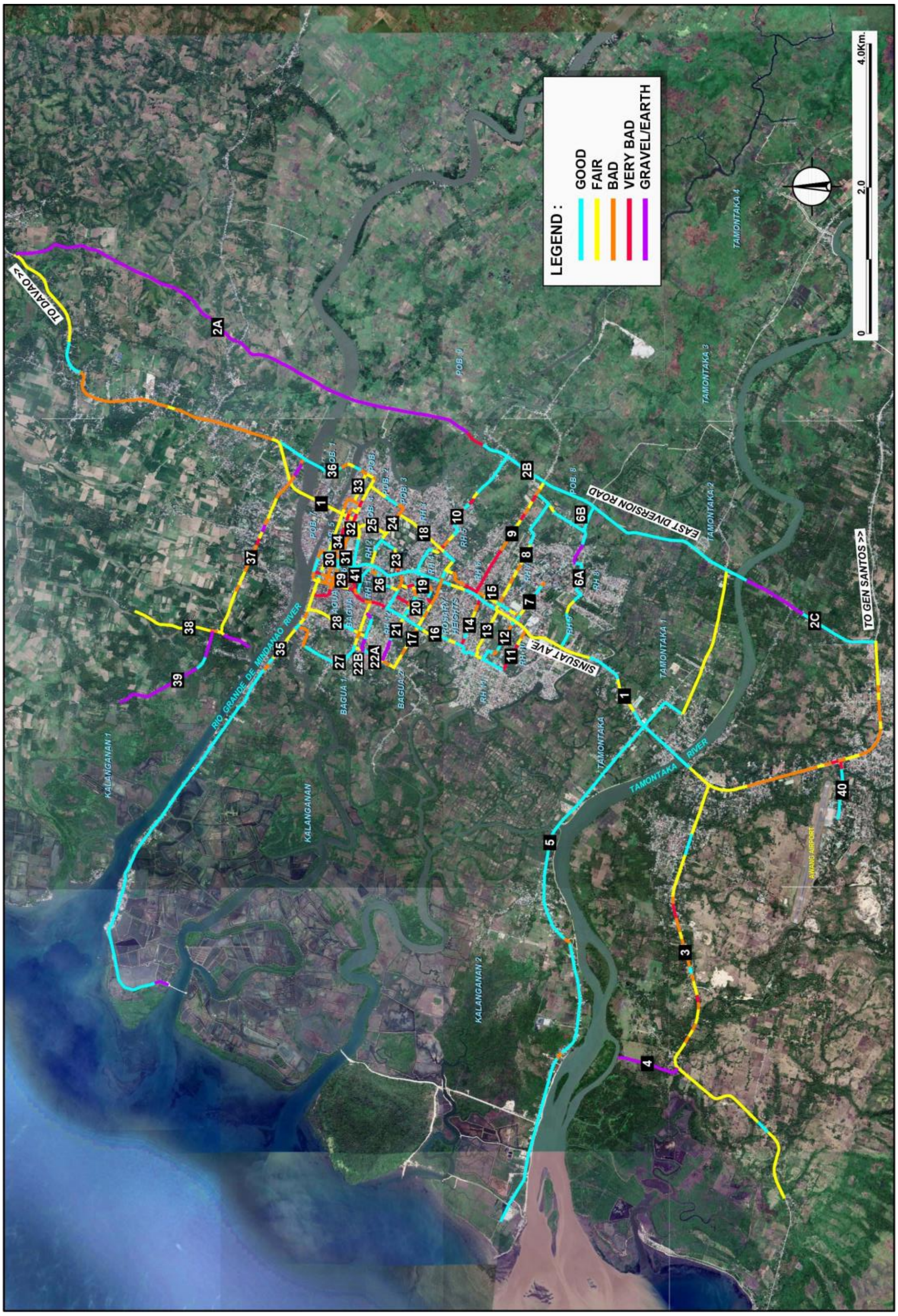
In order to preserve the road asset and recover its function, it is important to rehabilitate road sections under “bad” and “very bad” condition as seen in Figure 11.6-4. In total, about 21.4 km of roads (sum of “bad” and “very bad” condition) need immediate rehabilitation. In addition, approximately 12.3 km of gravel roads need to be upgraded to concrete surface. The summary of road surface condition is shown in Table 11.6-5.

Similarly, about 7.6 km of roadside drainage are non-functional as shown in Figure 11.6-5. The rehabilitation of these facilities is equally important to keep the road carriageway free from flood water.

Table 11.6-5 Summary of Road Surface Condition

Road Classification	Sub-Total		Road Condition (Concrete)				Gravel
			Good	Fair	Bad	Very Bad	
National Road	Km	40.7	15.7	10.8	5.6	0.4	8.1
	%	100%	38.7%	26.6%	13.9%	0.9%	19.9%
Cotabato City (City Road)	Km	45.9	21.4	11.2	7.8	4.8	1.0
	%	100%	46.7%	24.3%	17.0%	10.4%	2.3%
Sultan Kudarat (Local Road)	Km	6.1	0.2	2.4	1.2	0.1	2.3
	%	100%	3.3%	39.0%	19.2%	1.6%	36.9%
Datu Odin Sinsuat (Local Road)	Km	8.4	1.3	4.7	0.9	0.6	0.9
	%	100%	15.5%	56.1%	10.7%	7.3%	10.5%
Total	Km	101.1	38.7	29.1	15.5	5.9	12.3
	%	100%	38.2%	28.8%	15.3%	5.8%	12.2%

Source: JICA Study Team



Source: Road Surface Condition Survey by the JICA Study Team

Figure 11.6-4 Target Roads for Rehabilitation (Bad and Very Bad Sections)

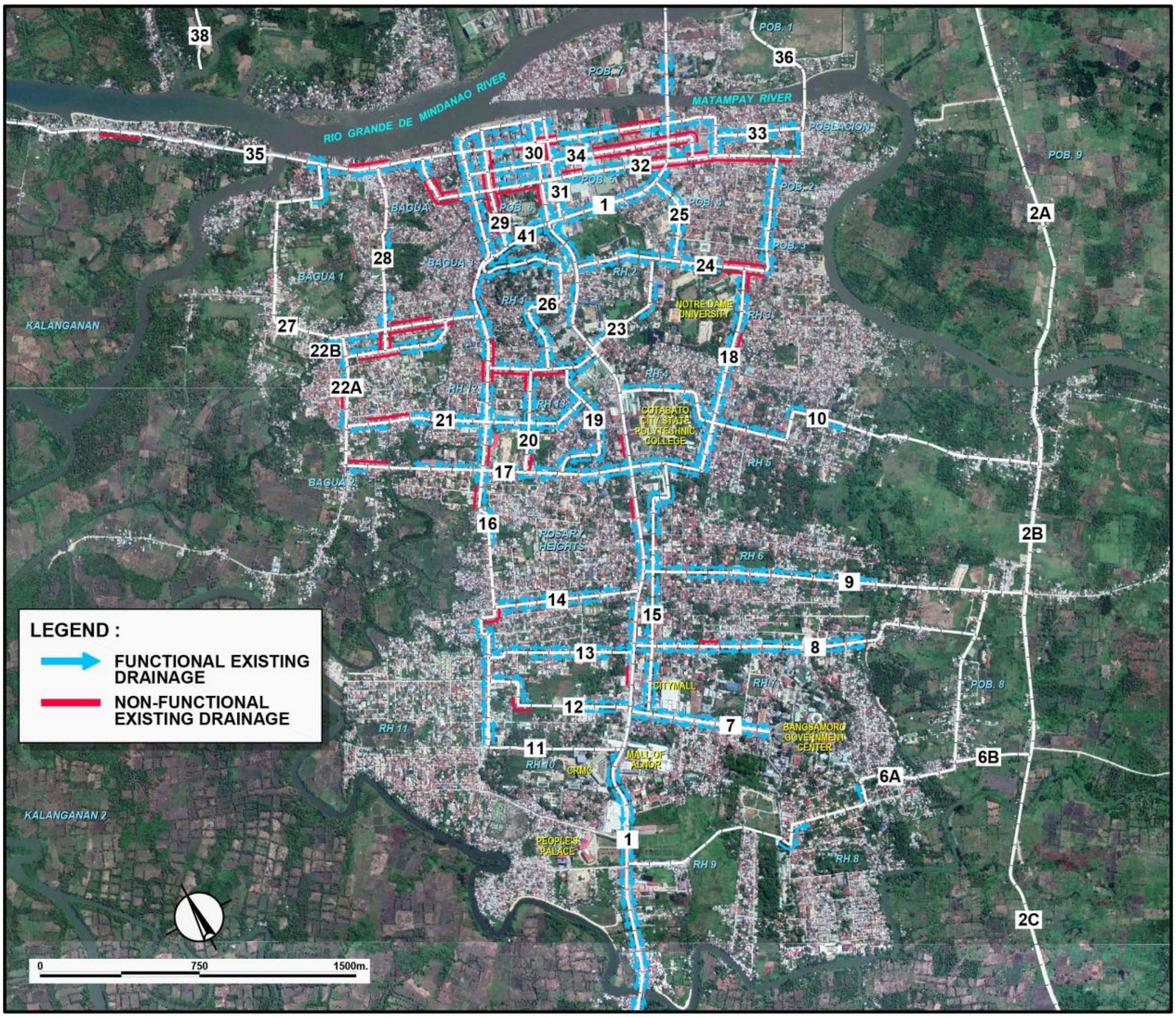


Figure 11.6-5 Target Drainage for Rehabilitation (Non-Functional)

<u>Road Improvement to Establish Hierarchical Road Network (Upgrading of road surface, construction of missing links and new strategic roads)</u>

The entire network of the Greater Cotabato that must be kept in good condition to achieve good mobility in the area is about 335 km. Some roads, however, are still surfaced with gravel/earth hence upgrading to concrete surface would be necessary. Similarly, some identified links to complete the network formation are still missing hence construction of new roads would also be needed. Table 11.6-6 presents the profile of roads comprising the proposed network shown in Figure 11.6-6. To summarize, the length of existing roads to be improved and new road to be constructed are as follows (based on Table 11.6-6 and Figure 11.6-6):

- Roads surfaced with gravel/earth: 48.56 km
- New road construction: 108.72 km

Total 157.28 km

Table 11.6-6 List of Roads composing the Road Network Masterplan

No.	Road Name	Road Class	Total Length (Km)	Road Condition (Km)		
				Concrete/ Asphalt	Gravel/ Earth	New Road
1-1	Sinsuat Avenue	Primary	9.53	9.53		
1-2	Cotabato City-Davao City Road (1)	Primary	8.28	8.28		
1-3	Cotabato City-Davao City Road (2)	Primary	12.79	12.79		
1-4	Cotabato City-Gen. Santos City Road	Primary	13.06	13.06		
2	Cotabato City-Zamboanga City Road	Primary	9.19	9.19		
3	Polloc Port Access Road	Secondary	4.63	4.63		
4-1	West Diversion Road (Cotabato City section)	Secondary	7.39			7.39
4-2	West Diversion Road (Sultan Kudarat-Parang section)	Secondary	10.10			10.10
5-1	Cotabato Coastal Road (Cotabato City section)	Tertiary	9.64	6.66	0.20	2.77
5-2	Mindanao River West Road (Jose Lim Sr. Street)	Secondary	4.03	4.03		
5-3	Cotabato Coastal Road (Sultan Kudarat-Parang section)	Tertiary	11.07			11.07
6	Maguindanao East-West Road 5 (Tapayan-Simua seashore section)	Tertiary	6.86	6.86		
7-1	Maguindanao East-West Road 3 (Sambolawan-Solon section)	Tertiary	2.45			2.45
7-2	Maguindanao East-West Road 3 (Rebuken-Solon section)	Secondary	5.66	0.31	1.15	4.21
7-3	Maguindanao East-West Road 4 (Macabiso-Solon section)	Tertiary	6.69	6.69		
8-1	Maguindanao East-West Road 2 (Limbo-Mulaug section)	Tertiary	4.44			4.44
8-2	Maguindanao East-West Road 2 (Pinaring-Manuangan Road)	Secondary	20.08	19.08	1.00	
9	Maguindanao East-West Road 1 (Bulalo-Katuri section)	Tertiary	4.05	2.20	0.10	1.75
10	Tamontaka River West Road (Tamontaka-Bubong section)	Tertiary	7.69	7.69		
11-1	Tamontaka River East Road (Tamontaka-Taveran section)	Tertiary	14.14	11.17	2.97	
11-2	Tamontaka River East Road (Taveran-Kabuntalan section)	Tertiary	9.78	9.78		
12-1	Mindanao River South Road (Bulibod-Gambar section)	Secondary	13.39			13.39
12-2	Mindanao River South Road (Gambar-Ganta section)	Tertiary	5.56	0.32	5.24	
13-1	Mindanao River North Road (Salimbao-Libungan Torreta section)	Tertiary	14.67	0.19	0.32	14.17
13-2	Mindanao River North Road (Simsiman-Libungan Torreta section)	Tertiary	9.25		8.58	0.67
14	East Diversion Road (Cotabato City section)	Secondary	13.44	5.24	8.20	
15-1	Cotabato City North-South Road 1-1 (Tamontaka 3-Kampimpilan section)	Tertiary	5.88		0.56	5.32
15-2	Cotabato City North-South Road 1-2 (Pinaring section)	Tertiary	1.86		1.17	0.69
15-3	Cotabato City North-South Road 1-3 (Pinaring-Ladia Road)	Tertiary	5.54		5.54	

No.	Road Name	Road Class	Total Length (Km)	Road Condition (Km)		
				Concrete/ Asphalt	Gravel/ Earth	New Road
16-1	Maguindanao North-South Road 1-1 (Pigkelegan-Katidtuan section)	Tertiary	5.38	3.24	1.57	0.57
16-2	Maguindanao North-South Road 1-2 (Damaniog-Pigcalagan section)	Tertiary	5.97	3.10	2.87	
17-1	Maguindanao North-South Road 2-1 (Datu Binasing-Kakar section)	Secondary	6.04		3.05	2.99
17-2	Maguindanao North-South Road 2-2 (Panatan-Alamada section)	Tertiary	6.46	6.06	0.40	
18	Cotabato City North- South Road (Lower Taviran-Katidtuan section)	Secondary	7.28	2.08		5.20
19-1	East-West Lateral Road 1	Tertiary	0.87			0.87
19-2	East-West Lateral Road 2	Tertiary	2.67	1.62	0.29	0.76
19-3	East-West Lateral Road 3	Tertiary	0.33	0.33		
19-4	East-West Lateral Road 4	Tertiary	0.80	0.80		
19-5	East-West Lateral Road 5	Tertiary	1.00	1.00		
19-6	East-West Lateral Road 6	Tertiary	2.04	0.39		1.64
19-7	East-West Lateral Road 7	Tertiary	1.15	0.97	0.18	
19-8	East-West Lateral Road 8	Tertiary	1.70	1.56	0.14	
19-9	East-West Lateral Road 9	Tertiary	3.80	1.69		2.10
19-10	East-West Lateral Road 10	Tertiary	4.42	2.30	2.12	
19-11	East-West Lateral Road 11	Tertiary	3.31	1.84	0.24	1.22
19-12	East-West Lateral Road 12	Tertiary	1.28	0.69	0.58	
19-13	East-West Lateral Road 13	Tertiary	0.68	0.68		
19-14	East-West Lateral Road 14	Tertiary	2.76	1.00	0.32	1.44
19-15	East-West Lateral Road 15	Tertiary	4.91			4.91
20-1	City Link Road 1	Tertiary	3.50			3.50
20-2	City Link Road 2	Tertiary	1.52	1.52		
20-3	City Link Road 3	Tertiary	2.15	1.79	0.35	
20-4	City Link Road 4	Tertiary	2.55	1.00	0.16	1.39
20-5	City Link Road 5	Tertiary	0.39	0.39		
20-6A	City Link Road 6-1	Tertiary	2.24	2.24		
20-6B	City Link Road 6-2	Tertiary	0.64	0.64		
20-6C	City Link Road 6-3	Tertiary	1.97	0.31	0.57	1.09
20-7	City Link Road 7	Tertiary	0.78	0.78		
20-8	City Link Road 8	Tertiary	3.85	1.11	0.38	2.37
20-9	City Link Road 9	Tertiary	1.49	0.92	0.33	0.24
TOTAL			**335.02**	**177.75**	**48.56**	**108.72**

Note: Refer to Figure 11.6-2 and Figure 11.6-3 for maps showing the roads in the table

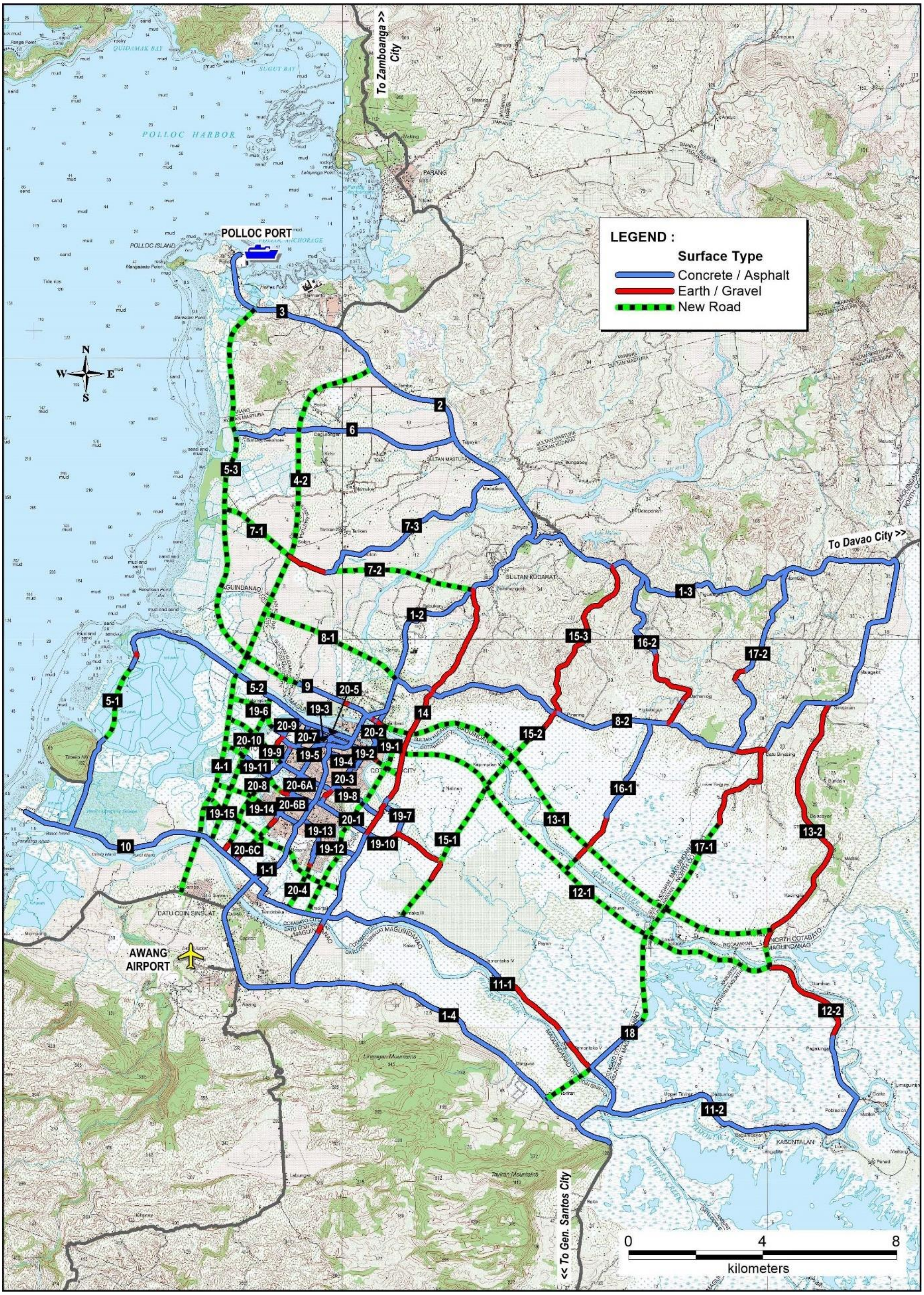
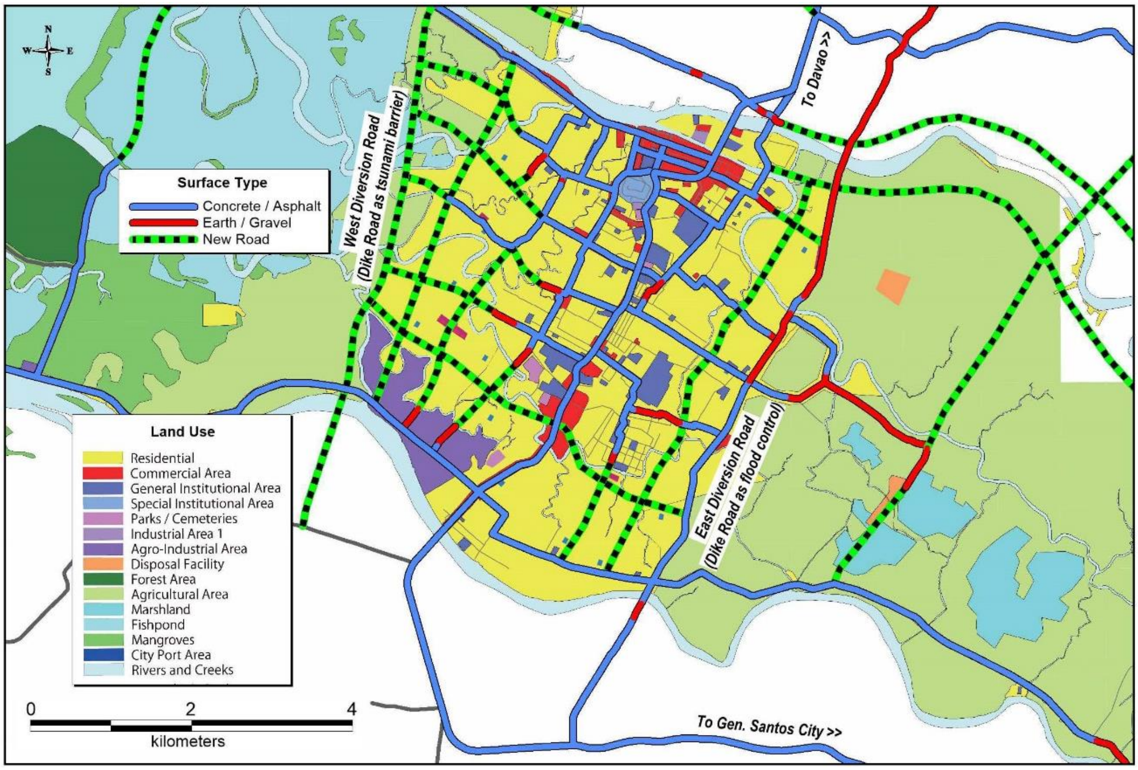


Figure 11.6-6 Roads for Improvement (Earth/Gravel and New Road)

Future Road Network supporting Future Land Use

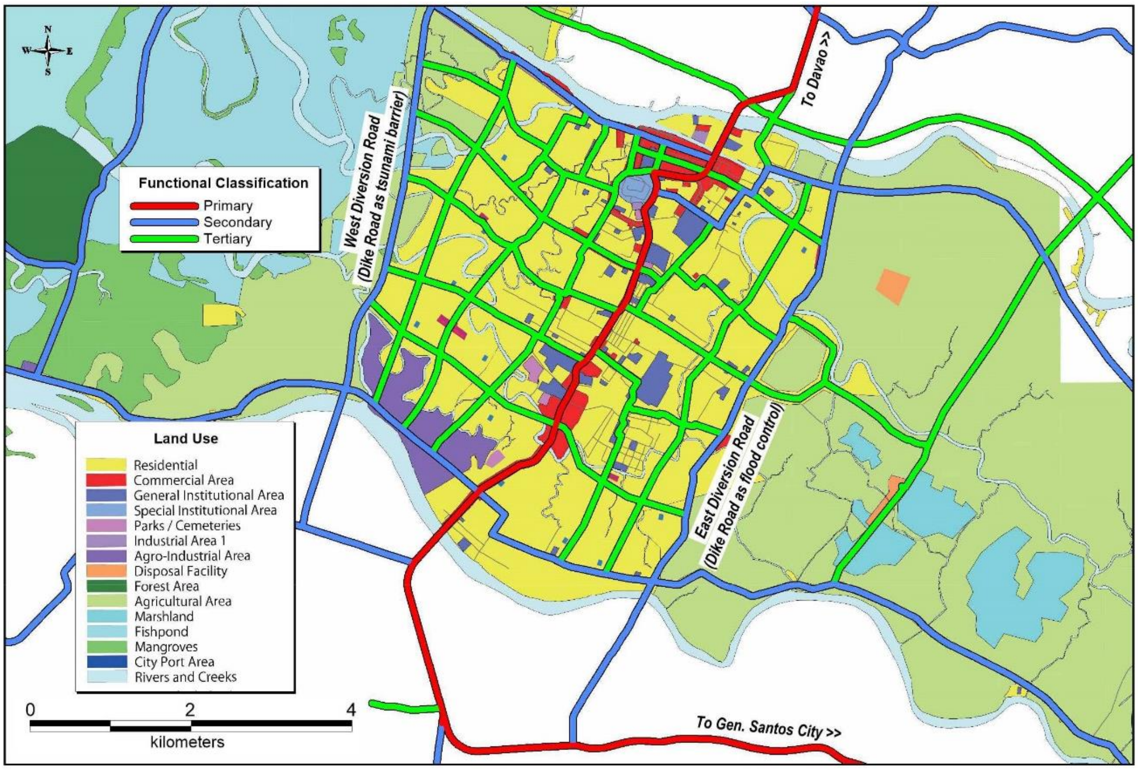
The proposed future road network (2040) is developed, in line with the future land use (2040) of Cotabato City. As shown in Figure 11.6-7 and Figure 11.6-8, the road network is structured in a way that efficient flow of traffic is achievable even if high traffic volume is expected coming from the new proposed commercial sites. However, as seen in Figure 11.6-7, many new roads must be constructed to ensure that the road network will be able to complement the future land use.

As far as relationship of road hierarchy and land use is concerned (Figure 11.6-8), the industrial areas (part of Tamontaka 1, part of Poblacion 4, among others) are largely served by secondary road, the second highest road hierarchy (i.e., road with second highest capacity). The most developed commercial areas (old historic core, Rosary Heights 9 and 10) and the designated future commercial areas (part of Rosary Height 9 and Tamontaka 1) are currently along the national primary road hence access is good. However, as seen in other cities in the Philippines, traffic congestion will be experienced if traffic management (e.g., parking policy and segregation of through traffic and local traffic, etc.) is not properly formulated and executed.



Source: JICA Study Team

Figure 11.6-7 Relationship of the Future Road Network (2040) (showing Road Surface) and Future Land Use Map (2040)



Source: JICA Study Team

Figure 11.6-8 Relationship of the Future Road Network (2040) (showing Road Hierarchy) and Future Land Use Map (2040)

Capacity Building on Road Development to Relevant Agencies

While roads classified as primary and secondary (Figure 11.6-1) are proposed to be a national road and therefore will be under the DPWH National, significant length of roads (57% of the total road length in the proposed road network masterplan which is equivalent to 190 km) will be under the local governments particularly the City Government through its City Engineering Office and the Bangsamoro Government through its Ministry of Public Works (MPW-BARMM). This is a difficult task for both local government agencies hence a capability enhancement training might be necessary. MPW-BARMM is a ministry created in 2019 as part of the newly established BARMM hence its experience in road development is rather limited. On the other hand, discussion with the City Engineering Office revealed the trainings necessary to successfully conduct their current functions (Table 11.6-7). The entire flow of development a new road from planning to construction is presented in Table 11.6-8. Since completion of the proposed road network in the MP involves construction of several new roads, enhancing the capability of the two agencies in the entire development process might be necessary.

Table 11.6-7 Training Needs Expressed by the Cotabato City Engineering Office, Cotabato LGU

Major Tasks	Issues and Concerns	Expressed Training Needs	Tools, Equipment, and Software Needed
1. Preparation of Annual Transportation Situation Report (with traffic count and road condition) Other Tasks: 1. Planning of Roads and other Infrastructure 2. Procurement of Contractors and Management of Contracts	• Lack of capacity to undertake comprehensive road condition, traffic count, and traffic speed surveys • Lack modern equipment for conducting surveys (e.g., drone) • Lack computers and licensed software for the preparation of maps, designing, and other engineering works • Lack of printers for generating good quality maps • Challenge in infrastructure projects being completed on time	• Training on Road and Drainage Condition Surveys • Training on Traffic Count Survey • Training on Travel Speed Survey • Training on the use of computers and software for map-making, designing, etc. • Project Management and Monitoring	• Computers appropriate for engineering works • Printers capable of printing maps • Software for making maps, designing, and other engineering works • Drone for survey of inaccessible areas

Table 11.6-8 Road Development Flow for a New Road Construction (Planning to Construction Supervision of Road Project)

Stages	Details
1. Planning Stage	a. Needs assessment/ Problem Identification b. Project identification (and screening) c. Preparation of Indicative Project Cost Estimate of Identified Projects d. Preparation of Implementation Schedule
2. Feasibility Study	a. Socioeconomic study of the communities to receive benefits of the project b. Road alignment study/selection c. Traffic Study d. Environmental and Resettlement Consideration e. Preliminary Design f. Construction Cost Estimate and Project Cost Estimate g. Economic Evaluation h. Project Implementation Plan i. Operation Effect and Indicators (comparison of benefits with and without the project)
3. Detailed Engineering Design	a. Undertake Engineering Surveys and Investigations (topographic survey, geotechnical survey, etc) b. Preparation of RAP (Relocation Action Plan) c. Identify Affected Existing Public Utilities (water pipes, power lines, etc.) d. Prepare Detailed Design Calculations and Construction Drawings e. Prepare Construction Plan, Traffic Management Plan and Implementation Schedule f. Prepare Contract Documents to Include and Detailed Specifications (Containing Quality, Safety and Environment Protection) and Bill of Quantities (BOQ) g. Prepare Cost Estimate h. Prepare Bid and Other Relevant Documents Including Contractor Qualification (PQ) and Bid Evaluation, Bid Evaluation Criteria, Requirements for Environmental Management Plan, and Construction Safety Requirements and Management Plan i. Prepare Necessary HIV Prevention Program to be Implemented by the Contractors

Stages	Details
4. Procurement (Tender Assistance)	a. Review and updating of Bid Documents (prepared during DD stage) b. Undertake Pre-qualification (to short list contractors and remove unqualified contractors) c. Issuance of Bid Invitation (to only short list contractors) d. Conducting Pre-Bid Conferences (to explain the project and answer some questions from bidders) e. Evaluate Bids in Accordance with the Criteria Set Forth in the Bidding Documents f. Prepare Bid Evaluation Reports for Approval of Bids and Awards Committee g. Contract Negotiation h. Prepare Draft and Final Contract Agreement
5. Construction Supervision	a. Schedule Control b. Quality Control c. Financial Control

Objective

The objective of the Road Network Development Sub-plan is to strengthen and complete the road network by upgrading the earth/gravel roads (from earth/gravel to concrete) and constructing new roads (missing links and strategic roads).

Scope

The scope of the Road Network Development Sub-plan is shown in Table 11.6-9 below:

Table 11.6-9 Scope of Work for Road Network Development Sub-plan

Tasks	Length (km)	Location
1. Strengthening of Existing Roads (Asset Preservation)		
a. Rehabilitation of roads in “bad” condition	15.51	Figure 11.6-4 Location of road sections in “bad” and “very bad” condition
b. Reconstruction of roads in “very bad” condition	17.51	
c. Upgrading of road surface (earth/gravel to concrete surface)	49.42	Figure 11.6-6 Roads for Improvement (Earth/Gravel and New Road)
d. Rehabilitation of Non-functional Roadside Drainage		Figure 11.6-5 for location map
2. Road Improvement to Establish Hierarchical Road Network		
a. New road construction (missing links and strategic roads including the West Diversion Road)	74.83	Figure 11.6-1 and Figure 11.6-6for the location map
3. Capacity Building to Road Related Agencies		
a. Capacity Building on Road Development to City Engineering Office and MPW-BARMM	N/A	N/A
Total	**157.27**	

Location

The road sections covered by the Sub-plan are shown in the following figures:

- Figure 11.6-4 Location of road sections in “bad” and “very bad” condition
- Figure 11.6-6 Roads for Improvement (Earth/Gravel and New Road)

Impact

Positive Impacts

The positive impact of the "Road Network Development Sub-plan" is significant especially in giving access to the communities to be connected by the new roads. This means that access to market and urban services including government services will be assured. Similarly, the link among the six LGUs will be enhanced, resulting to a more integrated economy. Furthermore, one of the components under this sub-programme is the establishment of a West Diversion Road, which will serve dual purposes: (1) as an arterial road and (2) as tsunami barrier to protect the city from the possible onslaught of a tsunami. In essence, the following are expected positive impacts of this sub-plan:

- Strengthened links among the LGUs hence integration of social, economic, disaster response could be achieved
- Sound urbanization of Cotabato City due to the provision of a complete network with suitable hierarchy
- Improved circulation of traffic both inside Cotabato City and between Cotabato City and neighboring municipalities
- Reduction of potential damage caused by natural calamities (storm surge and tsunami)
- Strengthened access to Polloc Port and other important facilities
- Improved traveler's amenity and increase of traveler's comfort

West Diversion Road: Its significance to traffic decongestion, disaster prevention, and sound urbanization of Cotabato City

The West Diversion Road is considered among the most important identified projects under the Road Network Development Sub-plan (under New Road Construction), due to the following reasons:

It will expand the road capacity for the north-south traffic

The lone arterial road (Sinsuat Avenue) is currently handling about 3,000/PCU/hour for the north-south traffic. Ideally, to maintain good flow of traffic, the said road should handle only about 2,000/PCU/hour. The 1,000/PCU/hour excess traffic therefore needs to be diverted. However, there is no alterative road which could absorb the excess traffic.

Assuming that in the future, the construction of both the East Diversion Road and the West Diversion Road are completed and the diverted traffic are equally distributed, each new road is expected to carry about 8,000 PCU/day (500 PCU/hr x 16 hrs = 8,000 PCU (6:00AM to 22:00PM)). It must be noted that this remains a very conservative estimate due to lack of OD (Origin-Destination) data.

It will protect the city from the impact of Tsunami

Cotabato City and other coastal towns along the Illana Bay were devastated by tsunami waves in 1976. A recent simulation data from PHIVOLCS (Figure 11.6-9) revealed that in the occurrence of a tsunami, about 190,000 inhabitants of Cotabato City will be affected (64% of the population). In addition, about 38,000 inhabitants of Sultan Kudarat Municipality (41% of the population) and 15,000 inhabitants of Sultan Mastura Municipality (70% of the population) will potentially be affected. In total, about 245,000 people from the three municipalities might be affected by a tsunami as seen in Table 11.6-10 below. The installation of the dike road (West Diversion Road) however has the potential to reduce the possible affected inhabitants to just 33,262 or a reduction of about 211,737 potentially affected inhabitants.

Table 11.6-10 Estimated Number of People Affected by Tsunami with and without West Diversion Road (Tsunami barrier)

LGU	Total Population	A. Without West Diversion Road		B. With Diversion Road		Difference (A-B)
		Affected Population	%	Affected Population	%	
Cotabato City	299,438	190,685	63.7%	26,826	9.0%	163,859
Sultan Kudarat	95,201	38,769	40.7%	1,674	1.8%	37,095
Sultan Mastura	22,261	15,581	70.0%	4,762	21.4%	10,819
Total	**416,900**	**245,035**	**58.8%**	**33,262**	**8.0%**	**211,773**

Source: Calculated by the JICA Study Team based on the tsunami inundation data from PHIVOLCS

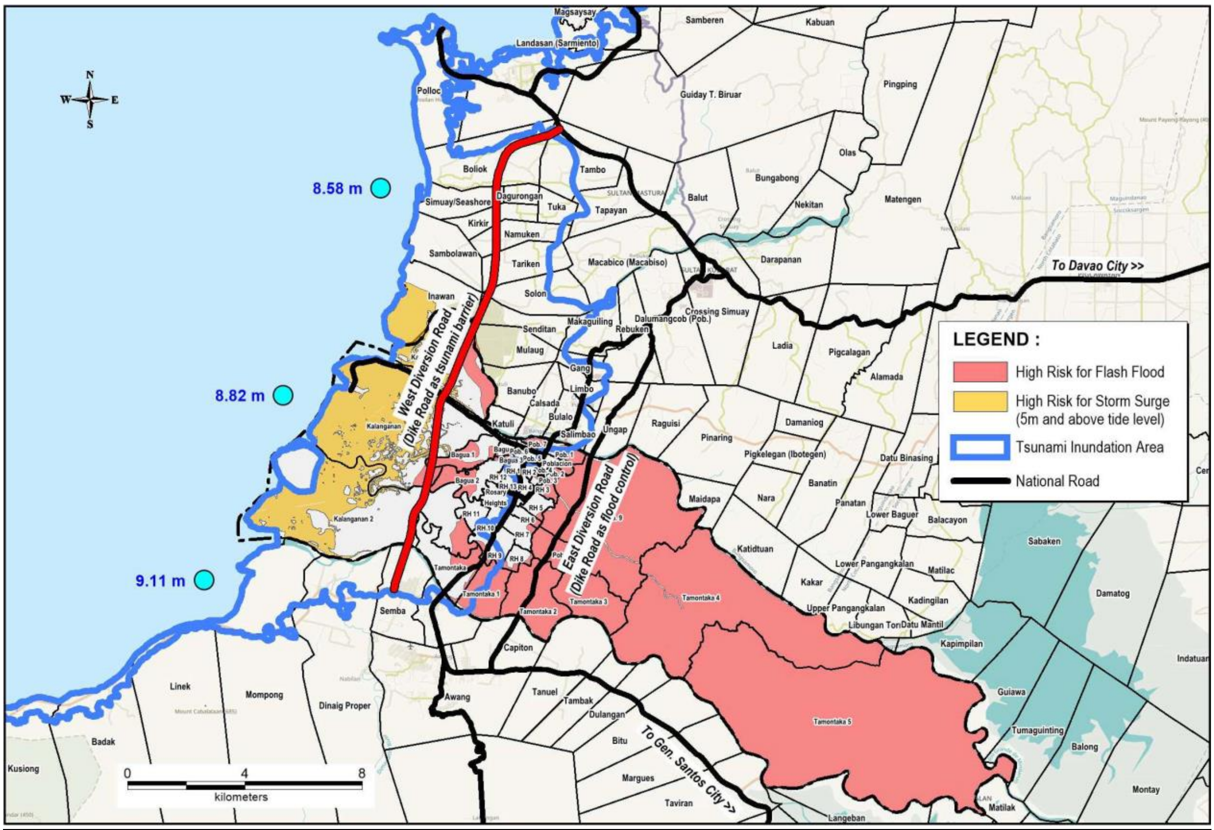


Figure 11.6-9 West Diversion Road will Expand the Network Capacity and Potect Cotabato City and Two Other LGUs from the Possible Impact of Tsunami

It will guide sound urbanization expansion of Cotabato City

Another important contribution of the West Diversion Road is to guide the sound urban expansion of Cotabato City. The city is expanding westward through the development of planned new settlements (e.g., Malagapas Resettlement, Concerned Riverside, etc.) and expansion of existing settlements. Agro-industry and integrated public terminal are also planned by the City Government at the southwest portion of Cotabato City and are expected to generate and attract substantial volume of traffic. All of these developments had been taking place without corresponding installation of roads with high capacity to handle the increasing volume of passengers and freight traffic. The West Diversion Road therefore would anchor the development of the western side of Cotabato City by absorbing the traffic volume that would be attracted/generated. Similarly, this facility will allow secondary and local roads to link with an arterial road (West Diversion Road), thus giving the new settlements and industries enhanced access.

Negative Impacts

The expected negative impacts may include:

- Acquisition of road ROW for new roads would be needed
- Disruption to traffic and riding public during the rehabilitation of existing city roads (including increase of noise level during construction which might irritate residents)
- Increased hazards due to construction activities

11.6.3 Public Transport Improvement Sub-Plan

(1) Background

The Public Transport Improvement Sub-plan has the following components:

a. Public Transport Terminal (Road) Improvement
b. Water Transport Terminal Improvement
c. High-Capacity Public Transport Promotion and Route Improvement

Basic Consideration

One of the indicators of a good city is the existence of an efficient and reliable public transport system where all segments of the society can enjoy. A good public transport system encourages the citizens to patronize it instead of private vehicles. Hence upgrading the LOS of the public transport in Greater Cotabato Area is necessary to encourage such shift from car-based trips to public transport-based trips. Currently, the share of cars in the total traffic along the Sinsuat Avenue (inside Cotabato City) is about 34%, which is higher than the share of public transport (Jeepneys at 26%). The same can be observed on the national road outside Cotabato City (Cotabato – Parang route and Cotabato – Dalican route) where the share of car is over 30% and public transport vehicles (Jeepneys, Vans, Buses) have just over 10%. Shifting from car-based trips to public transport-based trips is important in the long term due to limited road space. As illustrated in Figure 11.6-14, passenger occupancy of car is very low (normally 1 to 2 persons). For instance, the required road space to transport 60 passengers by car is equivalent to the road space occupied by 16 buses which could carry 960 passengers. Moreover, 60 passengers could be carried by a single bus. To encourage such shift of mode choice, however, car users and the public in general normally desired to have the following LOS from the public transport system:

1. Reliability (predictable schedule, journey time, etc.)
2. Convenience (short waiting time, good terminal access, wider route, etc.)
3. Comfort (air-conditioned vehicle, not too crowded, good terminal, etc.)
4. Security (good terminal security, safety inside the vehicle, etc.)

Public Transport Terminal (Road) Improvement

The existing public transport system of Greater Cotabato needs improvement to upgrade its level of service. One of the components of the public transport system that needs urgent improvement is the terminals. The terminal survey conducted under this study revealed that the five terminals are in poor condition both in physical and in operational aspect (Figure 11.6-10 and Figure 11.6-11). Interview with users (drivers and passengers) have identified the following as areas for improvement among all the terminals:

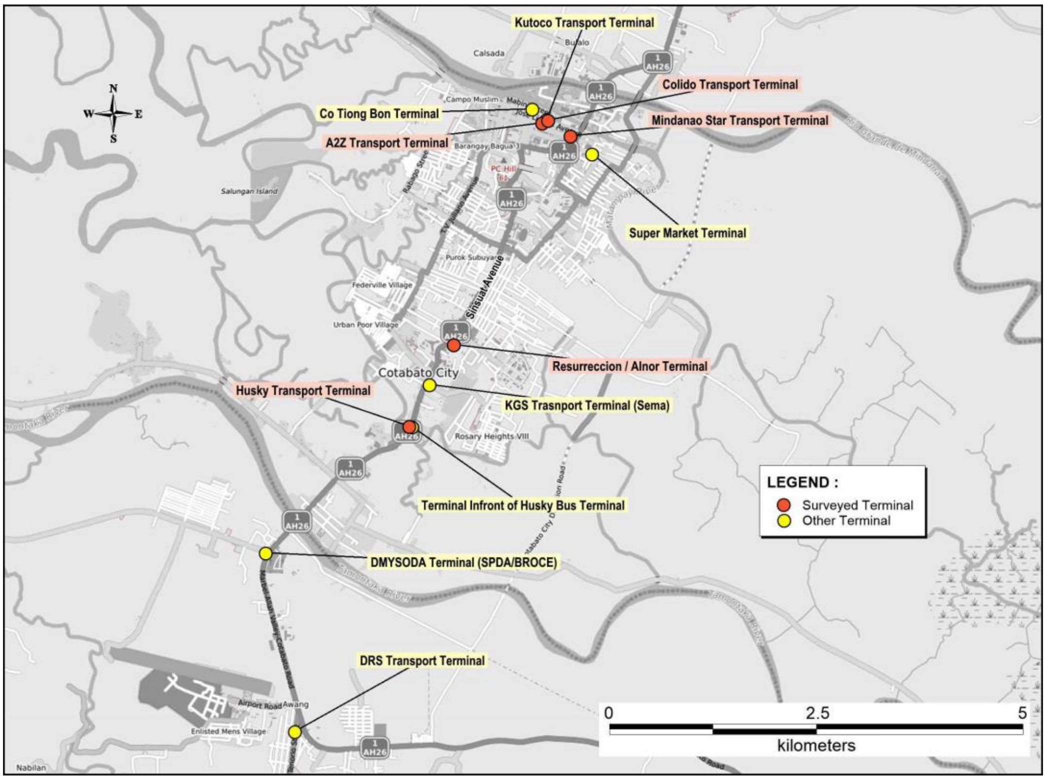
- Overall cleanliness and improvement of toilet facilities
- Enhancement of security and installation of closed-circuit television (CCTV) cameras
- Improvement of waiting area (provision of more chairs and electric fans)
- Provision of a prayer room
- Establishment of free wi-fi connection

The short-term plan may focus on elevating the level of service of the surveyed terminals by undertaking immediate improvement. In the medium to long-term however, effort may be directed on consolidating these small terminals into an integrated terminal serving the northbound trips (to Zamboanga/Marawi corridor and Davao corridor) to ensure better level of service is offered. For southbound trips, the City Government of Cotabato (CGC) is planning to construct an integrated terminal located along Bubong Road. Hence, in the future, Cotabato City might have only two integrated terminals – Northbound Terminal and Southbound Terminal.

Ideally, the integrated terminal shall be located close to a high-capacity road to ensure that the road can support high volume of traffic generated by the facility. Future road network has been prepared under this study and the location of future terminals should be in accordance with this network.

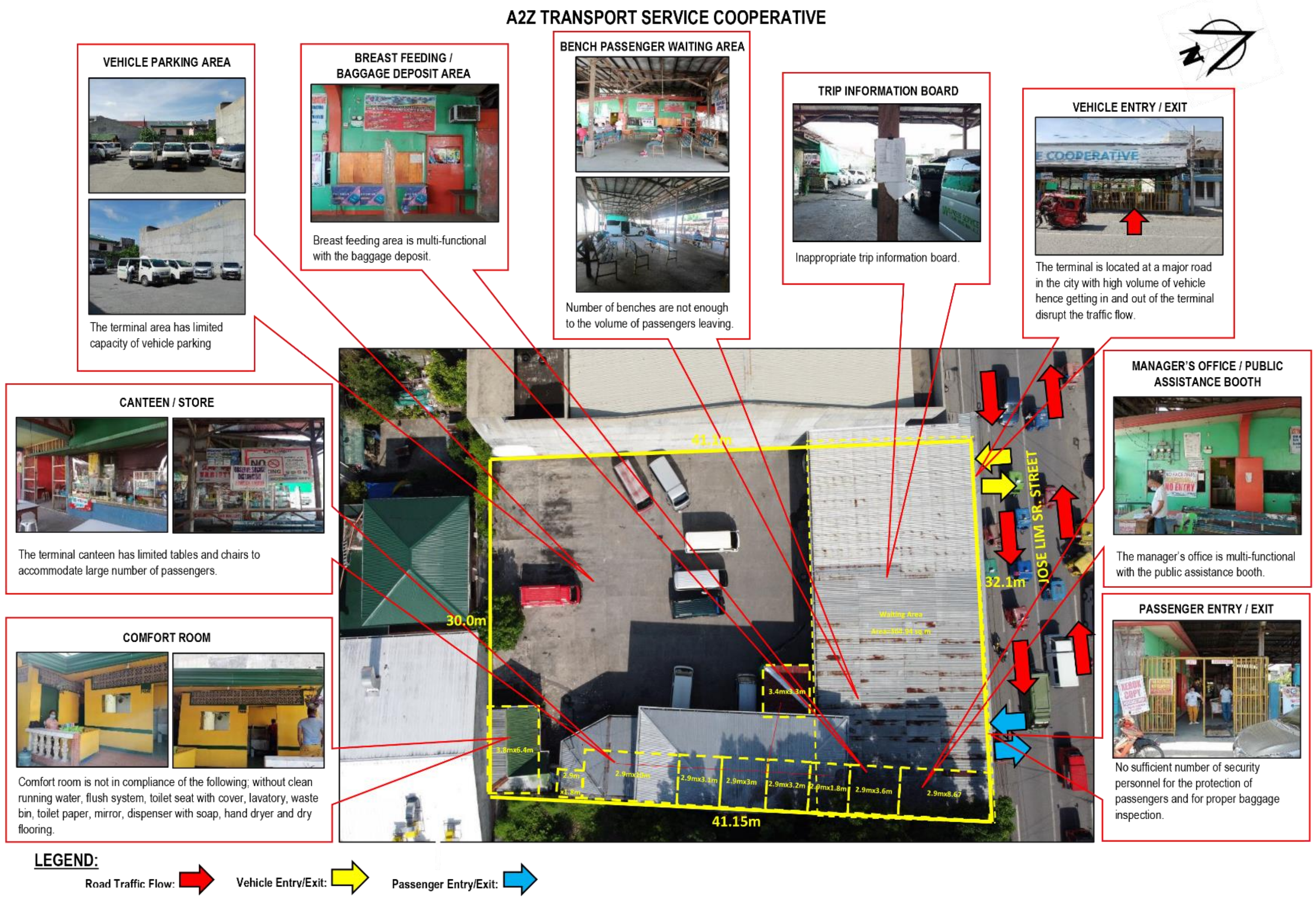
Similarly, in view of the rapid economic growth of the city which saw the construction of several shopping malls, it is worth considering for the CGC to explore the idea of linking the future integrated public terminals with existing or to be constructed shopping malls. The merits of this concept are as follows:

- Substantial number of passengers (coming outside Cotabato City) have their destination to the shopping malls to shop, watch a movie, eat in a restaurant, etc.;
- Waiting passengers will have immediate access to the facilities (clean toilets, restaurants, air-conditioned waiting area, etc.) of the shopping malls;
- Security system of the shopping malls is better with professional security personnel and well-maintained CCTV;
- Easy transfer of passengers since shopping malls serve like a hub for intermodal transport.



No.	Name of terminal	Location	Capacity and type of vehicle	Routes
1	A2Z Transport Service Cooperative	Jose Lim Sr. St., Cotabato City	50 vans	Cotabato-Davao Cotabato-Kidapawan Cotabato-Parang
2	Bangsamoro Terminal and Transport Services Cooperation	Sinsuat Ave., Cotabato City	17 vans	Cotabato-Tacurong Cotabato-Lebak-Kalamansig
3	Cotabato Line Drivers and Operators (Colido) Terminal	Jose Lim Sr. St., Cotabato City	50 vans	Cotabato-Marawi-Ilagan Cotabato-Malabang Cotabato-Pagadian Cotabato-Balabagan
4	Husky Tours (Biocrest Multi-Purpose Transport)	Sinsuat Ave., Cotabato City	12 large bus	Cotabato-Gen. Santos City Cotabato-Tacurong
5	Mindanao Star Bus Transport Inc.	Jose Lim Sr. St., Cotabato City	22 large bus	Cotabato-Davao Cotabato-Kidapawan-Kinuskusan

Figure 11.6-10 Surveyed Public Transport Terminals in Cotabato City



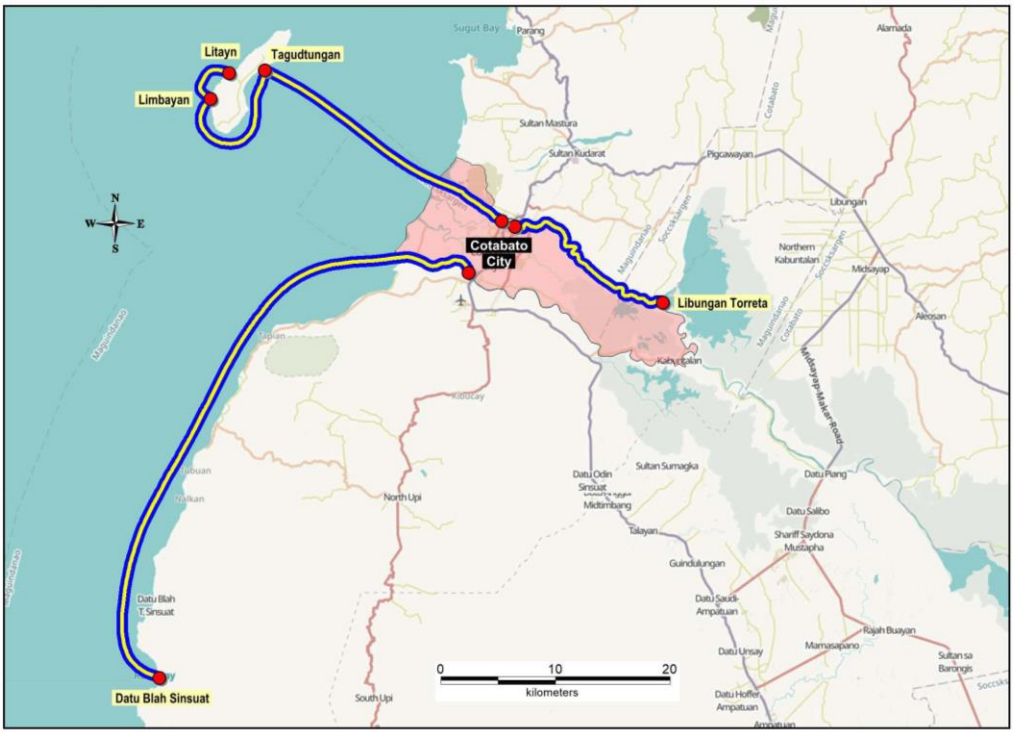
Source: Public transport terminal survey conducted by the JICA Study Team

Figure 11.6-11 Physical Evaluation of Facilities at A2Z Transport Service Cooperative

Water Transport Terminal Improvement

DPWH is planning to install a 5m high flood wall along the Pulangi River and Matampay River, which aims to protect the city from recurring intrusion of flood water. The said flood control facility covers both banks of the two rivers from the upper stream bridge of the CCEDR up to the mouth of the river (discharge point). The installation of the said facility will affect at least two water transport terminals serving the (i) Cotabato City - Libungan Torreta/Liguasan Marsh and (ii) Cotabato City – Bongo Island/Tagudtungan routes (Figure 11.6-12). Both terminals are currently in poor condition, hence improvement/reconstruction would be necessary. Around 10 to 20 trips/day is observed in the former route and 1 to 2 trips/day is observed in the latter route. The water transport route to Liguasan Marsh is expected to continue operations, due to the lack of an existing road infrastructure connecting the communities to Cotabato City. In this study, the upper stream of Pulangi River going to Liguasan Marsh is covered by the proposed future road network. Once completed, the said communities will have the option of using the road. However, the realization of this huge road project might take some time due to the required cost.

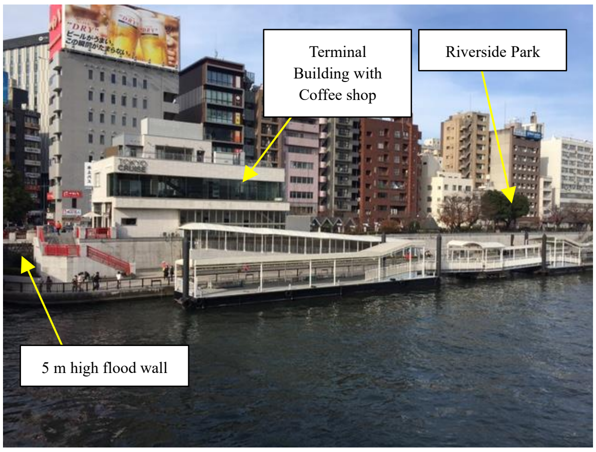
The reconstruction of the two transport terminals should take inspiration from other countries which have successfully established water transport terminals with higher level of service and with multiple functions. For example, in Tokyo, the flood wall (about 5m high) along the Sumida River has been integrated in the water transport terminals and riverside parks (Figure 11.6-13). This concept of integrated development of various urban facilities along the riverside shall be adopted in the planning process. Hence, it is important that coordination between the CGC and the DPWH shall take place at the earlier stage of the plan.



Source: Prepared by the JICA Study Team

Figure 11.6-12 Water Transport Routes

Current water transport terminal in Super Market (going Liguasan Marsh) in poor condition and will be affected by the DPWH flood control project



Water transport terminal in Sumida river in Tokyo, Japan inside the 5-meter high flood wall. The second floor of the terminal building has a coffee shop with panoramic view of the river.

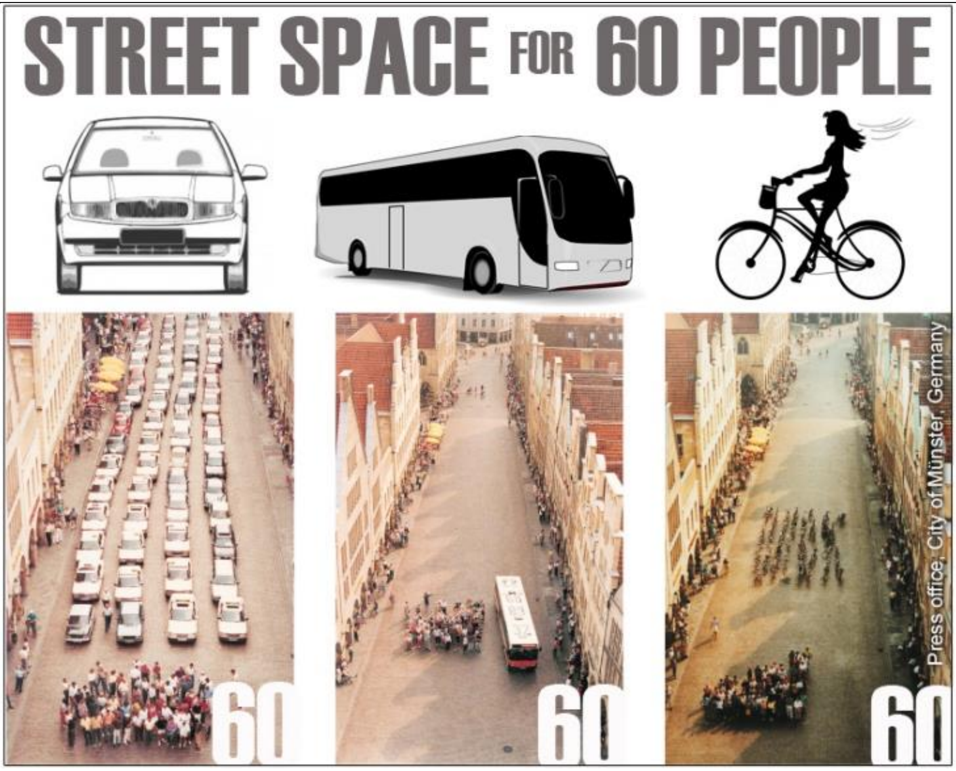
Figure 11.6-13 Transforming the River Port to an Important Facility

<u>High-Capacity Public Transport Promotion and Route Improvement</u>

In line with the Spatial Development Plan discussed in Chapter 7 and 9, the urbanization of Greater Cotabato Area will be accelerated further once the envisioned facilities are put in place (e.g. economic zones). Owing to the constraint posed by the proposed two barriers (5 m high CCEDR dike road against flood and 4 m or 5 m West Diversion dike road to serve as tsunami barrier) to protect Cotabato City and in turn limit the expansion of urbanization, population growth is expected to accelerate in the settlements along the national road. These include Awang (DOS), Salimbao, Gang, Poblacion Sultan Kudarat, Crossing Simuay/Darapanan, Poblacion Sultan Mastura, Campo Islam/Landasan until Polloc Port and Poblacion Parang. Naturally, traffic congestion will be experienced along this corridor. This will affect people's productivity due to the long hours spent moving from origin to destination. Under this condition, it is important to upgrade the current public transportation system from the current low-capacity PUVs/vans into a high-capacity public transport system in the form of a bus system. The following are the reasons:

- To upgrade the level of service (predictable time schedule, better vehicles in terms of comfort and safety, better terminals, etc.) of the public transport plying the important corridor befitting an important city.
- To improve the transportation system through efficient utilization of road space as indicated in Figure 11.6-14 (1 bus may be able to carry passengers of 3 to 4 Jeepneys/Vans).
- To encourage shift of transport mode choice of car users from private car to public transport (currently, over 30% of the traffic along the Cotabato City – Parang route and Cotabato City- Dalican route is composed of private cars which is much higher than the public transport vehicles share of just about 16% – jeepney, vans, bus).

To ensure the success of this shift from a low-capacity (and low level of service) transport system to a better bus system as the main transportation back bone, Jeepneys/PUVs/vans should not compete with bus routes. Instead, the low-capacity PUVs shall operate as feeders to buses or other roles that will complement the bus service.



Note: Amount of space required to transport the same number of passengers (60) by car, bus, or bicycle. The space used by cars is good for 16 buses (equivalent to transporting 960 passengers). Passengers of 4 Jeepneys/vans maybe carried by 1 bus.

Source: Transportation Demand Management, April 2009, GTZ

Figure 11.6-14 Efficient Road Space Usage

Candidate Corridor in Cotabato City for High-Capacity Public Transport Promotion

The Awang - City Plaza route along Sinsuat Avenue is a good candidate corridor to transform the primary public transport mode from low-capacity (and low level of service) to high-capacity vehicles, due to the following reasons:

- To upgrade the level of service of the public transport in Cotabato City
- Public transport demand is high in this corridor.
- Road carriageway is wide enough to accommodate bus system (over 6.7m and some sections even over 10 m).
- Road section has a good shoulder width and pedestrian lane which is a requirement for preparation of bus stops and waiting stations.
- This is heavily congested road, which handles about 3,000 PCU/hr (although its capacity is just 2,000 PCH/hr for level of service “D”). Passenger capacity of three (3) to four (4) Jeepneys may be accommodated by a single bus hence it has high potential impact to decongest the road.
- Jeepneys stop randomly to load/unload passengers. This creates road friction and tends to slow down the flow of traffic. Bus system, on the other hand, ideally features designated stops, which lessens the disruption to traffic flow.

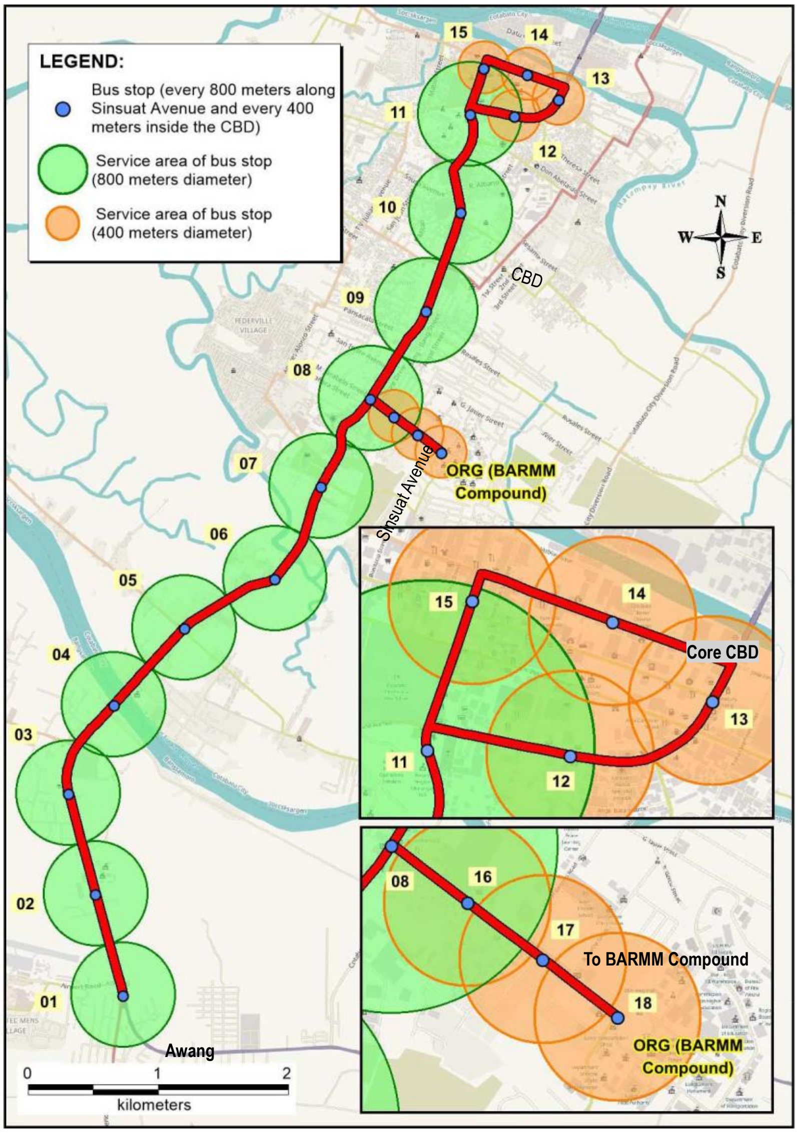


Figure 11.6-15 Conceptual Image of High Capacity Bus System along Sinsuat Avenue, Cotabato City

In principle, various studies (e.g., Explaining walking distance to public transport, The Journal of Transport and Land Use, 2013, Rhonda; Urban Development for Hanoi, Vietnam, 2015, JICA, etc.) stated that the desired walking distance to public transport stations shall be between 400 m to 800 m. In the proposed conceptual image, 400 m service area is proposed along the Sinsuat Avenue. This means that for every 800 m link, there is a bus stop. However, at the area where urban activity is intense like the core CBD and the link road leading to the BARMM compound, the bus stop spacing should be further reduced to 400 m or so. Final location of bus stops should be identified during the feasibility stage.

Resistance among the affected stakeholders like Jeepney drivers and operators to this new form of improved public transport is expected hence a dialogue with them would be necessary. Among the cities in the Philippines, Davao City is currently ahead in its development of a “High Priority Bus System (HPBS)” identified in the 2018 JICA-assisted Masterplan titled “Infrastructure Modernization for Davao City (IM4Davao)”. This project is said to affect more than 7,000 Jeepney drivers and operators. The success of the City Government of Davao in the dialogue with this affected sector will serve as a good template for the City Government of Cotabato.

(2) Objective

a. Public Transport Terminal (Road) Improvement

- [Short term] To upgrade facilities of the existing terminals in order to deliver better level of service;
- [Long term] To consolidate the various small public terminals which offer very low level of service and integrate them into a single terminal (one for northbound PUVs and another for southbound PUVs) and locate them in accordance with the future road network.

b. Water Transport Terminal Improvement

- To re-construct the two existing water transport terminals to upgrade their level of service taking into account the flood control project of the DPWH

c. High-Capacity Public Transport Promotion and Route Improvement

- To make bus system as backbone transportation system of the main corridor of Greater Cotabato and Cotabato City to ensure better level of service;
- To rationalize public transport routes by observing public transport hierarchy (low-capacity transport mode serves as feeder to high-capacity transport mode; for example: trisikad feeder to tricycle, tricycle feeder to Jeepney, Jeepney/PUVs/vans feeder to bus).

(3) Scope

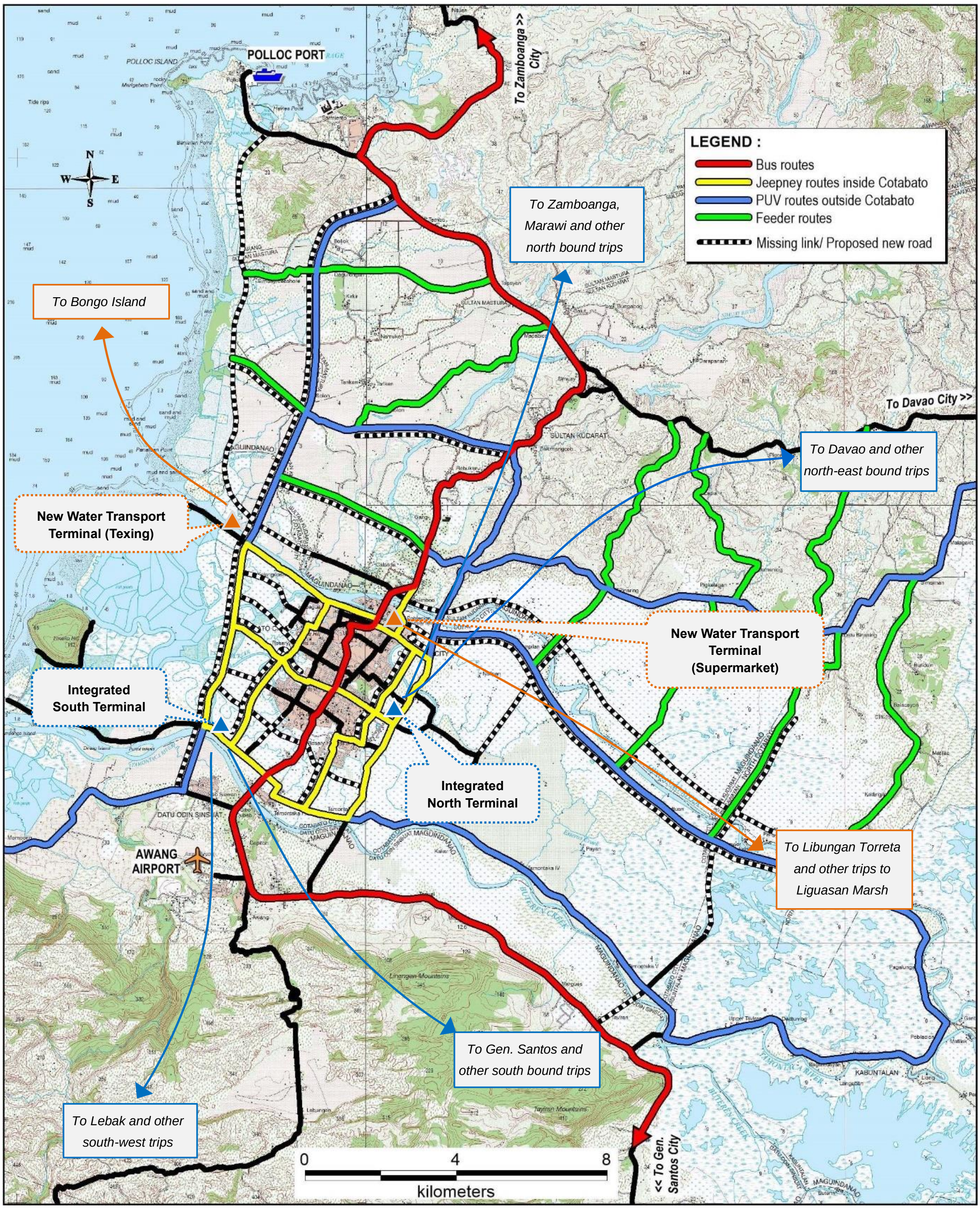
The scope of the Public Transport Improvement Sub-plan is discussed in Table 11.6-11.

Table 11.6-11 Scope of work for Public Transport Improvement Sub-Plan

Component	Details
a. Public Transport Terminal (Road) Improvement	
• Improvement of various existing terminals	General make-up of the 3 public terminals (functioning toilet, enough benches, etc.)
• Development of Integrated North Terminal	Consolidation of various small terminals serving northbound public transport (Cotabato-Zamboanga /Marawi route and Cotabato-Davao route)
• Development of Integrated South Terminal	Construction of integrated terminal serving southbound public transport (Cotabato- Gen. Santos route and Cotabato – Lebak route)
b. Water Transport Terminal Improvement	
• Re-construction of Water transport terminal in Supermarket	The current terminal will be affected by the flood wall project of the DPWH hence it needs to build a better terminal serving boats to/from Liguasan Marsh
• Re-construction of Water transport terminal in Teksing	The current terminal will be affected by the flood wall project of the DPWH hence it needs to build a better terminal serving boats to/from Bongo Island
c. High-Capacity Public Transport Promotion and Route Improvement	
• Cotabato City Bus System (Promotion of shifting from low-capacity (Jeepneys and PUVs) to high-capacity public transport (bus system) along key corridors)	Upgrading to bus system (key corridors): • Super→Cotabato→Awang/ ORG • ORG/Awang → City Plaza→Super
• Expansion of public transport routes inside Cotabato City according to progress of road expansion	Public transport routes inside the city should be considered for modification to rationalize public transport operations
• Inter-city Bus System Promotion	Upgrading to bus system (key corridors): • Cotabato→Crossing Simuay →Landasan → Parang • Cotabato→Awang→ Dalican

(4) Location

The location map of the projects identified under the Public Transport Improvement Sub-plan is indicated in Figure 11.6-16.



Note: Jeepney routes inside Cotabato City should be upgraded to bus routes in the future to provide better LOS

Figure 11.6-16 Proposed Future Public Transport Routes and Integrated Public Transport Terminals (Roads and Water)

(5) Impact

The expected impact of Public Transport Improvement Sub-plan are as follows:

a. Public Transport Improvement Plan
   - Improved level of service (passengers' comfort, security, reliability, etc.)
   - Contributed to the improvement of traffic circulation as a result of the strategic location (near high-capacity road) of future integrated terminals

b. Water Transport Terminal Improvement Plan
   - Improved level of service (passengers' comfort, security, reliability, etc.)

c. High-Capacity Public Transport Promotion and Route Improvement
   - Improved level of service (passengers' comfort, security, reliability, etc.)
   - Improved traffic circulation as a result of better distribution of vehicular traffic

11.6.4 Traffic Management Sub-Plan

(1) Background

The Cotabato City's Council has passed an ordinance, City Ordinance 4428: The 2016 Revised Traffic Code, which serves as legal basis to execute traffic management on the streets of Cotabato City. These include designation of roads for one-way traffic (e.g., S.K. Pendatun St.), designation of roads for "parallel parking only" (e.g., Gov. Gutierrez Avenue), designation of some roads as "no parking" (e.g., Sinsuat Avenue), imposition of penalties for traffic violators among others. The said law was in response to the worsening traffic congestion in the city which severely affected its socio-economic development. Table 11.6-12 below summarizes the causes of traffic congestion in Cotabato City.

Table 11.6-12 Summary of Causes of Traffic Congestion in Cotabato City

	Item	Details
Infra-structure issues	Incomplete road network formation	• Roads of the city have lacked formation (strong structure with functional hierarchy) hence traffic circulation is poor • Limited number of arterial roads to carry high traffic volume (currently, only Sinsuat Avenue) • Many missing links which hamper continuous traffic circulation
	Narrow roads and some roads are in poor condition	• City road's carriageway width per DPWH standard should be 6.10 m. However, survey revealed that there are many roads with less than 6 m carriageway hence capacity is low. • Roads with poor sections which affect vehicle movement is substantial.
	Absence of pedestrian network in the CBD	• Pedestrian network, which has the potential to accommodate short trips, has not been established yet. If short trips in the CBD is removed from the demand of vehicle use, this will contribute to reducing the number of vehicles in the network
	Absence of traffic lights (traffic control system)	• Currently, traffic police are manually controlling/directing traffic at the major intersection during peak hours. • Traffic control system aims to maximize the use of existing road facilities; hence, an increase of road capacities can be achieved.
	Absence of road markings	• Road markings designed to guide different road users are almost nonexistent, except along the national road (Sinsuat Avenue).
Operational issues	Increasing volume of vehicles	• Sinsuat Avenue, at present, is carrying over 30 thousand vehicles per day. The morning and afternoon rush hours indicate that the road is handling traffic volume above its intended capacity. It is expected that

	Item	Details
		as the economy of the city and surrounding municipalities improve, the income of the residents will subsequently increase. The greater spending power of the population will lead to more purchase of vehicles, thereby further increasing the demand for road transport. This trend is common in almost every city in the country.
	Lack of traffic discipline (road users)	• Jeepneys and tricycles (two main public transport modes in the city) stop near intersections to pick-up and drop-off passengers without any consideration of traffic flow. There were also observed instances when multiple jeepneys completely block the road, after stopping on the same road section to pick-up/drop-off passengers especially during rush hour. • Intersection is supposed to be kept free from vehicle queue to allow intersecting traffic to pass. However, vehicles occupying the intersection is commonly observed in the city hence resulting to gridlock. • Vehicles are parked at major roads which are designated as "no parking" zones.
	Pedestrian space is illegally occupied	• Pedestrians are forced to walk along the road's carriageway because sidewalks are occupied by vendors and parked vehicles.
	Poor traffic flow operation/ management	• Traffic lights are not yet installed in the streets of Cotabato City hence traffic police are directing traffic at the major intersections. • However, the lack of discipline of road users often result to gridlock at the major intersections
	Poor education of road users on traffic rules	• Understanding the basic traffic rules (and the proper use of road) will help improve flow of traffic and reduce the probability of traffic accidents. • Some of the basic problems which education may address include the following: loading and unloading passengers at designated area only, crossing of school children to designated area only, discouraging children playing on the roads (sometimes with basketball court), parking at designated area only, non-obstruction of pedestrian and vehicular traffic by placing merchandize on the road and sidewalk among others.

Source: JICA Study Team

As seen in Table 11.6-12, the causes of the traffic congestion in the city come from both infrastructure and operational aspects of the road. Hence, a comprehensive Traffic Management Sub-Plan (TMSP) would be needed to address problems coming from both sides. This means that infrastructure improvement must be coupled with improvement of the users' discipline (drivers and pedestrians), capacity of enforcers, among others.

At present, traffic lights haven't been installed at major intersections and pedestrian crossing in Cotabato City. Consequently, traffic police are normally positioned at various major intersections of the city during the morning and afternoon rush hours to control and direct traffic flow for the meantime. This group of traffic enforcers is aided by the Traffic Management Center (TMC), a unit under the Public Safety Office of the City Government of Cotabato. However, as seen in Table 11.6-13 below, the TMC appears to be under-equipped to manage the difficult task hence capacitating this unit is a major step forward.

Table 11.6-13 Profile of the Traffic Management Center (TMC) of Cotabato City

Item	Details
Number of personnel	83
Function	To implement the Traffic Management Rules and Regulation within the vicinity of the Cotabato City (Traffic Violators, Double Parking, Counter Flow, Counter Flow Parking, Pedestrian Parking and other Traffic Rules Violation)
Budget	PhP 6.5 Million/ year
Current Equipment	• Handheld transceiver/radio (HT) • 1 Multi-cab (small vehicle) • Basic PPE (Personal protective equipment)

Source: Interview with the TMC

(2) Objective

The overall goal of the TMP is to address the serious traffic congestion in Cotabato City. The specific objectives are as follows:

- To achieve smooth traffic flow
- To reduce traffic accidents
- To create pedestrian-friendly road network

(3) Scope

The first task is to prepare the Traffic Management Sub-plan (TMSP). Since the TMSP has large scope and needs technical evaluation method (e.g. Microsimulation of intersection improvement and route improvement), the city may request the support of an international or domestic consultant. The programs proposed under the TMSP are presented in Table 11.6-14 below.

Table 11.6-14 Proposed Program and Scope of Work

Item	Plan/Program	Details
Short-term	**Preparation of Traffic Management Plan**	**Full scale study is needed and may need outsourcing**
Short-term to Medium (possible plans and programs under the TDM)	a. Strengthening of capacity of TMU, Traffic Police and relevant organizations	• Training on traffic rules and effective implementation of traffic rules • Supply of basic traffic equipment*
	b. Pedestrian Improvement Plan	• Identification of target areas and prioritization of pedestrian space to improve • Implementation of a Pilot Project • See Figure 11.6-17
	c. Parking Improvement Plan and Promotion of Parking Business	• Study of legal aspect (passing of ordinance if needed) • Identification of corridors and prioritization for improvement • Implementation of a Pilot corridor • See Figure 11.6-17 and Figure 11.6-18
	d. Intersection Improvement Plan	• Assessment of intersections to improve (e.g. Quezon Ave. and Notre Dave Avenue., Sinsuat Ave. and Gov. Gutierrez, etc)

Item	Plan/Program	Details
		• Implementation of priority intersections to improve (e.g. widening, intersection markings to guides traffic movement, etc.) • See • Figure 11.6-19 and Figure 11.6-20
	e. Traffic Awareness and Safety Campaign	• Identification of target areas and prioritization of pedestrian space to improve • Pilot area (ex. Kindergartens and primary schools)
Long- term	f. Full scale implementation of a, b, c, d, e	
	g. Installation of traffic lights and traffic control system	

*Note: Per interview with TMC, the following are their urgent needs: 1 unit of Tow Truck, 3 additional Vehicles (Multicab), 6 units of motorcycles, Flashlights (for Evening Purposes)

(4) Location

There are three (3) areas in the city where traffic congestion is severe hence most of the plans and programs of the Traffic Management Plan may apply in these areas. These areas are: (a) Central business district (composing the parallel three major roads: Jose Lim Sr. St., Don Rufino Alonzo St., and S.K. Pendatun Ave.), (b) national road (Quezon Ave. and Sinsuat Avenue) and (c) Gov. Gutierrez Avenue leading to the BARMM compound.

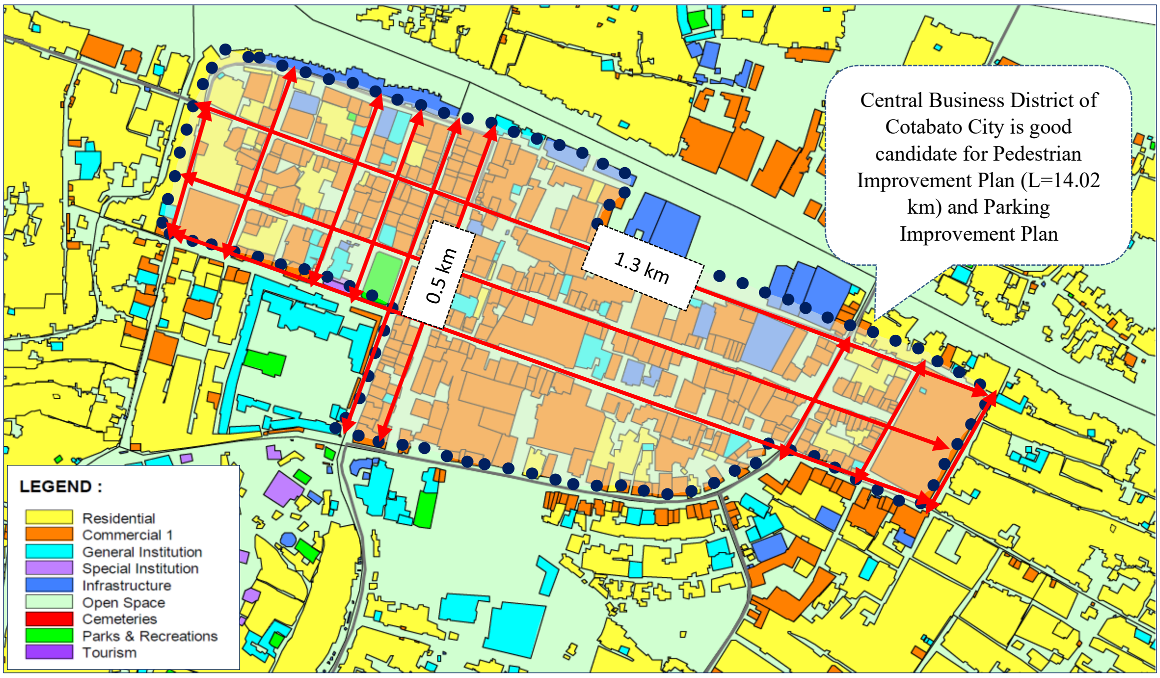


Figure 11.6-17 Candidate Site for Pedestrian Improvement Plan and Parking Improvement Plan (plus Sinsuat Avenue and Gov. Gutierrez Ave. for Parking Improvement Plan)

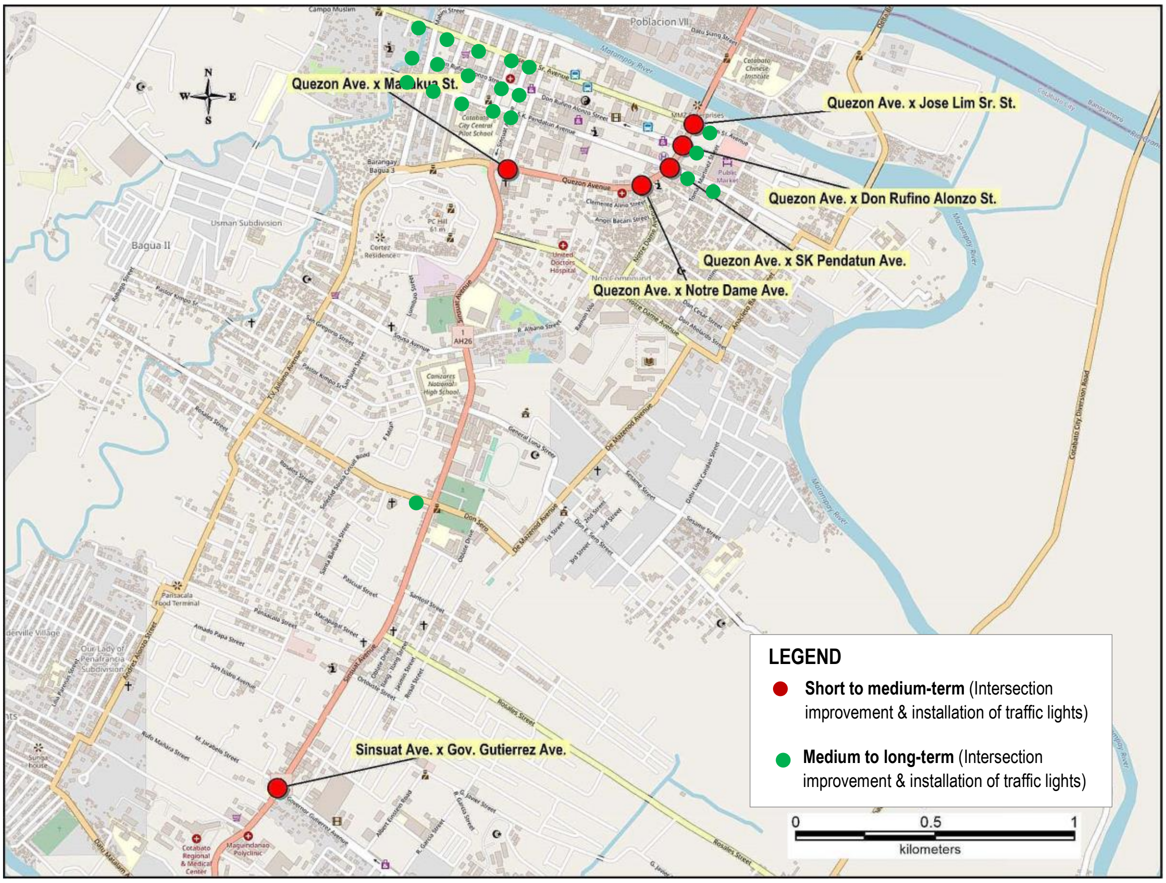


Figure 11.6-18 Possible Candidate Sites for Intersection Improvement Plan

Note: Intersection Improvement Plan may include (i) Physical improvement of the intersection, (ii) Road markings, (iii) Installation of traffic lights

Figure 11.6-19 Example of Intersection Improvement by Road Marking at Quezon Avenue

Note: Intersection Improvement Plan may include (i) Physical improvement of the intersection, (ii) Road markings, (iii) Installation of traffic lights

Figure 11.6-20 Example of Intersection Improvement by Road Marking at Quezon Avenue (Channelization Method)

(5) Impact

Positive Impacts

It is expected that once the TMSP is executed, it will contribute to the improvement of travel speed in the city which can then be translated into economic gains. As a result, it will reduce vehicle-km and vehicle operating cost. Fewer vehicle km means less source of pollution thus less greenhouse gas emissions. The positive impacts may include:

- Improvement of travel speed
- Reduction of transport cost
- Reduction of traffic accidents
- Improvement of traveler’s amenity and increase of traveler’s comfort

Negative Impacts

The negative impacts may include:

- Reluctance of affected vendors during the clearing of pedestrian spaces
- Traffic disruption during the improvement of intersections
- Increase in noise level during construction especially those inside the city center
- Construction wastes
- Dust caused by construction work
- Increased hazards due to construction activities

11.7 Cost of Transport Development Plan and Programme

11.7.1 Cost Estimation of Transport Development Plan

The estimated cost for the Transportation Development Plan is about PhP 39.41 billion as shown in Table 11.7-1.

Table 11.7-1 Cost estimation of the proposed projects in the Transport Development Plan

Project/Programme	Implement Agency	Indicative Cost (PhP M)
1. Establishment of Road Functional Classification (Road Network Concept)		N/A (just for adaptation of LGU as official road network plan)
• Proposed Road Functional Hierarchy in Greater Cotabato	DPWH/MPW/LGU	
2. Road Network Development Sub-Plan		
2.1 Strengthening of Existing Roads (Asset Preservation)		
• Rehabilitation of roads in "bad condition" by Preventive Maintenance – overlay 80 mm (15.51 km)	DPWH/MPW/LGU	280
• Reconstruction of roads in "very bad condition" by Reconstruction – assumption with base failure (5.86 km)	DPWH/MPW/LGU	117
• Upgrading of road surface from earth/gravel surface to concrete (12.29 km) – 280 mm new road	DPWH/MPW/LGU	492
• Rehabilitation of Non-functional Roadside Drainage (7.575 km) (see Table 11.7-4)	DPWH/MPW/LGU	56.18
2.2 Road Improvement to Establish Hierarchical Road Network (see Table 11.7-3)	DPWH/MPW/LGU	36,126.54
2.2 Capacity Building on Road Development to City Engineering Office and MPW-BARMM	LGU/MPW	120
3. Public Transport Improvement Sub-Plan		
3.1 Public Transport Terminal (Road) Improvement and Development		
• Improvement of various existing public terminals	LGU/Private Sector	5
• Development of Integrated South Terminal	LGU/Private Sector	200
• Development of Integrated North Terminal	LGU/Private Sector	200
3.2 Water Transport Terminal Improvement		
• Re-construction of East water transport terminal (Super Market)	LGU	50
• Re-construction of West water transport terminal (Texing)	LGU	50
3.3 High-Capacity Public Transport Promotion and Route Improvement		
• Cotabato City Bus System (Promotion of shifting from low capacity (Jeepneys and PUVs) to high-capacity public transport (bus system) along key corridors (100 bus x 8 M/unit x.02 FS cost))	LGU/Private Sector	816
• Expansion of Bus routes inside Cotabato City according to progress of road expansion	LGU	TBD
• Inter-city Bus System (Cotabato--->Parang and Cotabato-->Dinaig) (48 bus x 8 M/unit x.02 FS cost)	LGU/Private Sector	392
4. Traffic Management Sub-Plan		
4.1 Strengthening of capacity of TMU, Traffic Police and relevant organizations	PNP/ LGU	5

Project/Programme	Implement Agency	Indicative Cost (PhP M)
4.2 Pedestrian Improvement Plan*		
• Old CBD (Width= 2.5 m); (L=14.02 km total of both sides)	DPWH/MPW/LGU	82
• Sinsuat Avenue to BARMM Compound (Width= 2.5 m); (L=1.36 km total both sides)	LGU	8
4.3 Parking Improvement Plan (including Parking Business Promotion)	LGU	8
4.4 Intersection Improvement Plan (6 intersections along Quezon Avenue and Sinsuat Avenue)	DPWH/MPW/LGU	
• Road surface improvement (carriageway, shoulder, pedestrian lane)	DPWH/MPW/LGU	41.2
• Road/intersection marking (6 intersections)	DPWH/MPW/LGU	0.3
• Installation of Traffic lights (at 6 intersections along Quezon and Sinsuat Avenue)	DPWH/MPW/LGU	24
4.5 Traffic Awareness and Safety Campaign for 3 years (radio, TV, social media, traffic awareness and traffic safety campaign at various kindergarten and primary schools + Study Team)	LGU/ Traffic Police	20
4.6 Installation of Traffic Lights and Traffic Control System (20 intersection)	LGU	
• Installation of traffic lights including road improvement, markings (20 intersections)	LGU	220
• Construction of Traffic Control Center (control center, detectors, CCTV, traffic information provision, etc.)	LGU	100
Total		39,413.22

*Note: Per 2015 DPWH Design Manual = sidewalk widths in lower speed residential areas may vary from 1.2 to 2.4 m. Additional width should be considered for higher volume sidewalks. A good minimum width for a sidewalk that allows two people to pass is 1.8 m. In this study, sidewalk width is assumed to be 2.5 m
**Based on the installation cost of C3 in Metro Manila (PhP 4 Million/intersection)
***Based on the cost from a JICA-assisted project in Manila (MMDA Capacity Building)
**** Based on the cost from a JICA-assisted project in Manila (MMDA Capacity Building)

11.7.2 Cost Estimation and Implementation Program of Road Improvement Project

Cost Estimation

Project list of roads for improvement is available in Table 11.6-6 and estimated cost of each project is shown in Table 11.7-2.

Implementation Priority of Each Project

Implementation priority of each project is assessed based on the following criteria:

Factors Evaluated

- Importance and urgency
- Project Impact
- Implementing Agency’s Plan (if the Implementing Agency included in its Implementation Program)
- Compatibility with Cotabato City’s Plan
- Environmental Aspects
- Needs of Japanese Technology
- Contribution to Peace Building

Above factors were assessed in accordance with the following rating:

◎ 5 Points (evaluated highly applicable)

○ 3 Points (Evaluated moderately applicable)

△ 1 Point (Evaluated not necessarily be applicable)

-- No Point (Note applicable, no point

All identified projects were evaluated their implementation priority in accordance with the evaluation criteria (Table 11.7-2).

Table 11.7-2 Implementation Priority of Identified Projects (1/5)

Sector	Project Name	Implementing Agency	Evaluation							Overall Evaluation	Recommendation for action plan studies
			Importance and Urgency	Project Impact	Implementing Agency's Plan	Compatibility with Cotabato City Plan	Environmental Aspect	Needs of Japanese Technology	Contribution to Peace Building		
Road	West Diversion Road and Peace Bridge Construction Project (4-1,4-2)※	Department of Public Works and Highways (DPWH) and Ministry of Public Works (BARMM Government)	◎ ・ Important for traffic congestion reduction, guiding sound urbanization and tsunami barrier ・Highly Urgent	◎ ・ Reduction of traffic congestion ・ Guidance for proper urbanization ・ Function as Tsunami barrier	◎ ・ Expected for realization to cope with population increase and urban expansion ・ To be included in the land use plan.	◎ ・ Compatible with city's land use plan	◎ ・ Road development at marsh area along the coast, attention must be paid for mangove protection.	◎ ・ Requires 4 bridges which need to adopt Japan's technology	◎ ・ Movement of people accelerated which contribute to peace building.	◎ ・ Urgent realization needed. ◎ = 7 × 5 = 35 ○ = 0 × 3 = 0 <u>△ = 0 × 1 = 0</u> 35	◎
	Mindanao River Southside Road Development Project (12-1)※	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	◎ ・ Improve access to marsh area ・ Promote agricultural development ・ Improve connection with Davao City. ・Urgent	◎ ・ Contribute to agricultural development ・ Improve accessibility to Davao City.	○ ・ To be programmed for implementation in the nexxt 6-Year Plan	○ ・ Compatible with City's Land Use Plan	◎ ・ Road development at the marsh area will require soft ground treatment.	○ ・ Japan's technology of soft ground treatment will be adopted.	○ ・ Contribute to peace building.	○ ・ Not so urgent ・ Realized within 10 years. ◎ = 3 × 5 = 15 ○ = 4 × 3 = 12 <u>△ = 0 × 1 = 0</u> 27	
	Sinsuat Avenue Improvement Project (1-1)※	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	◎ ・Most important trunk road in the existing road. ・Improvement of existing pavement. ・To be widened to a 4-lane road. ・Urgent	◎ ・ Reduction of traffic congestion and traffic cost.	○ ・ Road right-of-way secured. ・ Implemented in accordance with pavement deterioration.	○ ・ Compatible with city's land use plan. ・ BARMM Government is responsible.	◎ ・ Environmentally no problem, since it is improvement of existing road.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ Maintenance works intensified. ◎ = 3 × 5 = 15 ○ = 3 × 3 = 9 <u>△ = 1 × 1 = 1</u> 25	
	Cotabato City-Davao City Road Improvement Project (1-2,1-3)※	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	◎ ・ Most important trunk road in the existing road network. ・ Improvement of existing pavement. ・ To be widened to a 4-lane road ・Urgent	◎ ・ Reduction of traffic congestion and traffic cost.	○ ・ Road right-of-way secured. ・ Implemented in accordance with pavement deterioration.	― ・ BARMM Government is responsible. ・ Located outside Cotabato City.	◎ ・ Environmentally no problem, since it is improvement of existing road.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ Maintenance works intensified. ◎ = 3 × 5 = 15 ○ = 2 × 3 = 6 <u>△ = 1 × 1 = 1</u> 22	
	Cotabato City-Gen. Santos City Road Improvement Project (1-4)※	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	◎ ・Most important trunk road in the existing road network. ・Improvement of existing pavement. ・To be widened to a 4-lane road. ・Urgent	◎ ・ Reduction of traffic congestion and traffic cost.	○ ・ Road right-of-way secured. ・ Implemented in accordance with pavement deterioration.	― ・ BARMM Government is responsible. ・ Located outside Cotabato City.	◎ ・ Environmentally no problem, since it is improvement of existing road.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ Maintenance works intensified. ◎ = 3 × 5 = 15 ○ = 2 × 3 = 6 <u>△ = 1 × 1 = 1</u> 22	

Table 11.7-2 Implementation Priority of Identified Projects (2/5)

Sector	Project Name	Implementing Agency	Evaluation: Importance and Urgency	Project Impact	Implementing Agency's Plan	Compatibility with Cotabato City Plan	Environmental Aspect	Needs of Japanese Technology	Contribution to Peace Building	Overall Evaluation	Recommendation for action plan studies
Road	Polloc Port Access Road Improvement Project (3)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	◎ ・ Access road to the important port ・Urgent	○ ・ To secure smooth movement of traffic related to port operation. ・ To reduce traffic cost and traffic congestion.	○ ・ Road right-of-way acquired. ・ Implemented when pavement deteriorated.	○ ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ Environmentally no problem, since it is improvement of existing road.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ Maintenance works intensified. ◎ = 1 × 5 = 5 ○ = 5 × 3 = 15 △ = 1 × 1 = 1 21	
	Cotabato Coastal Road (Cotabato City section) & Mindanao River West Road (Jose Lim Sr. Street) Improvement	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Provide access to the coastal area. ・ Improve accessibility to aquaculture area. ・ Aquaculture industry developed. ・Urgent	○ ・ Reduction of traffic cost. ・ Promotion of aqua-culture.	○ ・ To be programmed for implementation in the next 6-Year Plan.	○ ・ Compatible with city's land use plan.	○ ・ Environmentally no problem, since it is improvement of existing road.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 6 × 3 = 18 △ = 1 × 1 = 1 19	
	Cotabato Coastal Road (Sultan Kudarat-Parang section) Improvement Project (5-3)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ There is no access road in the area, so the road functions as an important access road. ・ Accessibility improved to the agricultural area and agricultural production improved. ・Urgent	○ ・ Provide access to the coastal area. ・ Promote agricultural development of the coastal area.	○ ・ To be programmed for implementation in the next 6-Year Plan.	― ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ Though new road construction, no relocation required. There is no serious environmental and social impact.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 1 × 1 = 1 16	
	Maguindanao East-West Road 5 (Tapayan-Simua seashore section) Improvement Project (6)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Existing road is to be widened and paved which contribute improvement of accessibility to the area. ・ With the improved accessibility, agricultural production will improve. ・Urgent	○ ・ Improve accessibility to the area. ・Promotion of agricultural development.	○ ・ To be programmed for implementation in the next 6-Year Plan.	― ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No environmental problem expected	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 1 × 1 = 1 16	
	Maguindanao East-West Road 3 Improvement Project (7)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Better accessibility provided by a paved road ・ With the improved accessibility, agricultural production will improve. ・Urgent	○ ・ Improve accessibility to the area. ・Promotion of agricultural development.	○ ・ To be programmed for implementation in the next 6-Year Plan.	― ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No environmental problem expected.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 1 × 1 = 1 16	

Table 11.7-2 Implementation Priority of Identified Projects (3/5)

Sector	Project Name	Implementing Agency	Evaluation							Overall Evaluation	Recommendation for action plan studies
			Importance and Urgency	Project Impact	Implementing Agency's Plan	Compatibility with Cotabato City Plan	Environmental Aspect	Needs of Japanese Technology	Contribution to Peace Building		
Road	Maguindanao East-West Road 4 Improvement Project (7-3)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	△ ・ Better accessibility provided by a paved road ・ Not so Urgent	○ ・ Improve accessibility to the area. ・ Promotion of agricultural development.	△ ・ With the improved accessibility, agricultural production will improve.	— ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No environmental problem expected.	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 3 × 3 = 9 △ = 3 × 1 = 3 12	
	Maguindanao East-West Road 2 Improvement Project (8)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Better accessibility provided by a paved road ・ With the improved accessibility, agricultural production will improve. ・ Urgent	○ ・ Improve accessibility to the area. ・ Promotion of agricultural development.	○ ・ To be programmed for implementation in the next 6-Year Plan.	— ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No environmental problem expected.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 1 × 1 = 1 16	
	Maguindanao East-West Road 1 Improvement Project (9)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Provide access to north area of Mindanao River ・ With the improved accessibility, agricultural production will improve. ・ Urgent	○ ・ Improve accessibility to the area. ・ Promotion of agricultural development.	○ ・ To be programmed for implementation in the next 6-Year Plan.	— ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No environmental problem expected.	△ ・ Not required.	○ ・ Contribute to peace building.	○ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 1 × 1 = 1 16	
	Tamontaka River West Road (Tamontaka-Bubong section) Improvement Project (10)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	△ ・ Improvement of Existing road. ・ Not so Urgent	△ ・ Coastal side section passes through mangrove area and the rest of the section promote urbanization.	△ ・ Already paved, when pavement deteriorated, rehabilitation will be required.	○ ・ Compatible with City's land use plan.	○ ・ No environmental problem expected	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 3 × 3 = 9 △ = 4 × 1 = 4 13	
	Mindanao River Southside Road Development Project (12)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Dike road construction at southern bank of Mindanao River. ・ Access to agricultural area improved, and production will improve. ・ Urgent	○ ・ Promote aricultural development. ・ Contribute to flood control. ・ Provide alternative access to Davao City.	○ ・ To be programmed for implementation in the next 6-Year Plan.	△ ・ City has no plan for this road.	○ ・ No environmental problem expected.	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 2 × 1 = 2 17	

Table 11.7-2 Implementation Priority of Identified Projects (4/5)

Sector	Project Name	Implementing Agency	Evaluation: Importance and Urgency	Evaluation: Project Impact	Evaluation: Implementing Agency's Plan	Evaluation: Compatibility with Cotabato City Plan	Evaluation: Environmental Aspect	Evaluation: Needs of Japanese Technology	Evaluation: Contribution to Peace Building	Overall Evaluation	Recommendation for action plan studies
Road	Tamontaka River East Road Improvement Project (11)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Half section already paved. ・ The rest of the section is new construction. ・Urgent	○ ・ Agricultural development at Liguasan Marsh.	△ ・ To be programmed for implementation in the next 6-Year Plan.	○ ・ Compatible with city's land use plan.	○ ・ No relocation of people required. No serious environmental problem is expected.	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 2 × 1 = 2 17	
	Mindanao River North Road Improvement Project (13)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ New dike road construction at north side of Mindanao River. ・Not so urgent	○ ・ Agricultural development promoted with improved accessibility. ・ Contribute to flood control.	△ ・ To be programmed for implementation in the next 6-Year Plan.	○ ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No relocation of people required. No serious environmental problem is expected.	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 5 × 3 = 15 △ = 2 × 1 = 2 17	
	East Diversion Road (Cotabato City section) Improvement Project (14)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Two-lane paved road is opened to traffic. Widening to a 4-lane road needed. ・Not so urgent	○ ・ Connectivity with Davao City and Gen. Santos City is improved.	△ ・ To be programmed for implementation in the next 6-Year Plan.	○ ・ Compatible with City's land use plan.	△ ・ Some people started settling along th road side. They need to be relocated.	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 4 × 3 = 12 △ = 3 × 1 = 3 15	
	Cotabato City North-South Road Improvement Project (15)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・New road construction. ・Not so urgent	○ ・ Agricultural development promoted with improved accessibility.	△ ・ To be programmed for implementation in the next 6-Year Plan.	— ・ Sections 15-2 and 15-3 are located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No people affected. ・ No serious environmental problem	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 4 × 3 = 12 △ = 2 × 1 = 2 14	
	Maguindanao North-South Road (Pigkelegan-Katidtuan, Damaniog-Pigcalagan section)	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Improvement of Existing road. ・Not so urgent	○ ・ Agricultural development promoted with improved accessibility.	△ ・ To be programmed for implementation in the next 6-Year Plan.	— ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No people affected. ・ No serious environmental problem	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 4 × 3 = 12 △ = 2 × 1 = 2 14	

Table 11.7-2 Implementation Priority of Identified Projects (5/5)

Sector	Project Name	Implementing Agency	Evaluation							Overall Evaluation	Recommendation for action plan studies
			Importance and Urgency	Project Impact	Implementing Agency's Plan	Compatibility with Cotabato City Plan	Environmental Aspect	Needs of Japanese Technology	Contribution to Peace Building		
Road	Maguindanao North-South Road (Datu Binasing-Kakar, Panatan-Alamada section) Improvement	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Improvement of Existing road. ・ Not so urgent	○ ・ Agricultural development promoted with improved accessibility.	△ ・ To be programmed for implementation in the next 6-Year Plan.	— ・ Located outside Cotabato City. ・ BARMM Government is responsible.	○ ・ No people affected. ・ No serious environmental problem	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 4 × 3 = 12 <u>△ = 2 × 1 = 2</u> 14	
	Cotabato City North- South Road (Lower Taviran-Katidtuan section) Improvement Project	Department of Public Works and Highways (DPWH) Central Office and Ministry of Public Works (BARMM Government)	○ ・ Construction of a new road which crosses Liguasan Marsh. ・ Not so urgent	○ ・ Agricultural development promoted with improved accessibility.	△ ・ To be programmed for implementation in the next 6-Year Plan.	△ ・ Not included in the City Plan.	○ ・ No relocation of people required. ・ No serious environmental problem is expected.	△ ・ Not required.	○ ・ Contribute to peace building.	△ ・ To be implemented within 10 years. ◎ = 0 × 5 = 0 ○ = 4 × 3 = 12 <u>△ = 3 × 1 = 3</u> 15	
	Feeder Roads in Cotabato West Urban Area	Cotabato City Covernment	◎ ・ Rehabilitation and Improvement of City Roads (Area A) ・ Pavement Condition Survey to be undertaken. ・ Paving of city roads be programmed based on the survey result and implemented annually.	◎ ・ Reduction of traffic congestion ・ Improvement of accessibility to residential area and commercial area	◎ ・ Implemented by City Fund. ・ Bad, very bad section repaired.	◎ ・ Compatible with City's land use plan.	◎ ・ Since it is improvement/ rehabilitation of eisting roads, no serious environmental problems are expected	△ ・ Not required.	○ ・ Contribute to peace building.	◎ ・ To be implemented within 10 years. ◎ = 5 × 5 = 25 ○ = 1 × 3 = 3 <u>△ = 1 × 1 = 1</u> 29	
	Feeder Roads in Cotabato East Urban Area	Cotabato City Covernment	◎ ・ Rehabilitation and Improvement of City Roads (Area B) ・ Pavement Condition Survey to be undertaken. ・ Paving of city roads be programmed based on the survey result and implemented annually.	◎ ・ Reduction of traffic congestion ・ Improvement of accessibility to residential area and commercial area	◎ ・ Implemented by City Fund. ・ Bad, very bad section repaired.	◎ ・ Compatible with City's land use plan.	◎ ・ Since it is improvement/rehabilitation of eisting roads, no serious environmental problems are expected	△ ・ Not required.	○ ・ Contribute to peace building.	◎ ・ To be implemented within 10 years. ◎ = 5 × 5 = 25 ○ = 1 × 3 = 3 <u>△ = 1 × 1 = 1</u> 29	

The detailed scope of work per road project is show in Table 11.7-3. Road project with number 4-1 and 4-2 is the West Diversion Road which is one of the roads subjected to action plan studies. On the other hand road project with number12-1 is the Mindanao River Southside Road which is another road project subjected for action plan studies under this survey.

Table 11.7-3 Implementation Schedule of Road Improvement to Establish Hierarchical Road Network

No.	Road Name	Total Length (km)	Road Class	Road Condition (Km)				Estimated Cost (M PhP)					
				Concrete / Asphalt	Concrete but width is less than 6.7 m	Gravel / Earth	New Road	Widening of national road (2-lane to 4-lane)	Widening to 6.7m+ shoulder+ drainage	Change of pavement (gravel to concrete)	New construction (2-lane)	Add gravel shoulder and drainage	TOTAL
1-1	Sinsuat Avenue	9.53	Pri	9.53				381.16					381.16
1-2	Cotabato City-Davao City Road (1)	8.28	Pri	8.28				331.26					331.26
1-3	Cotabato City-Davao City Road (2)	12.79	Pri	12.79				511.79					511.79
1-4	Cotabato City-Gen. Santos City Road	13.06	Pri	13.06				522.22					522.22
2	Cotabato City-Zamboanga City Road	9.19	Pri	9.19				367.41					367.41
3	Polloc Port Access Road	4.63	Sec	4.63				185.13					185.13
4-1	West Diversion Road (Cotabato City section)	7.00	Sec				7.00	1.Pre-FS Road (1/2)					9,869.40
4-2	West Diversion Road (Sultan Kudarat-Parang section)	10.49	Sec				10.49	1.Pre-FS Road (2/2)					
5-1	Cotabato Coastal Road (Cotabato City section)	9.64	Ter	6.66		0.20	2.77	No action needed (On-going construction)					0.00
5-2	Mindanao River West Road (Jose Lim Sr. Street)	4.03	Sec	4.03									0.00
5-3	Cotabato Coastal Road (Sultan Kudarat-Parang section)	11.07	Ter				11.07				2,124.97		2,124.97
6	Maguindanao East-West Road 5 (Tapayan-Simua seashore section)	6.86	Ter	6.86	6.86				137.12			0.00	137.12
7-1	Maguindanao East-West Road 3 (Sambolawan-Solon section)	2.45	Ter				2.45				469.65		469.65

No.	Road Name	Total Length (km)	Road Class	Road Condition (Km)				Estimated Cost (M PhP)					
				Concrete / Asphalt	Concrete but width is less than 6.7 m	Gravel / Earth	New Road	Widening of national road (2-lane to 4-lane)	Widening to 6.7m+ shoulder+ drainage	Change of pavement (gravel to concrete)	New construction (2-lane)	Add gravel shoulder and drainage	TOTAL
7-2	Maguindanao East-West Road 3 (Rebuken-Solon section)	5.66	Sec	0.31	0.31	1.15	4.21		6.15		808.02		814.17
7-3	Maguindanao East-West Road 4 (Macabiso-Solon section)	6.69	Ter	6.69					133.85				133.85
8-1	Maguindanao East-West Road 2 (Limbo-Mulaug section)	4.44	Ter				4.44				852.37		852.37
8-2	Maguindanao East-West Road 2 (Pinaring-Manuangan Road)	20.08	Sec	19.08	19.08	1.00			381.63	31.00			412.63
9	Maguindanao East-West Road 1 (Bulalo-Katuri section)	4.05	Ter	2.20		0.10	1.75			3.10	336.86	17.54	357.51
10	Tamontaka River West Road (Tamontaka-Bubong section)	7.69	Ter	7.69				No action needed (recently completed road)					0.00
11-1	Tamontaka River East Road (Tamontaka-Taveran section)	14.14	Ter	11.17	1.00	2.97			20.00	92.07			112.07
11-2	Tamontaka River East Road (Taveran-Kabuntalan section)	9.78	Ter	9.78				No action is needed					0.00
12-1	Mindanao River Southside Road (Bulibod-Gambar section)	17.70	Sec				17.70	2.Pre-FS Road (2)					4,149.10
12-2	Mindanao River Southside Road (Gambar-Ganta section)	1.25	Sec	0.32		5.24				162.44			
13-1	Mindanao River North Road (Salimbao-Libungan Torreta section)	14.67	Ter	0.19		0.32	14.17		6.36		2,719.95		2,726.31
13-2	Mindanao River North Road (Simsiman-Libungan Torreta section)	9.25	Ter			8.58	0.67				128.22		128.22

No.	Road Name	Total Length (km)	Road Class	Road Condition (Km)				Estimated Cost (M PhP)					
				Concrete / Asphalt	Concrete but width is less than 6.7 m	Gravel / Earth	New Road	Widening of national road (2-lane to 4-lane)	Widening to 6.7m+ shoulder+ drainage	Change of pavement (gravel to concrete)	New construction (2-lane)	Add gravel shoulder and drainage	TOTAL
14	East Diversion Road (Cotabato City section)	13.44	Sec	5.24		8.20				254.20			254.20
15-1	Cotabato City North-South Road 1-1 (Tamontaka 3-Kampimpilan section)	5.88	Ter			0.56	5.32			17.45	1,021.37		1,038.82
15-2	Cotabato City North-South Road 1-2 (Pinaring section)	1.86	Ter			1.17	0.69			36.12	132.97		169.08
15-3	Cotabato City North-South Road 1-3 (Pinaring-Ladia Road)	5.54	Ter			5.54				171.76			171.76
16-1	Maguindanao North-South Road 1-1 (Pigkelegan-Katidtuan section)	5.38	Ter	3.24	3.24	1.57	0.57		64.80	48.68	108.74		222.23
16-2	Maguindanao North-South Road 1-2 (Damaniog-Pigcalagan section)	5.97	Ter	3.10		2.87				88.82			88.82
17-1	Maguindanao North-South Road 2-1 (Datu Binasing-Kakar section)	6.04	Sec			3.05	2.99			94.47	574.46		668.93
17-2	Maguindanao North-South Road 2-2 (Panatan-Alamada section)	6.46	Ter	6.06		0.40				12.40			12.40
18	Cotabato City North-South Road (Lower Taviran-Katidtuan section)	7.28	Sec	2.08			5.20				998.50		998.50
19-1	East-West Lateral Road 1	0.87	Ter				0.87				167.06		167.06
19-2	East-West Lateral Road 2	2.67	Ter	1.62		0.29	0.76			8.92	145.55		154.47
19-3	East-West Lateral Road 3	0.33	Ter	0.33	0.30				6.00				6.00
19-4	East-West Lateral Road 4	0.80	Ter	0.80	0.20				4.00				4.00
19-5	East-West Lateral Road 5	1.00	Ter	1.00	1.00				20.03				20.03
19-6	East-West Lateral Road 6	2.04	Ter	0.39	0.39		1.64		7.87		315.78		323.65

No.	Road Name	Total Length (km)	Road Class	Road Condition (Km)				Estimated Cost (M PhP)					
				Concrete / Asphalt	Concrete but width is less than 6.7 m	Gravel / Earth	New Road	Widening of national road (2-lane to 4-lane)	Widening to 6.7m+ shoulder+ drainage	Change of pavement (gravel to concrete)	New construction (2-lane)	Add gravel shoulder and drainage	TOTAL
19-7	East-West Lateral Road 7	1.15	Ter	0.97	0.97	0.18			19.40	5.50			24.90
19-8	East-West Lateral Road 8	1.70	Ter	1.56	1.56	0.14			31.22	4.35			35.57
19-9	East-West Lateral Road 9	3.80	Ter	1.69	1.60		2.10		32.00		404.11		436.11
19-10	East-West Lateral Road 10	4.42	Ter	2.30	2.30	2.12			45.96	65.66	0.00		111.61
19-11	East-West Lateral Road 11	3.31	Ter	1.84	1.84	0.24	1.22		36.84	7.45	234.96		279.24
19-12	East-West Lateral Road 12	1.28	Ter	0.69	0.69	0.58			13.89	18.08			31.96
19-13	East-West Lateral Road 13	0.68	Ter	0.68									0.00
19-14	East-West Lateral Road 14	2.76	Ter	1.00	0.80	0.32	1.44		16.00	9.87	276.45		302.33
19-15	East-West Lateral Road 15	4.91	Ter				4.91				942.15		942.15
20-1	City Link Road 1	3.50	Ter				3.50				671.70		671.70
20-2	City Link Road 2	1.52	Ter	1.52	0.20				4.00				4.00
20-3	City Link Road 3	2.15	Ter	1.79	0.80	0.35			16.00	11.00			27.00
20-4	City Link Road 4	2.55	Ter	1.00	1.00	0.16	1.39		20.01	5.04	266.49		291.54
20-5	City Link Road 5	0.39	Ter	0.39				No action (road in good condition)					0.00
20-6A	City Link Road 6-1	2.24	Ter	2.24	1.10				22.00				22.00
20-6B	City Link Road 6-2	0.64	Ter	0.64	0.64				12.79				12.79
20-6C	City Link Road 6-3	1.97	Ter	0.31	0.24	0.57	1.09		4.80	17.66	208.75	2.40	233.61
20-7	City Link Road 7	0.78	Ter	0.78	0.78				15.55			7.78	23.33
20-8	City Link Road 8	3.85	Ter	1.11	1.11	0.38	2.37		22.12	11.67	455.27	11.06	500.12
20-9	City Link Road 9	1.49	Ter	0.92		0.33	0.24			10.10	46.63		56.73
	TOTAL	**335.02**		**177.75**	**48.01**	**48.56**	**113.02**	**2,298.97**	**1,100.39**	**1,187.80**	**14,410.97**	**38.78**	**33,055.42**

Source: Calculated by the JICA Study Team; Note: See Figure 11.6-2 and Figure 11.6-3 for location map

Table 11.7-4 Rehabilitation of Non-functional Roadside Drainage

Road No.	Length (m)	Drainage (Left & Right) (m)		Road Category	Unit Cost/m	Amount (PhP)
		Functional	Non-Functional		Non - Functional	Non - Functional
1	17,300	12,200	300	National Road	7,416.6	2,224,992.0
8	1,664	2,100	100	Local Road	7,416.6	741,664.0
12	760	800	100	Local Road	7,416.6	741,664.0
16	3,433	4,466	600	Local Road	7,416.6	4,449,984.0
17	1,685	2,470	200	Local Road	7,416.6	1,483,328.0
18	977	1,754	200	National Road	7,416.6	1,483,328.0
20	479	600	179	Local Road	7,416.6	1,327,578.6
21	1,157	1,914	200	Local Road	7,416.6	1,483,328.0
22A	1,066	1,000	400	Local Road	7,416.6	2,966,656.0
23	1,108	1,000	400	Local Road	7,416.6	2,966,656.0
24	1,452	2,404	400	Local Road	7,416.6	2,966,656.0
27	1,923	646	500	Local Road	7,416.6	3,708,320.0
28	877	400	154	Local Road	7,416.6	1,142,162.6
29	567	334	700	Local Road	7,416.6	5,191,648.0
30	482	864	100	Local Road	7,416.6	741,664.0
31	476	852	100	Local Road	7,416.6	741,664.0
32	1,942	642	942	Local Road	7,416.6	6,986,474.9
34	1,170	1,340	1,000	Local Road	7,416.6	7,416,640.0
35	8,538	2,776	1,000	National Road	7,416.6	7,416,640.0
TOTAL	47,056	38,562	7,575			**56,181,048.0**

Source: DPWH's Cost Estimate for Work Item of Projects for Region 12, as of October 2020
Note 1: Unit Cost for Concrete Lined Canal (H=1.00x0.60); Note 2: See Figure 11.6-5 for location map

11.8 Implementation Schedule

The Implementation Plan of the TDP is presented in Table 11.8-1.

Table 11.8-1 Implementation Schedule for Each Project under the TDP (1/2)

No.	Project/Programme	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	**Establishment of Road Functional Classification (Concept)**																				
	Proposed Road Functional Hierarchy in Greater Cotabato																				
2	**Road Network Development Sub-Plan**																				
2.1	**Strengthening of Existing Roads (Asset Preservation)**																				
	Rehabilitation of roads in "bad condition" by Preventive Maintenance – overlay 80mm (15.51 km)	■	■																		
	Rehabilitation of roads in "very bad condition" by Reconstruction – assumption with base failure (5.86 km)	■	■																		
	Upgrading of road surface from earth/gravel surface to concrete (12.29 km) – 280mm new road	■	■																		
	Rehabilitation of Non-functional Roadside Drainage (7.575km)**(see table below for details)	■	■																		
2.2	**Road Improvement to Establish Hierarchical Road Network**																				
1-1	Sinsuat Avenue			■	■																
1-2	Cotabato City - Davao City Road (1)			■	■																
1-3	Cotabato City - Davao City Road (2)				■	■															
1-4	Cotabato City - Gen. Santos City Road (1)				■	■															
2	Cotabato City - Zamboanga City Road				■	■															
3	Polloc Port Access Road					■	■														
4 (1)	West Diverion Road (Cotabato City Section)	■	■	■	■																
4 (2)	West Diverion Road (Sultan Kudarat-Parang Section)												■	■							
5-1	Cotabato Coastal Road (Cotabato City Section)					■	■	■													
5-2	Mindanao River West Road (Lose Lim Sr. Street)					■	■	■													
5-3	Cotabato Costal Road (Sultan Kudarat -Parang Section)									■	■	■									
6	Maguindanao East-West Road 5 (Tapayan-Simua seashore section)									■	■	■									
7-1	Maguindanao East-West Road 3 (Sambolawan-Solon section)					■	■														
7-2	Maguindanao East-West Road 3 (Rebuken-Solon section)						■	■													
7-3	Maguindanao East-West Road 4 (Macabiso-Solon Section)									■	■										
8-1	Maguindanao East-West Road 2 (Limbo-Mulaug section)							■	■												
8-2	Maguindanao East-West Road 2 (Pinaring-Manuangan Road)											■	■								
9	Maguindanao East-West Road 1 (Bulalo-Katuri Section)							■	■												
10	Tamontaka River West Road (Tamontaka-Bubing section)												■	■							
11-1	Tamontaka River West Road (Tamontaka-Taveran section)				■	■															
11-2	Tamontaka River West Road (Taveran-Kabuntalan section)				■	■															
12-1	Mindanao River South Road (Bulibod-Gambar section and parts of 13-1 and 18)	■	■	■	■																
12-2	Mindanao River South Road (Gambar-Ganta Section)							■	■												
13-1	Mindanao River North Road (Salimbao-Libungan Torreta Section)													■	■						
13-2	Mindanao River North Road (Simsiman-Libungan Torreta Section)				■	■															
14	East Diversion Road (Cotabato City section)						■	■													
15-1	Cotabato City North-South Road 1-1 (Tamontaka 3 -Kampimpilan Section)							■	■												
15-2	Cotabato City North-South Road 1-2 (Pinaring Section)										■	■									
15-3	Cotabato City North-South Road 1-3 (Pinaring-Ladia Section)										■	■									
16-1	Maguindanao North-South Road 1-1 (Pigkelegan- Katidtuan Section)					■	■														
16-2	Maguindanao North-South Road 1-2 (Damaniog- Pigcalagan Section)											■	■								
17-1	Maguindanao North-South Road 2-1 (Datu Binasing-Kakar Section)						■	■													
17-2	Maguindanao North-South Road 2-2 (Panatan-Alamada Section)												■	■							
18	Cotabato City North-South Road (Lower Taviran - Katidtuan Section)			■	■																

Table 11.8-2 Implementation Schedule for Each Project Under the TDP (2/2)

No.	Project/Programme	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
19-1	East-West Lateral Road 1																				
19-2	East-West Lateral Road 2																				
19-3	East-West Lateral Road 3																				
19-4	East-West Lateral Road 4																				
19-5	East-West Lateral Road 5																				
19-6	East-West Lateral Road 6																				
19-7	East-West Lateral Road 7																				
19-8	East-West Lateral Road 8																				
19-9	East-West Lateral Road 9																				
19-10	East-West Lateral Road 10																				
19-11	East-West Lateral Road 11																				
19-12	East-West Lateral Road 12																				
19-13	East-West Lateral Road 13																				
19-14	East-West Lateral Road 14																				
19-15	East-West Lateral Road 15																				
20-1	City Link Road 1																				
20-2	City Link Road 2																				
20-3	City Link Road 3																				
20-4	City Link Road 4																				
20-5	City Link Road 5																				
20-6A	City Link Road 6-1																				
20-6B	City Link Road 6-2																				
20-6C	City Link Road 6-3																				
20-7	City Link Road 7																				
20-8	City Link Road 8																				
20-9	City Link Road 9																				
2.3	**Capacity Building on Road Development to relevant agencies**																				
	Caoacity Building to City Engineering Office and MPW-BARMM																				
3	**Public Transport Improvement Sub-Plan**																				
3.1	**Public Transport Terminal (Road) Improvement**																				
	Improvement of various existing public terminals																				
	Development of Integrated South Terminal																				
	Development of Integrated North Terminal																				
3.2	**Water Transport Terminal Improvement**																				
	Re-construction of East water transport terminal (Super Market)																				
	Re-construction of West water transport terminal (Texing)																				
3.3	**High Capacity Public Transport Promotion and Route Improvement**																				
	Cotabato City Bus System (Promotion of shifting from low capacity (Jeepneys and PUVs) to high capacity public transport (bus system) along key corridors)																				
	Expansion of Bus System inside Cotabato City according to progress of road expansion																				
	Inter-city Bus System (Cotabato--->Parang and Cotabato-->Dinaig)																				
4	**Traffic Management Sub-Plan**																				
4.1	Strengthening of capacity of TMU, Traffic Police and relevant organizations																				
4.2	Pedestrian Improvement Plan																				
	- Old CBD (Width= 2.5m); (L=14.02 km both sides)																				
	- Sinsuat Avenue to ORG (Width= 2.5m); (L=1.36km both sides)																				
4.3	Parking Improvement Plan																				
	- Physical improvement of road shoulder target for paid parking																				
	- Surface markings of proposed parking area (both on street and off-street)																				
4.4	Intersection Improvement Plan																				
	- Physical improvement (road surface improvement, shoulder, pedestrian lane, etc.)																				
	- Road surface markings (intersection, zebra croissing, etc.)																				
	- Installation of 6 traffic light (6 intesections along Quezon Avenue and Sinsuat Avenue))																				
4.5	Traffic Awareness and Safety Campaign																				
	- Radio, TV, Social Media Campaign																				
	- Traffic Awareness and Safety Campaign at Various Schools (Kindergarden and Primary Schools)																				
4.6	Installation of Traffic Lights (covering all major roads) and Traffic Control System																				
	- Study of roads to be covered by the integrated traffic signal system																				
	- Installation of traffic lights, CCTV camera, etc																				
	- Installation of traffic control system including training of personnel																				

11.9 Selection of High Priority Projects

Among the projects identified under the TDP, two projects are proposed as high priority projects. These are the (i) West Diversion Road (Road number 4-1 and 4-2 in Figure 11.6-2) and (ii) Mindanao River South Road. The justification for these two roads is discussed in Table 11.9-1 below.

Table 11.9-1 Summary of Quick Evaluation of the Two High Priority Projects

Evaluation Item	West Diversion Road	Mindanao River South Road
a) Urgency/ importance	• To serve as tsunami barrier (63.7% of the population of Cotabato City is expected to be affected by tsunami without the barrier) • To guide sound urbanization of Cotabato City (the city is expanding west but without corresponding road network to guide the expansion) • To reduce traffic congestion by constructing another arterial road (the sole arterial road of Cotabato City, Sinsuat Avenue, is handling traffic volume over its capacity, hence, serious traffic congestion is experienced) • To expand network capacity by constructing one major component of the future road network of Greater Cotabato (one of the biggest reasons for the traffic congestion is the lack of formation/shape of the road network)	• To provide access (currenty using water transport going Cotabato City) to barangays in Liguasan marsh, including 11 barangays in Pigcawayan which voted to be included in the BARMM • To promote agricultural development in the Liguasan marsh • To provide road redundancy between Cotabato City and Davao City • To expand network capacity by constructing one major component of the future road network of Greater Cotabato (eastern part of Cotabato City lacked road network)
b) Positive Impact	• Reduction of tsunami damage • Improvement of urban development including amenities • Improvement of traffic circulation	• Improvement of access to Cotabato City of the communities along the Mindanao River • Contribution to agricultural development
c) Compatibility with land use	• In line with the land use plan where the tsunami barrier serves as the limit of urbanization of Cotabato City on the west side	• Compatible with the land use plan where due to the sensitive environmental characteristics of the marsh, only limited access road will be constructed
d) Contribution to peacebuilding	• Improved access will lead to a stronger presence of law enforcers hence public order is enhanced • New road access will bring development which would encourage people to pursue livelihood-related activities	• Provision of access road will lead to a stronger presence of law enforcers hence public order is enhanced • New road access will bring development which would encourage people to pursue livelihood-related activities
e) Needs of Japanese technology	• Construction of tsunami barrier is new to the Philippines hence Japanese technology would be needed for the construction of a strong dike road which will also serve as tsunami barrier. • Long span bridges over Timako River and Mindanao River might be needed to secure clearance for the safe navigation of boats	• The road will traverse a wetland hence soft ground treatment for road construction would be needed.

11.9.1 Project Profiles of High Priority Projects

11.9.1.1 West Diversion Road

(1) Background

Sinsuat Avenue, at present, is the lone arterial road of Cotabato City, hence it serves as the main carrier of the north-south vehicular traffic. It is classified as a national road which is intended to primarily carry inter-city traffic. However, it has been observed that local traffic tends to combine with through (inter-city) traffic due to absence of an alternative high-capacity road to serve the north-south traffic. As a result of this mixed traffic (inter-city and local), the road becomes highly congested. The data obtained from the traffic survey revealed that the level of service along majority of the stretch (from intersection of Sinsuat Avenue and Sinsuat Avenue to Notre Dame Hospital) of Sinsuat Avenue is "F" (forced flow, stop and go) almost the entire day. Level of service "F" indicates that the road is carrying volume of traffic over its capacity (to maintain "D" level of service which represents better traffic flow, the road has to carry about 2,000 PCU/hour but current traffic volume is close to 3,000 PCU/hour). In the long term, the road network of Cotabato City must be strengthened by completing the construction of the proposed future road network, as indicated in this study. However, in the short to medium term, there is a need to provide an alternative road that could potentially divert a portion of the north-south traffic away from Sinsuat Avenue.

(2) Objectives

The objectives of the project are as follows:

- To protect Cotabato City and nearby municipalities from the possible damage caused by tsunami (Without WDR=245,000 people are affected by tsunami; With WDR=33,000)
- To construct an arterial road on the west side of Cotabato City to guide sound urbanization of the city
- To reduce traffic congestion by expanding the capacity of the road network by constructing another arterial road to divert a portion of the traffic away from the lone arterial road of Cotabato City (Sinsuat Avenue)
- To strengthen the link between Cotabato City and major facilities (e.g., Awang Airport and Polloc Port), new planned ecozone at Polloc Port, and the planned New BARMM Administrative Center in Barangay Landasan, Parang Municipality

(3) Scope

The project involves the construction of a 17.5 km arterial road (dike road which serve as tsunami barrier) and eight (8) access roads, of which five (5) would be situated within Cotabato City. These access roads are important components of the project to increase the functionality of the arterial road.

(4) Location Map

The location map of the project is shown in Figure 11.9-1.

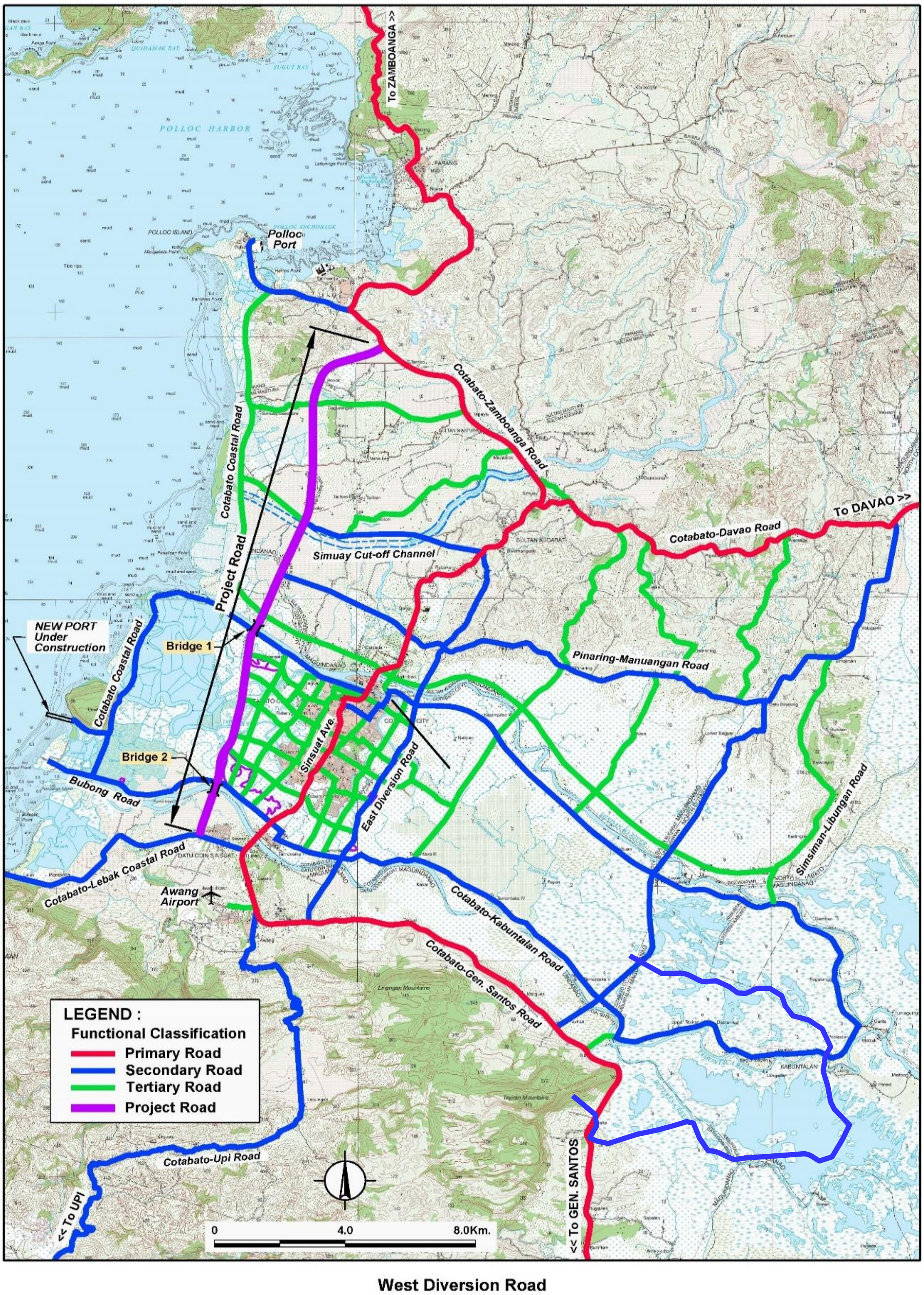


Figure 11.9-1 Location Map of West Diversion Road

(5) Impact

The expected impacts are as follows:

- Protection of the inhabitants of Cotabato City and municipalities of Sultan Kudarat and Sultan Mastura from the possible occurrence of a tsunami
- Improvement of urban development including amenities due to the systematized expansion of the city
- Improvement of traffic circulation due to the expansion of road network capacity
- Contribution to the improvement of peace and order in the communities due to the stronger presence of law/security enforcers brought by better access

11.9.1.2 Mindanao River South Road

(1) Background

The project will address the lack of road connection along the eastern part of Cotabato City, part of Sultan Kudarat Municipality and Pigcawayan Municipality. At present, water transport along the Mindanao River remains the only means of access of these communities to Cotabato City. The area has potential for agriculture and aquaculture as part of the huge Liguasan Marsh.

(2) Objectives

The objectives of the project are as follows:

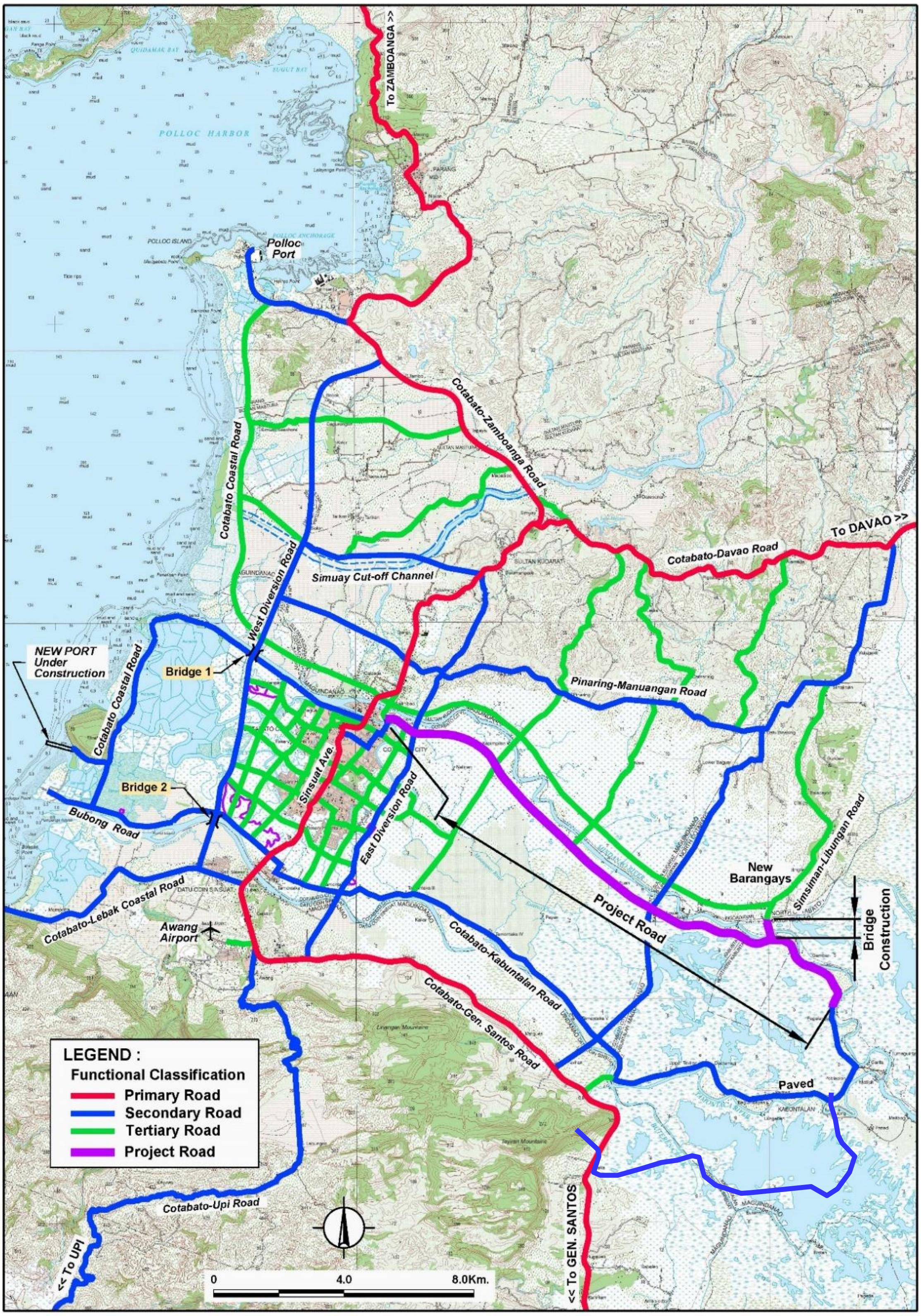
- To promote agricultural development in the eastern side of Cotabato City and Liguasan marsh in general
- To complete the east circumferential road of Cotabato City
- To promote social and economic integration of the four LGUs (Cotabato City, Sultan Kudarat, Kabuntalan and Pigcawayan)
- To provide access to barangays in Liguasan marsh (currently using water transport) including the 11 barangays which joined the BARMM

(3) Scope

The project involves the construction an elevated 14.7 km secondary road and five (5) access roads. These access roads are important components of the project to increase the influence (service area) of the road.

(4) Location Map

The location map of the project is shown in Figure 11.9-2.



Mindanao River South Dike Road

Figure 11.9-2 Location Map of Mindanao River South Road

(5) Impact

The expected impact are as follows:

- Improvement of access to/from Cotabato City of the communities along the Mindanao River
- Contribution to agriculture and aquaculture development
- Contribution to peacebuilding through the provision of an access road which will lead to a stronger presence of law enforcers, hence, public order would be enhanced

11.10 Environmental and Social Consideration of Transport Development Plan

The Environmental and Social Consideration for each project under the TDP is presented in the table below. Environmental assessment is mainly required to the following projects which would entail large-scale construction works and operation:

- Construction of New Roads under the "Road Network Development Sub-plan"
- Construction of New Integrated Public Transport Terminals (Road) under the "Public Transport Improvement Sub-plan"
- Construction of New Water Transport Terminals under the "Public Transport Improvement Sub-plan"

Table 11.10-1 Environmental and Social Consideration of the Transport Development Plan

		Pollution control								Natural				Social environment																Others		Type of Permit
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Project/ Program	Phases	Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment, livelihood	Land use and utilization of local resources	Water usage	Existing social infrastructures and services	Social institutions such as social infrastructure and local decision-making	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR
1. Establishment of Road Functional Classification (Concept)	Pre-construction	N/A																														N/A
	Construction																															
	Operation & Maintenance																															
2. Road Network Development Sub-Plan	Pre-construction	D	D	D	D	D	D	D	D	D	D	D	D	B-	C	C	C	C	D	D	C	D	C	D	B-	C	D	D	D	D	D	ECC
	Construction	B-	C	B-	C	B-	C	D	D	C	C	C	C	B-	C	C	A+	A+	C	C	C	D	C	D	B-	C	D	C	D	B-	C	
	Operation & Maintenance	B-	C	D	C	B-	C	D	D	C	C	C	D	D	C	C	B+	B+	C	A+	B+	C	C	D	B-	C	B+	C	D	B-	C	
3. Public Transport Improvement Sub-Plan	Pre-construction	D	D	D	D	D	D	D	D	D	D	D	D	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	ECC
	Construction	B-	C	B-	C	B-	C	D	C	D	C	C	C	C	C	C	B+	B+	C	C	D	D	D	D	C	C	D	C	D	B-	C	
	Operation & Maintenance	B-	C	B-	C	B-	C	D	C	D	C	C	D	D	C	C	D	D	C	B+	B+	C	C	D	C	C	D	C	D	C	C	
4. Traffic Management Sub-Plan	Pre-construction	D	D	D	D	D	D	D	D	D	D	D	D	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	CNC
	Construction	B-	C	B-	C	B -	D	D	D	D	D	D	D	C	C	C	B+	B+	C	C	B+	C	C	D	C	C	D	C	C	B-	C	
	Operation & Maintenance	B-	C	C	C	B -	D	D	D	D	D	D	D	C	C	C	B+	B+	C	A+	B+	C	C	D	C	C	D	C	C	C	C	

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.
D: No impact is expected.
N/A: Not applicable (for exaple, Capacity Building Project)
ECC: Environmental Compliance Certificate
CNC: Certificate of Non-Coverage

11.11 Peacebuilding

"Peacebuilding does not simply mean creating a situation where there is no conflict (negative peace), but where there is not cause of conflict (positive peace) by removing factors that contribute to the eruption of conflicts and establishing a new structure within a society which contributes to consolidation of peace" (Our Commitment to Peace, JICA's Approach to Peacebuilding, 2020). Similarly, the United Nations Office for Project Services (UNOPS), an integral member of the United Nations with focus on implementation produced a report in 2020 titled "Infrastructure for Peacebuilding: the role of infrastructure in tackling the underlying drivers of fragility". The said report was drawn from the UNOPS 25 years' experience in implementing infrastructure projects in fragile and conflict affected environment. It pointed out that "when implemented with wider reforms, infrastructure investments can support long-term peace and resilience by enabling access to basic services and has the potential to foster structural changes that reduce the risk of violence and promote sustainable development". On the other hand, "infrastructure can hinder peacebuilding if services are lacking or if infrastructure is unable to protect communities. Poorly planned, designed and implemented infrastructure can fuel tensions by reinforcing an inequitable environment." It warned that "investments that fail to account for the complex interactions that infrastructure has with fragility, risk contributing to prolonged instability".

The above is relevant to this study since the study area in general had experienced violent conflict for a long period of time and is just now enjoying relative peace largely due to the peace agreement between the GRP and the MILF (Chapter 19 discussed in detail). As earlier indicated, although one of the objectives of implementing road and other transport related projects is to improve the socio-economic condition of the inhabitants, a less-cautious method of implementing these projects might trigger or contribute to a new conflict. Therefore, the following activities related to road projects which have high potential to create a conflict in the study area if not properly handled are highlighted:

- **Selection of Road Alignment** – selecting the final alignment of a road project brings both tension and excitement to the communities. This is because most people want their assets and properties close to the road project. At times, people with influence in the community will try to dictate the alignment with the eye of maximizing benefits (e.g. the road has to pass through his/her land). It is important to communicate to the community that alignment of the road will be selected based on verifiable criteria such as technical/engineering aspect, social and environmental aspect, and economic aspect and not based on individual's interest. This effort is designed to win the trust of the community, gain their support and avoid a situation where the project will become a source of conflict.

- **Right-of-way Acquisition** – past experiences of road project in the area like the JICA-assisted Tapian-Lebak Coastal Road revealed that most of the land claimants affected by the project lacked sufficient legal documents to prove ownership. This is not an isolated case (example of another project with land issue: ADB's Improving Growth

Corridors in Mindanao Road Sector Project) hence best practices in handling land issue should be studied as part of the preparation of the project implementation. Insecurity among the land claimants that their land might be taken without compensation by the project proponent will create animosity which might lead to a new conflict. Hence support should be extended by proponent that would allow them to complete the documentary requirements to qualify for compensation.

- **Relocation Action Plan (RAP)** –the RAP contains land value, value of affected trees, crops and other entitlements of the project affected people (PAP). It is important these entitlements and amounts they are expected to receive is well communicated to avoid a situation where the gap between their expectation and valuation are too wide to bridge. In addition, relocating PAP is not only a technical issue (e.g. finding suitable relocation sites) and financial issue but to some it is an emotional issue due to their long acquaintance with their surroundings. Therefore, continues dialogue to find amicable solution with those who find it difficult to leave their original place must be pursued.

- **Indigenous People (IP)** – Table 2.3-8 in Chapter 2 revealed that four (4) of the six (6) LGUs have indigenous peoples (all are migrants except those in Pigkawayan). Whether they will be affected or not, this will be confirmed during the Feasibility Stage of the project. Once IPs are confirmed to be affected, support of MIPA (Ministry of Indigenous Peoples Affairs) should be sought immediately to ensure their rights and interests are protected.

- **Equal opportunity to participate in the project** – DPWH is actively promoting Republic Act (RA) No. 6685 which require private contractors to hire at least fifty percent (50%) of the unskilled and thirty percent (30%) of the skilled labor requirements from the available bona fide residents in the project area. It is important that access to this job opportunity is equally given to all members of the community to avoid jealousy or feeling of injustice which could lead to a new conflict.

On the other hand, once the project is completed, its impact on the lives of the community is enormous. It may address economic disparity which is one of the causes of conflict, security issue, employment deprivation, among others. In essence, the following maybe achieved:

- **Improved socio-economic condition** - New road access will bring development which would encourage people to pursue economic activities. For example, logistics between agricultural production area and city markets become easier than before. Consequently, producers/farmers can supply more fresh products with less transportation costs and time. At the same time, buyers can purchase those products with lower prices and in good quality. The expansion of economic activities will lead to poverty reduction among the people involved, and thus contribute to peace building in the target area. To illustrate, according to the 2019 NEDA Region 12-commissioned study entitled "Impact Evaluation of Awang-Upi-Lebak-Kalamansig-Palimbang-

Sarangani Road", a JBIC-funded project in Mindanao where poverty and security issue were high, based on perception survey on the barangay officials, the majority of the barangays now say that in general, the level of poverty among the households has reduced from 72.2% of the barangays before the road to 56.6% barangays today.

- **Enhanced peace and security conditions** - Improved access will lead to a stronger presence of law enforcers hence public order is enhanced. The presence of military and police check points will allow immediate response and deter crime. Immediately, after information on accidents, crimes and other social unrests is reached to the police and other public authorities concerned, mobilization of the concerned authorities to deal with these social problems become much faster and with sufficient scale. If this kind of knowledge is disseminated properly to the public, these activities will create preventive effects in the society so that possibility of crimes and public disorder will be also diminished. Quoting again the 2019 NEDA Region 12-commissioned study entitled "Impact Evaluation of Awang-Upi-Lebak-Kalamansig-Palimbang-Sarangani Road", the following were the contribution of the road project in peace and security:

  (i) The majority of the barangay officials claim that their barangays have become more peaceful today (93.4%) compared to before the project.
  (ii) The majority of the passengers (97%) say that they feel that the general peace and order situation in their barangay has improved after the road was constructed.
  (iii) Barangay official-respondents said that 56 barangays (72.7%) were considered peaceful and orderly before the road project and this has increased to 74 barangays (96.1%) after the road project.

- **Enhanced access to school for children** - New or improved access also makes children's going to school much easier and safer. The same is true in the cases of elderly people who constantly need to receive medical care. Those elderly people feel more secure to reach medical institutions. These positive social impacts minimize psychological anxiety and insecurity which have been prevailed deep in the people's minds. These improvement in social services will turn the community psychology into positive phase and contribute to peace building in the communities.

- **Enhanced public services** - New or improved access also makes closer not only the physical but also psychological distances between public officials and people in the communities. Reduced travel time and convenient travel brought by the road will make it easier for the people to directly consult with public officials in person and to seek opportunities to receive various social services. For public offices, it is much easier to understand the conditions and issues in the communities so that they can arrange appropriate public services, sooner than before. Through improvement in practical dimension of public administration, the governance in the area will be improved and strengthened in real terms. Relationship between public officials and the communities will be strengthen because of better communication and service delivery.

- **Enhanced social interactions** - New or improved access also stimulate social and economic intermingling among the residents of neighboring barangays and communities. Increase of close contact through exchange and sharing of news and events eventually expand scale of mutual understanding and trust. The formulation of mutual trust and common interests leads to use of peaceful means rather than antagonistic or competitive approaches, if any social major issue arises and it needs to achieve fast solution. Through these processes, governance in general at community level is improved and peacebuilding is strengthened. For the case of the JBIC-funded Awang-Upi-Lebak-Kalamansig-Palimbang-Sarangani Road, it was revealed that with the road, there has been a change in the travel behavior of the communities. They are now traveling outside of their municipality/province to work, to visit relatives, and to avail of health services in more affluent areas (e.g., Cotabato City). Barangay officials have observed the increase in the number of visitors and tourists coming to their barangays. Nearly all (75 of 77 barangays or 96.1%) of the barangays surveyed have joint activities/projects with other barangays and municipalities.

CHAPTER 12
AIRPORT DEVELOPMENT PLAN

12.1 Background of the Airport Development Plan

12.1.1 Background

The existing Cotabato Airport (CBO) facility itself has not reached the capacity limit from the view of the current daily aircraft operation, since CBO can accommodate the other aircrafts except the current peak time handling scheduled daily 2 flights from/to NAIA during the limited time of the day, even though the Passenger Terminal Building (PTB) and Vehicle Parking Area (VPA) are congested due to the substandard facility during the limited time. However, the utilization of CBO is under limitations and constraints due to the following factors.

(1) Limitation on Further Runway Expansion of the Existing Airport

CBO does not meet the international standard set by the International Civil Aviation Organization (ICAO). Its runway length of 1,900 meters could not serve bigger aircrafts capable of longer international routes. But the further expansion of the runway is restricted due to the surrounded topographical conditions.

(2) Overconcentration on Passenger Demand from/to NAIA

The passenger demand of CBO from/to the other destinations is hardly any volume, therefore the destination of the schedule flight is limited from/to NAIA. Recently flight from/to Zamboanga Airport is operated but unsteady.

(3) Limitation of Slot Allocation at NAIA

Day time operation in NAIA is far beyond capacity for a long while. Therefore, further slot allocation for CBO may not be expected under the current situation of NAIA. The slot can be allocated further if NAIA expands nighttime operation for domestic flights, but local domestic airports must be equipped with appropriate aeronautical ground lighting system and navigational aids to meet the relevant regulations with considerable cost.

In consideration of the above situation, a new airport which can perform as a gateway of this region accommodating bigger aircrafts capable of longer international routes is expected.

There are efforts by the Cotabato City Government and BARMM Regional Government to build a New Cotabato Airport situated in a better location.

Apart from the above, the development of the Central Mindanao (M'lang) Airport is promoted by the National Government, particularly by the Department of Transportation (DOTr). It may affect to the above discussion of New Cotabato Airport as a gateway airport of this region.

12.2 Issues on Airport Development

12.2.1 Limitation on Improvement of Aviation Safety

(1) Runway Limitations

The runway length of the existing Cotabato Airport (CBO) is shorter than the requirements of the international standard set by ICAO to accommodate larger aircrafts including wide-bodies. Thus, bigger aircrafts that could fly direct to ASEAN and Middle East countries could not be served by CBO. And extending the runway to sufficient length may pose some technical difficulties owing to deep ravine along its end.

(2) Aerodrome Obstructions

Furthermore, CBO is in violation against standards within the Obstacle Limitation Surface (OLS) as specified by ICAO Annex 14 Volume 1 (Aerodromes -Aerodrome Design and Operations) for air traffic safety. The huge land mass at the southern portion of the runway is Mount Cabalalaan with a towering height of 709 meters above sea level. This clearly presents a serious amount of obstacles that would cause limitations for visual circling operations and endanger aircraft operations.

12.2.2 Limitation on Improvement of User Convenience

(1) Substandard Facilities on Passenger Terminal Building

The Passenger Terminal Building (PTB) has limited space, thus, overcrowding at pre-departure area and check-in counters is a regular experience of departing passengers. Similarly, the arrival area with a baggage carousel has limited space, hence, arriving passengers feel uncomfortable in retrieving their baggage.

(2) Substandard Facilities on Vehicle Parking Area

The airport Vehicle Parking Area (VPA) could only accommodate a limited number of vehicles owing to space limitation.

As described in the above, CBO should be improved to meet the relevant regulations and to enhance the user convenience as much as possible.

Furthermore, considering under COVID-19 pandemic and even after the pandemic that the treatment has been established, the risks against unknown infectious virus shall be considered on the airport facility improvement.

12.2.3 Constraints Under the Current Operational Situation of CBO

The outstanding constraints due to the external factors such as limited peak time operation due to overconcentration on passenger demand from/to NAIA, and limitation of NAIA slot allocation strains CBO facility utilization. This cannot be settled by CBO facility improvement itself.

12.3 Objectives for Airport Development

The objectives of the airport sector development are the following:

12.3.1 Objectives of Existing Airport Development

To enhance aviation safety based on the improvement of runway strip and navigational aids.

To enhance user convenience based on the improvement of passenger terminal building and the vehicle parking area.

To encourage new air linkages with the other domestic destinations other than NAIA to expand the utilization of CBO which is currently operated only for a few flights from/ to NAIA.

12.3.2 Objectives of New Airport Development

To provide optimal new airport as a gateway of this region which accommodates bigger aircrafts capable of longer international routes, with reliable facilities in consideration of aviation security and user convenience.

To encourage airlines to adopt bigger aircrafts for the operation between NAIA and new airport to accommodate further passenger demand.

To promote air linkage from/to the other domestic destinations other than NAIA, furthermore, international destinations among BIMP-EAGA.

To encourage a consensus building among the relevant stakeholders of not only this region but also national central government in terms of the candidate site for new airport.

12.4 Strategies for Airport Development

The strategies of the airport sector development are the following:

12.4.1 Strategies of Existing Airport Development

The following are proposed to enhance aviation safety of the airport:

(1) Expansion of Runway Strip

(2) Installation of Navigational Aids and Aeronautical Ground Lighting System

The following are proposed to improve user convenience of the airport:

(3) Expansion of Passenger Terminal Building (PTB)

(4) Expansion of Vehicle Parking Area (VPA)

12.4.2 Strategies of New Airport Development

The activities as shown in the section 12.3.2 above shall be proposed for the development of new airport as a gateway of this region. The optimal location shall be selected in consideration of fundamental factors such as natural conditions, road access, and environmental and social considerations during the construction phase and the operation phase, etc.

12.5 Airport Sector Plan

The following are the airport sector plans.

12.5.1 Improvement of Existing Airport

(1) Cotabato Airport Improvement Plan

The feasibility study which proposed to establish the new terminal area at the opposite side of the existing terminal area was undertaken by ADB in 2006.The widening of runway had already implemented but most of the items are still left undone up to now.

The proposed plan includes:

[1] Airside Facilities and Works

- Runway strip widening and grading works
- Rehabilitation of existing runway
- Widening of existing runway from 30m to 45m
- Runway shoulders, turning eave and blast pads at both ends
- Taxiway and Apron
- Runway extension of 110 m
- Airside roads (Rescue and Firefighting, apron, maintenance and air service roads)
- Perimeter fence and roads
- Demolition of various obstacles

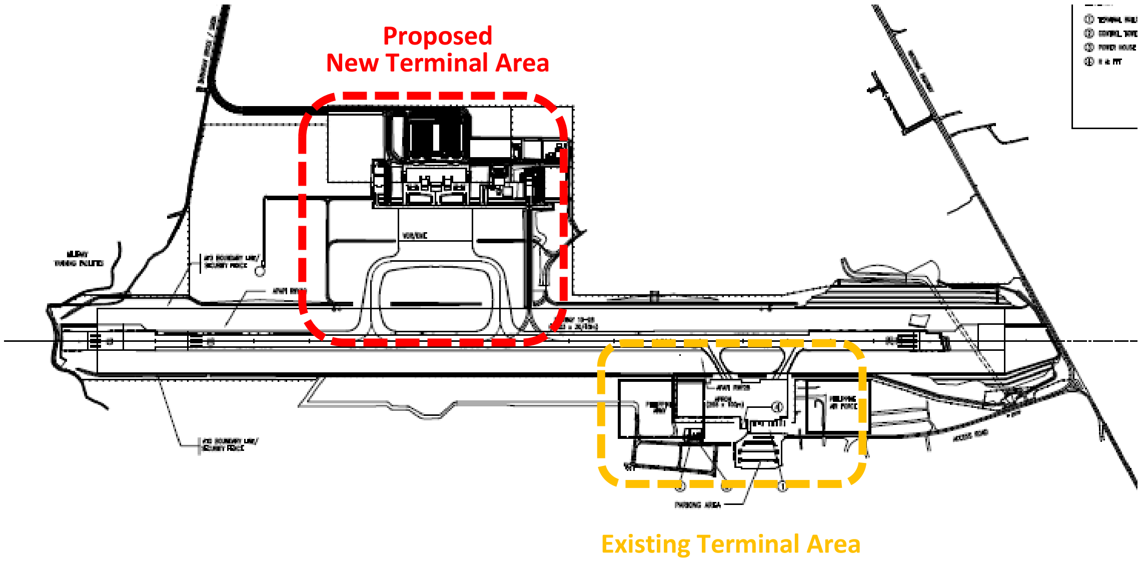
[2] Landside Facilities and Works

- New passenger terminal building
- New cargo terminal building
- Other new buildings (Administration and operations; Rescue and Firefighting; Powerhouse; Solid waste disposal, Chiller Pump house; Control Tower.)
- New landside roads, security fence and parking facilities
- Drainage (Runway strip, apron, road, parking)

[3] Equipment

- Navigational Aids (DVOR; DME; Remote control; Power supply)
- ATC & Communications (VHF system; Voice switch control system; recording equipment, and UPS
- Airfield Ground Lighting (High intensity simple approach lighting system for RWY 30 and 12; High intensity runway edge lighting; High intensity runway end lighting; High intensity runway threshold lighting; Medium intensity taxiway edge lighting; Apron flood lighting; Obstacle lighting; Illuminated wind cones)
- Airfield Maintenance (Tractor; Grass mower; Utility vehicle)
- One fire fighting vehicle

The layout of the proposed master plan for new terminal area development is shown in Figure 12.5-1.



Source: Asian Development Bank (2006)

Figure 12.5-1 New Terminal Area Development Plan in Cotabato Airport

(2) Airport Infrastructure Program

Airport Infrastructure Programs from CY2017 to CY2020 which are supposed to be undertaken by the Philippine national budget are discussed below.

According to DOTr-CBO, the CY2018 programs which enhance aviation security by grading of runway side strip and improve user convenience by rehabilitation/expansion of Vehicle Parking Area (VPA) are still under the jurisdiction by DOTr-HQ prior to the implementation, therefore these programs are still not implemented at CBO as of now.

The following development plans are scheduled to implement at CBO.

[1] Upgrading/Expansion of the existing Passenger Terminal Building (PTB)

- Description: expansion of seating capacity from 270 to 360 passengers
- Cost: PhP 41.4 Million
- Funding source: DOTr Head Office
- Status: For implementation, pending notice-to-proceed (NTP), expected to begin within October 2020

[2] Asphalt overlay of airport runway

- Cost: PhP 340 Million
- Funding source: DOTr, under Memorandum of Agreement (MOA) with the Department of Public Works and Highways (DPWH) Central Office
- Status: For finalization of terms

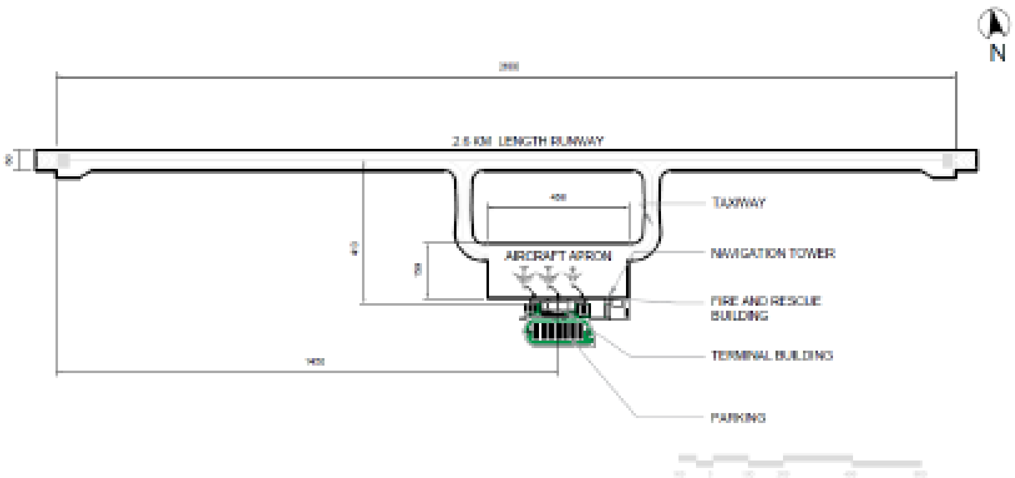
[3] Shoulder grade correction

- Cost: PhP 161 Million
- Funding source: DOTr, under MOA with the Department of National Defense (DND)
- Status: Under procurement

12.5.2 Development of New Cotabato Airport

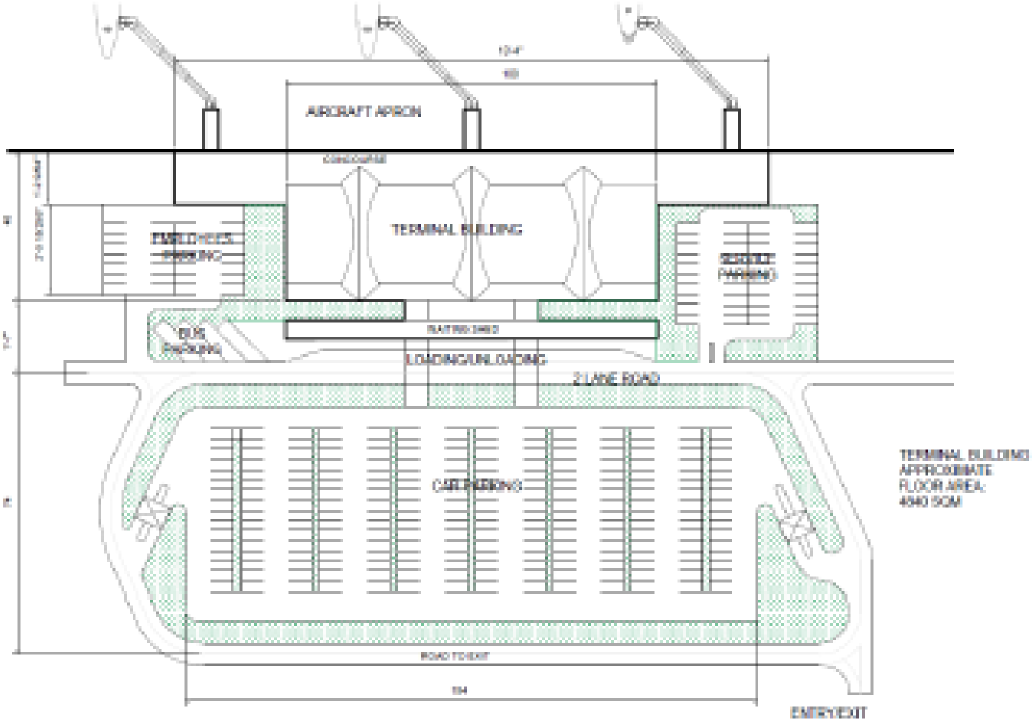
(1) Pre-F/S for New Cotabato Airport Development

Pre-F/S for New Cotabato Airport Development was conducted by in 2018 and financed by the City Government of Cotabato. The proposed general facility layout plan and the terminal layout plan are shown in the following figures.



Source: Pre-F/S, City Government of Cotabato (2018)

Figure 12.5-2 General Facility Layout Plan of New Cotabato Airport



Source: Pre-F/S, City Government of Cotabato (2018)

Figure 12.5-3 Terminal Layout Plan of New Cotabato Airport

(2) M'lang Airport Development

The development of Central Mindanao (M'lang) Airport will be among the major support facilities in this region that will provide efficient access for various agricultural commodities to domestic and international market.

The Airport is projected to be an alternate airport for Cotabato Airport and will also cater to the entire province of Cotabato and nearby municipalities of Sultan Kudarat, Maguindanao and South Cotabato.

Under the Central Mindanao (M'lang) Airport Development Project, the expansion of airport including the extension and widening of airport runway, concreting of apron, installation of fire station and construction of perimeter fence was completed with a cost of PhP 160 million.

On the expansion of airport land area, the survey was completed and the DOTr downloaded to Cotabato Province PhP10 M out of the PhP 20 M budget for the project.

12.6 Air Traffic Demand Forecast

Air traffic demand forecasts until 2030 of CBO was summarized in the previous JICA study (2016) as shown in Table 12.6-1.

In comparison with the air traffic statistics shown in Section 5.2.4, Chapter 5, and the transition of annual cargo movement is steadily increasing as forecasted. On the other hand, the transition of annual passenger movement is lower than the forecast under the effect of stagnant on aircraft movement. This implies that limitation on the number of aircraft operation restrains potential passenger demand.

Table 12.6-1 Summary of Air Traffic Demand Forecast for CBO (2020-2030)

Item*1	Year			
	2018 (Actual)	2020	2025	2030
1.Passenger				
International		-	-	-
Domestic		442,920	556,216	669,139
GA		2504	2,684	2,878
Total	298,345	445,424	558,900	672,017
2.Cargo (Ton)				
International		-	-	-
Domestic		2,960	3,645	4,329
GA		-	-	-
Total	3,037	2,960	3,645	4,329
3.ATM International				
Total		-	-	-
4.ATM Domestic				
LJ		-	-	-
MJ		-	-	-
SJ		3,048	3,827	4,604
TP		1,016	1,276	1,535
STOL		-	-	-
Total	2,889	4,064	5,103	6,139
5.ATM GA		446	479	513
Grand Total		4,510	5,582	6,652

*1: LJ: Large Jet, MJ: Middle Jet, SJ: Small Jet, TP: Turboprop, STOL: Short takeoff and landing, GA: General Aviation, ATM: Air Traffic Movement

Source: JICA Study Team (2020) updated from JICA Study Team (2016)

Apart from the above, the following factor caused by COVD-19 pandemic should be considered in 2020 and for several years on the demand forecast.

According to the statistics of IATA (International Air Transport Association), air travel may recover more slowly than most of economy. RPKs (Revenue Passenger Kilometers) may recover 2019 levels in 2023, 2 years behind GDP recovery. On the other hand, CTKs (Cargo Ton Kilometers) may recover 2019 levels in 2021.

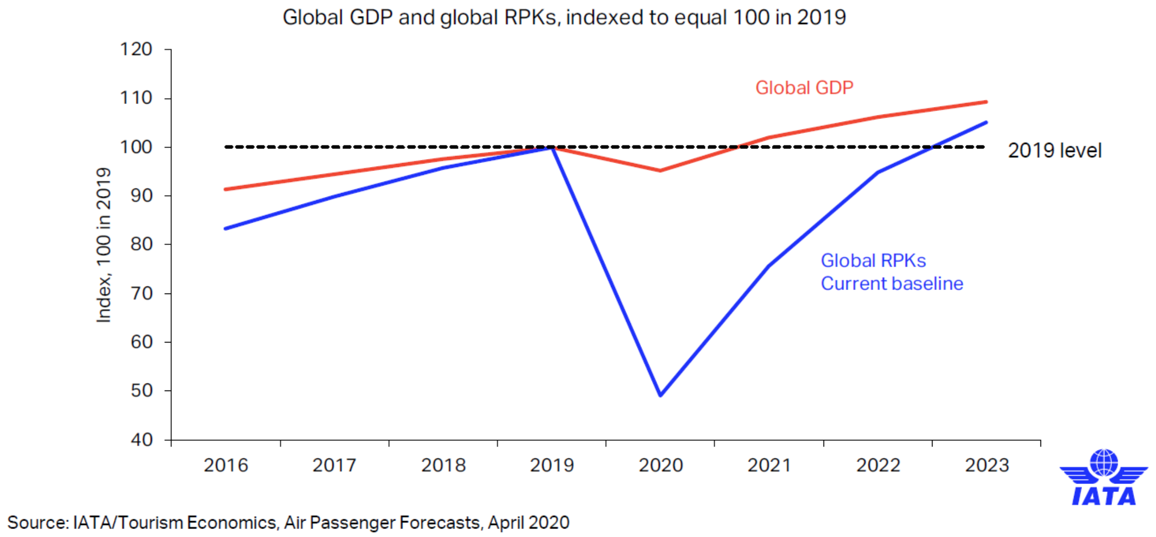


Figure 12.6-1　Global GDP and Global RPK Forecast

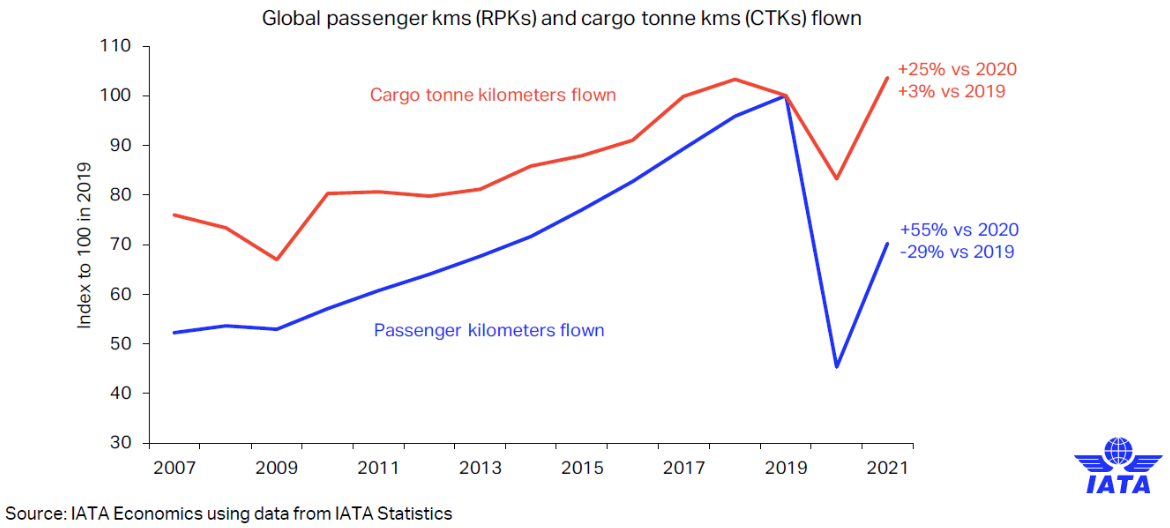


Figure 12.6-2　Air Passenger and Cargo Forecast

12.7 Cost of Airport Sector Plan

The following are the cost estimation for airport development project.

12.7.1 Cost Estimation for Existing Airport Improvement Project

The project cost estimation by phase up to 2030 for CBO was summarized in the previous JICA Study (2016) based on the above-mentioned airport development plan. The JICA study team updated the implementation schedule and the cost estimation in consideration of the latest information gathered through site survey and interview.

The latest cost estimation is summarized in Table 12.7-1.

Table 12.7-1 Cost Estimation for CBO Development Project (Up to 2030)

(Unit: '000 PhP)

Main Work	Future Requirements		Note
	2025	2030	
Airside Facilities			
Runway Extension			
Runway Widening			
Taxiway System	25,300		
Apron Expansion	40,000		
Strip Expansion and Site Preparation	707,220		
Upgrade of AGL	144,000		
Upgrade of RFFS	6,560		
Sub Total	923,080	0	
Landside Facilities			
PTB Expansion	396,000	96,000	
CTB Expansion			
VPA Expansion	26,880		
Construction of Control Tower	120,000		1)
Site Preparation	31,120	3,200	
Sub Total	574,000	99,200	
CNS/ATM			
RNA	128,082		
AIS	34,247		
MET			
Sub Total	162,329	0	
Other Improvements			
Runway Overlay	139,788		
Completion of Fence	4,000		
X-ray Machine and Metal Detector			
Sub Total	143,788	0	
Contingency (10%)	180,320	9,920	
Total Construction Cost	1,983,517	109,120	

Abbreviations: AGL: Aeronautical Ground Lighting, RFFS: Rescue and Fire Fighting Station, PTB: Passenger Terminal Building, CTB: Cargo Terminal Building, VPA: Vehicle Parking Area, CNS/ATM: Communication Navigation and Surveillance/Air Traffic Management, RNA: Radio Navigational Aids, AIS: Aeronautical Information Service, MET: Meteorological Facilities

1) The cost is referred from proposed CY 2016 Annual Investment Program of CAAP-CBO

2) Expenses for land acquisition, compensation and incidental expenses have not been considered

Source: JICA Study Team (2020) updated from JICA Study Team (2016)

12.7.2 Cost Estimation for New Cotabato Airport Construction Project

According to the Pre-F/S conducted by the City Government of Cotabato, Approx. 4,800M PhP will be required for the construction project. But it is noted that the cost estimates need to be further refined in the course of full feasibility studies and detailed engineering design.

According to the Pre-F/S, the New Cotabato Airport Project is found to be both financially and economically viable. It is found to be financially feasible with IRR of 17.2% and an NPV of almost 909 million pesos at 15% IRR. On the other hand, it is found to be economically feasible with an IRR of 33.1% and a NPV of around 6 billion pesos at 15% IRR. And it is recommended that a Full Feasibility Study be undertaken in order to ascertain the detailed project costs and revenue streams. Since the eventual operation of the new airport facility is inextricably linked with other developments, there is also a need to develop an overall implementation plan to ensure that each component is strategically placed and that complementary among projects are achieved.

Table 12.7-2 Construction Cost Estimation for the New Cotabato Airport

Construction Works	Area (square meter)	Cost per square meter	Total Cost
1 External Costs			2,500,000,000.00
General			
Earthworks			
New Pavements			
Rehabilitation of Pavements			
Drainage			
Civil Works for External Utilities			
Others			
2 Buildings			
Passenger Terminal Building	5000	70,000.00	350,000,000.00
Cargo Terminal	300	40,000.00	12,000,000.00
Control Tower and Admin Building	2000	40,000.00	80,000,000.00
R&FFF	550	50,000.00	27,500,000.00
Other Buildings			50,000,000.00
3 Equipment			
Navigational Aids			70,000,000.00
ATC & Communication Equipment			90,000,000.00
Airfield Ground Lighting			175,000,000.00
Maintenance Equipment			5,000,000.00
R&FFF			70,000,000.00
		Total Construction Cost	**3,429,500,000.00**

Source: Pre-F/S, City Government of Cotabato (2018)

Table 12.7-3 Total Project Cost Estimation for New Cotabato Airport

	Quantity	Unit Cost	Total Cost
1 Preliminary Consulting Services			
Geotech	2250	3,000.00	6,750,000.00
Feasibility Study			20,000,000.00
EIS			10,000,000.00
Detailed Engineering Design	4%		137,180,000.00
2 Construction Cost			3,429,500,000.00
3 Construction Consulting Services	5%		171,475,000.00
3 ROW			50,000,000.00
4 Contingencies	10%		382,490,500.00
5 Project Administration Cost	2%		84,147,910.00
6 VAT	12%		514,985,209.20
		GRAND TOTAL	**4,806,528,619.20**

Source: Pre-F/S, City Government of Cotabato (2018)

12.8 Proposed Priority Projects

12.8.1 Proposed Priority Project for Existing Cotabato Airport

The proposed priority project with the implementation schedule is shown in Table 12.8-1.

The airport development plan by phase up to 2030 for CBO was summarize in the previous JICA Study (2016) based on the master plan proposed by ADB (2006). The JICA study team updated the plan in consideration of the latest information gathered through site survey. It is noted that the development plan shall be promoted in consideration of the progress on the discussion of New Cotabato Airport Development.

Table 12.8-1 Development Plan by Phase for CBO (Up to 2030)

Phase	Contents	Scale
Short-Term Plan (2020-2025)	Securing the Width of Runway Strip	
	New Stub Taxiway (110m x 23m x 2)	5,060m^2
	New Apron	8,000m^2
	Improvement of Aeronautical Lighting Facilities upgraded to Grade C	
	Expansion of Rescue and Fire Fighting Station	170m^2
	New Passenger Terminal Building	5,500m^2
	New Vehicle Parking Area	8,960m^2
	Installation of Radio Navigational Aids (VOR/DME)	
	Installation of Aeronautical Information Service (VHF)	
	Runway Overlay (1,913m x 45m)	86,085m^2
	Completion of Fence Connection	500m
	New Control Tower	
Mid-Term Plan (2026-2030)	Expansion of Passenger Terminal Building	1,600m^2
Long-Term Plan (2031-)	None (New Cotabato Airport Development shall be considered.)	

Source: JICA Study Team (2020) updated from JICA Study Team (2016)

*The followings are written again from JICA Study Report (2016).

Cotabato Airport is expected to be upgraded to a local leading airport, from which more than 500,000 passengers are expected to be handled by the Airport. The facility expansion is required in accordance with the expected air traffic demand.

The expected demand in 2025 will exceed 500,000, and the runway approach category shall be upgraded from Non-Instrument to Non-Precision in accordance with facility requirements. The airport needs to ensure that its facilities meet safety standards while installing and operating approach light system and radio navigational aids.

In addition, the top priority in Non-Precision approach operation is the securing of runway strip. The current 130-meter-wide runway strip shall be expanded to 300 meters.

It is suggested to include key facilities for Non-Precision approach in the Short-Term Plan, such as runway strip securing, VOR/DME installation and aeronautical lighting facility upgrade from B to C, since the relocation of landside facilities should be carried out in the Short-Term Plan.

Distance between runway and apron taxiway shall follow international standards for 4C, which is the airport classification category of A320 aircraft currently under operation. This calls for the expansion in the depth of the apron, which is impossible under the current situation as the apron is surrounded by Passenger Terminal Building (PTB), Vehicle Parking Area (VPA) and other buildings. Therefore, it is proposed that the apron shall be relocated to the opposite side of the existing landside area. Such relocation would be accompanied with the construction of passenger terminal, VPA and access roads, which needs to be reflected in the Short-Term Plan.

Cotabato Airport has limited expandability since there is a significant height difference or faulting between both ends of the runway and surrounding areas. Accordingly, the conditions are unfavorable not only for securing 2,600-meter-long runway required to service A321 planes in 2025 but also for meeting the facility requirement of 2,200-meter-long runway to service A320. However, it is possible to service A320 aircrafts flying domestic routes within Manila without separate load limit owing to the already secured stop-way and clear-way in both direction by 45 and 60 meters respectively. Therefore, it seems feasible to operate A320 planes until 2030 without additional expansion. Realistically, however, it is challenging to secure Runway End Safety Area (RESA).

Still, runway overlay has been included in the Short-Term Plan in consideration of the asphalt pavement's service life of 20 years and of the growing air traffic demand.

New Rescue and Fire Fighting station shall be expanded in accordance with the number of the vehicle.

Table 12.8-2 Summary of Practical Development Target for CBO (Up to 2030)

Demand/Main facility	Unit	Current	Future Requirements		Note
		2020	2025	2030	
Traffic Demand					
Annual Passengers	Pax.	-	558,900	672,017	
Annual AC Movements		-	5,103	6,139	
Peak Hour Passengers	Pax.	-	436	545	
Peak Hour AC Movements		2	4	5	
Design Aircraft		A320	SJ	SJ	
Approach Category		Non-Instrument	Non-Precision	Non-Precision	
Airside Facility					
Runway Length	m	1,913	1,913	1,913	
Runway Width	m	45	45	45	
Runway Strip Width	m	130	300	300	
Taxiway System		Stub	Stub	Stub	New Construction
Apron Area	m^2	25,600	8,000	8,000	New Construction
Airfield Lighting		B	C	C	
RFF (Category)		6	6	6	
RESA Length	m	0/0	0/0	0/0	
Landside Facility					
Passenger Terminal Area	m^2	1,152	6,600	8,200	New Construction
Cargo Terminal Area	m^2	**243**			**Constructed in 2018**
Vehicle Parking Area	m^2	7,920	8,960	8,960	New Construction
R/W-T/W Separation	m	86.6	168	168	
CNS/ATM					
RNA		Non-1	Non-P	Non-P	
AIS	CH	2/3/4	6/3/4	6/3/4	*VHF/TRSC/HF
MET	Set	1/0/0	1/0/0	1/0/0	*WIND/RVR/CCLM
Other Improvement					
Runway Overlay			Overlay		1,913m x 45m *1
Perimeter Fences		Incomplete	Complete		500m (250 bays)

Abbreviations: AC: Aircraft, RFF: Rescue and Fire Fighting, RESA: Runway End Safety Area, R/W: Runway, T/W: Taxiway, CNS/ATM: Communication Navigation and Surveillance/Air Traffic Management, RNA: Radio Navigational Aids, AIS: Aeronautical Information Service, VHF: Very High Frequency, TRSC: Multi Transceiver, HF: High Frequency, MET: Meteorological Facilities, WIND: Anemometer, RVR: Runway Visual Range, CCLM: COSMO Climate Limited-area Model

Source: JICA Study Team (2020) updated from JICA Study Team (2016)

12.8.2 Proposed Priority Project for New Cotabato Airport

The proposed priority project with the implementation schedule is shown in Table 12.8-3.

Table 12.8-3 Development Plan by Phase for New Cotabato Airport (Up to 2037)

Phase	Contents	Scale
Short-Term Plan (-2027) New Construction	Runway L2,600 m x W45 m (Runway Strip L2,720 m x W300 m) Stub Taxiway W23 m x 2 Apron Passenger Terminal Building Cargo Terminal Building Control Tower and Administration Building Rescue and Fire Fighting Station Other Buildings Navigational Aids ATC & Communication Equipment Airfield Ground Lighting Maintenance Equipment Rescue and Fire Fighting Vehicle	 64,500 m^2 4,840 m^2
Mid-Term Plan (2028-2032)	None	
Long-Term Plan (2033-2037)	Expansion of Apron Expansion of Passenger Terminal Building	45,500 m^2 9,160 m^2

Source: JICA Study Team (2020) summarized from Pre-F/S, City Government of Cotabato (2018)

Table 12.8-4 Summary of Practical Development Target for New Cotabato Airport (Up to 2037)

Demand/Main facility	Unit	Current (CBO)	Future Requirements		Note
		2020	2027	2037	
Traffic Demand					
Annual Passengers	Pax.	-	**1,390,452**	**3,509,314**	
Annual AC Movements		-			
Peak Hour Passengers	Pax.	-	**535**	**1,347**	
Peak Hour AC Movements		2	**2**	**5**	
Design Aircraft		A320	**A330**	**A330**	
Approach Category		Non-Instrument			
Airside Facility					
Runway Length	m	1,913	**2,600**	**2,600**	
Runway Width	m	45	**45**	**45**	
Runway Strip Width	m	130	**300**	**300**	
Taxiway System		Stub	**Stub**	**Stub**	
Apron Area	m^2	25,600	**64,500**	**110,000 (+45,500)**	
Airfield Lighting		B			
RFF (Category)		6			
RESA Length	m	0/0			
Landside Facility					
Passenger Terminal Area	m^2	1,152	**4,840**	**14,000 (+9,160)**	
Cargo Terminal Area	m^2	243			
Vehicle Parking Area	m^2	7,920			
R/W-T/W Separation	m	86.6			
CNS/ATM					
RNA		Non-1			
AIS	CH	2/3/4			*VHF/TRSC/HF
MET	Set	1/0/0			*WIND/RVR/CCLM
Other Improvement					
Runway Overlay					
Perimeter Fences		Incomplete			

Abbreviations: AC: Aircraft, RFF: Rescue and Fire Fighting, RESA: Runway End Safety Area, R/W: Runway, T/W: Taxiway, CNS/ATM: Communication Navigation and Surveillance/Air Traffic Management, RNA: Radio Navigational Aids, AIS: Aeronautical Information Service, VHF: Very High Frequency, TRSC: Multi Transceiver, HF: High Frequency, MET: Meteorological Facilities, WIND: Anemometer, RVR: Runway Visual Range, CCLM: COSMO Climate Limited-area Model

Source: JICA Study Team (2020) summarized from Pre-F/S, City Government of Cotabato (2018)

12.9 Environmental and Social Considerations of Airport Sector Plan

The required Environmental and Social Considerations items for the following programs are shown in Table 12.9-1.

1) Existing Cotabato Airport Improvement Project
2) New Cotabato Airport Construction Project

Table 12.9-1 Environmental and Social Considerations of Airport Development Plan

		Pollution control								Natural				Social environment																Others		Type of Permit
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Project/ Program	Phases	Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment,	Land use and utilization of local	Water usage	Existing social infrastructures and	Social institutions such as social	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR
1. Existing Cotabato Airport Development	Pre-construction																															CNC
	Construction	B-	B-	B-	B-	B-	D	B-	D	D	D	D	D	D	D	D	B+	D	D	D	D	D	D	D	B-	D	D	B-	B-	B-	D	
	Operation & Maintenance	B-	B-	B-	B-	B-	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
2. New Cotabato Airport Development	Pre-construction																															ECC
	Construction	B-	B-	B-	B-	B-	D	B-	B-	D	D	D	D	C	D	D	B+	D	D	D	D	D	D	D	D	D	D	B-	B-	B-	D	
	Operation & Maintenance	B-	B-	B-	B-	B-	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	

Notes:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.

D: No impact is expected.

N/A: Not applicable (for exaple, Capacity Building Project)

ECC: Environmental Compliance Certificate

CNC: Certificate of Non-Coverage

12.10 Peacebuilding

As highlighted in Section 11.11 of Chapter 11, due to the fragile peace in the study area, there is a need to proceed carefully in implementing infrastructure project so as not to trigger new conflict or contribute to an environment which could weaken the foundation of peace. Among the projects identified in the Airport Development Plan, development of new airport has the high potential to generate tension in the affected communities due to the following reasons:

- **Vast land is needed to build a new airport** – recent developed airport (e.g. New Iloilo International Airport sits in a 188 hectares land; other newly developed airports like Laguindingan International Airport and Bohol–Panglao International Airport also sits in an over 100 hectares of land) reveals that over 100 hectares of land is needed to establish a new airport. Securing this vast land will involve securing consent of many landowners (e.g. 215 land owners for the case of the New Iloilo International Airport per 2011 JICA's Ex-Post Evaluation of New Iloilo Airport Development Project). In general, land ownership in the study area is still problematic where many land claimants lacked legal documents to prove ownership. This was the experience with the 2021 JICA-assisted study in the area (Detailed Engineering Design of Sub-Project 1 and Sub-Project 6 under the Road Network Development Project in Mindanao) where lack or insufficient legal documents are prolonging the project implementation.
- **Relocation of Project Affected People (PAP) –** acquiring vast land will most likely involves relocating affected people in the target land and while some might be supportive of the project, some might not be happy to be relocated. Quoting the 2011 Ex-Post Evaluation by JICA of the New Iloilo International Airport, it states: "In general, dissatisfaction on the negotiation process during the implementation of the relocation and on the compensation amount is strong. Complaints on the loss of income generating measures are also strong." It is therefore necessary to perhaps review the past implementation of the newly completed airport projects and see what the necessary improvements are to be done next time to improve project approach particularly in land acquisition and relocation of PAP.
- **Equal job opportunities to locals –** Unemployment (4.4% for Cotabato City and 6.6% for ARMM in 2019 per PSO) is one of the serious problems in the area hence access to job is an attractive part of the project to the locals. In addition, a law called Republic Act (RA) No. 6685 requires private contractors to hire at least fifty percent (50%) of the unskilled and thirty percent (30%) of the skilled labor requirements from the available bona fide residents in the project area. To build a harmonious relationship between the project contractor and the local population, it is important to faithfully follow this law and access to the job opportunity is equally given to all qualified locals.

When an airport is completed, its impact to the economy is enormous and improved economy will certainly contribute to stabilize peace in the area through poverty reduction. For example, for the case of the New Iloilo International Airport, the 2011 Ex-Post Evaluation report revealed that new business establishment increased by 665 compared to the previous year (1,084 in 2006 and 1,7849 in 2007 during the opening). These new businesses in the forms of hotels, restaurants, travel agencies among others created jobs for the locals and contributed to the income of the city in the form of tax payment. The same is true to another airport project located in Coron, Palawan. The 2013 Ex-Post Evaluation showed that the revenue of the Coron Municipality increased by 2.3-fold (PhP 7.3 Million in 2012 compared to PhP 3.0 Million in 2006, before the development of the airport). The said report concluded that " Taking into account the tourist industry-related development indices such as hotels, restaurants and resorts, and fiscal revenue data provided by the city of Coron, combined with the result of interviews with business representatives, a positive impact on the region's economic development is recognized definitely." The following stages of the airport project may have the following contribution in peacebuilding:

- **Construction Stage** – new airport is a massive infrastructure project which would need high number of construction workers. As explained earlier, RA No. 6685 requires private contractors to hire at least fifty percent (50%) of the unskilled and thirty percent (30%) of the skilled labor requirements from the available bona fide residents in the project area. Hence hundreds of locals have the opportunity to secure a temporary job. Depending on scale, an airport project may take 5 years to 10 years to complete (e.g. original plan for the New Iloilo International Airport was to complete it by 5 years but was extended to 7 years due to various reasons including delayed in the bidding of civil works, extension of construction works due to bad weathers among others). Assuming that it would take 5 years to construct the new airport, this is a significant time to provide temporary jobs to the local communities. In particular, having a job during this transition period for the project affected people (PAP) who are still getting to use on their new situation is comforting.
- **Operation and Maintenance Stage** – as seen in the experiences of other towns discussed above, the new airport created new businesses which benefited both (i) the local communities through additional job opportunities and (ii) the local government units (LGU) through increased tax revenues. In general, lack of available job is one of the primary drivers of poverty; and poverty is one of the root causes of violence. Hence the additional jobs created by the new airport will surely contribute to reduce the poverty in the area. Similarly, increased financial power of the LGUs means increased level of service delivery to the communities. Increased service delivery may include better roads which may help the farmers, more visible presence of law enforcers, better response to other needs of the communities among others. This enhanced functional performance will lead to a better relationship between the government and the local communities that will surely contribute to reducing violent conflicts in the area.

CHAPTER 13
PORT DEVELOPMENT PLAN

13.1 Background

13.1.1 Cotabato Port

The existing Cotabato river port consist of a 360-meter long (water depth -2.0 m) reinforced concrete bulkhead wharf situated along the south bank of the northern arm of the Mindanao Grande River, about 11 km from the mouth. The back-up area of about 4,000 sq. meters along the length of the wharf is too narrow. Due to the heavy siltation of Mindanao Grande River the port operation of Cotabato Port was totally terminated as shown in Figure 13.1-1.

Source: Google Earth

Figure 13.1-1 Present Condition of Cotabato River Port

Therefore, Cotabato City wants a new port with no issues on siltation and has minimal maintenance cost of port operation.

13.1.2 Polloc Port

Polloc Port was constructed in 1977 and was fully operational in 1980 under the Philippine Ports Authority (PPA). Polloc Port has a total of 119 hectares designated area for various Freeport facilities and business activities catering conventional, break bulk and containers for domestic and international cargoes. Aerial Photo of Polloc Port is shown in Figure 13.1-2.

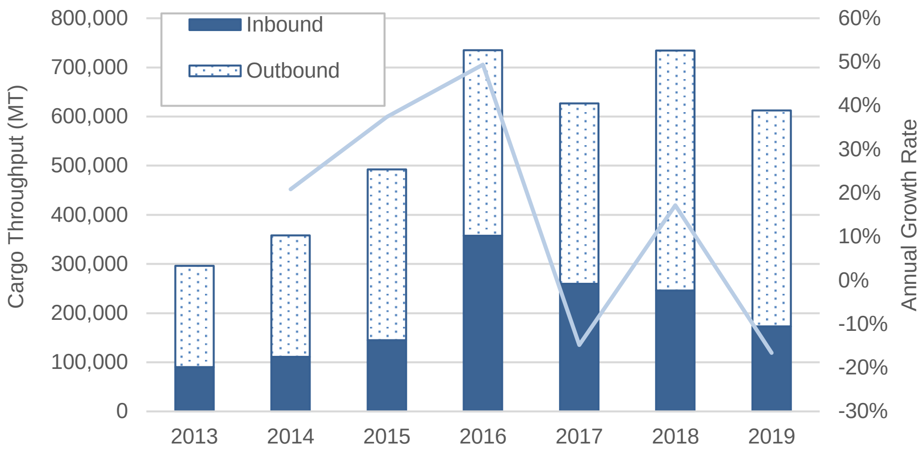
Source: Prepared by the JICA Study Team based on Aerial Photo of Polloc Port Administration

Figure 13.1-2 Aerial View of Polloc Port

In order to increase the port capacity and upgrading the port services, the following facilities are under construction or newly provided;

1) Ongoing 50-meter expansion of berthing facility beside existing marginal wharf
2) Petroleum depot to supply the fuel to the ships
3) RORO wharf for multi-purpose cargoes
4) CCTV cameras to increase port safety

Although as mentioned in 5.3.3 Polloc Port, the cargo throughput handled in the port increased from 2013 to 2016 but relatively decreased from 2016 to 2019 as shown in Figure 13.1-3. It is therefore very urgent to revitalize the Polloc Port.



Note: Arrival of foreign cargoes decreased in 2017, following the implementation of Martial Law in Mindanao
Source: Regional Economic Zone Authority (REZA)

Figure 13.1-3 Annual Cargo Throughput of Polloc Port, Per Flow of Cargo (2013-2019)

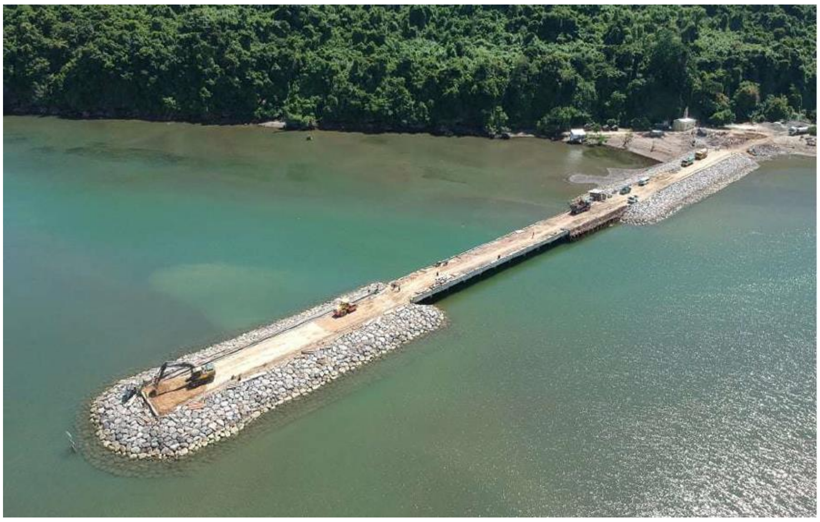
13.1.3 Timako Port

Former President Gloria Macapagal-Arroyo, in her State of the Nation speech of July 2006, has emphasized the development of infrastructure as the administration's major strategy in jumpstarting economic development, providing livelihood and employment and reducing poverty. Because the Philippines is an archipelago, the role of port development within this overall context has gained greater importance.

PPA had initially selected thirteen (13) ports in the Port District of Southern Mindanao for the formulation of master plans and feasibility studies for possible development. Timako Port was also considered as potential alternative sites to accommodate the anticipated overflow of passenger and cargo traffic from the original study ports in view of their geographical locations.

PPA is implementing an on-going construction of Timako Port Development Project Phase 1 along the coast of Timako Hill in Cotabato City. However, funding of 90 million pesos for Short-term development project covers the construction of rock causeway and RORO ramp only. Additional funding for full construction of Short-term development project is required as soon as possible.

Figure 13.1-4 shows the ongoing construction of causeway and trestle of access way to Timako Port. In the original design of access way to the reclamation area of port, all portion of access from land to reclamation area was designed by rock mound type causeway but trestle type of structure is applied in the construction in order not to disturb the river stream at the mouth of Tamontaka river.



Source: Philippine Ports Authority

Figure 13.1-4 Construction of Part of Short-Term Development Plan of Timako Port (Under Construction)

13.2 Issues on Port Development

13.2.1 Cotabato Port

As earlier mentioned, Cotabato River Port along the Rio Grande de Mindanao is heavily silted and seaport routes turned out to be financially unsustainable and were eventually terminated. No loading/unloading cargo activities of the port can be seen in Figure 13.2-1.

Source: Survey conducted by the JICA Study Team

Figure 13.2-1 Present Cotabato Port (No Port Operation on the Apron)

13.2.2 Polloc Port

(1) Continued Revitalization of Polloc Port

Over the years, the level of port operation has shrunk. This resulted to shippers in Bangsamoro patronizing other ports in Mindanao, particularly the Sasa Port of Davao, Macabalan Port of Cagayan de Oro and Makar Wharf of General Santos. A revitalized port will capture back port traffic including the shipping of agricultural exports (e.g. banana, mango, palm oil products, industrial cassava, rubber, corn, etc.) to BARMM.

(2) Urgent Repair of Steel Pipes Supporting the Concrete Deck

The BDP-2 undertook a comprehensive examination of the condition of port structure. In general, the main berth structure is in fine condition despite more than four decades of service operation after its completion (constructed in 1977), with the exception of some minor damage/deterioration. However, the upper portions of the steel pipe piles supporting the concrete deck have corroded. In addition, the concrete cover of beams of the wharf have been peeled off, with the exposed re-bars showing signs of corrosions as well. To this day, these have not been repaired. It is important to repair the pile head and beam immediately to protect the structure from further corrosion. Detailed photos of pile head and concrete beams are shown on Figure 13.2-2 and Figure 13.2-3 as indicated below;

Source: Survey conducted by the JICA Study Team

Figure 13.2-2 Corrosion of Steel Pipe Piles

Source: Survey conducted by the JICA Study Team

Figure 13.2-3 Corroded Steel Bars of Concrete Beam

(3) Encroachment Inside the Polloc Freeport Ecozone

Polloc Port has a plan to further expand the facility in 2028 (short-term plan) and 2043 (long-term plan). The area dedicated for expansion will affect the informal settlers. According to the 2018 FS, about 30 to 40 households will be affected. Accordingly, REZA has secured a relocation site in coordination with the Parang Municipality.

Source: Prepared by the JICA Study Team based on Aerial Photo of Polloc Port Administration

Figure 13.2-4 Informal Settlers in Short-term Development Plan

(4) Attracting More Locators in the PFEZ

In 2010, through a law called the ARMM Special Economic Zone Act of 2003, Polloc Port was declared a free port/zone, making it a non-Customs territory. Investors are granted tax exemptions, as well as duty free importations. Due to various factors including peace and order, only one (1) locator - Power Up Ventures (Petroleum) currently operates within the free zone. Vigorous promotion of the free zone would be needed to attract more locators and eventually utilize the remaining available space within the 119-hectare lot of the PFEZ.

(5) Piracy at Sulu and Celebes Sea

International trade within the region has been greatly affected by security issues in the Sulu and Celebes Sea (Anuar, et. al, 2018). In 2017, a Vietnamese cargo ship was hijacked 20 nautical miles north of Tawi-tawi, while on its way to deliver 4,500 MT of cement to Polloc Port. Successive incidences of piracy by the Abu Sayyaf Group (ASG) have caused several international shipping companies to temporarily halt operations.

(6) Urgent Projects

Port Administration of BARMM revealed that aside from the projects included in the 2018 masterplan, additional projects have been identified to urgently address the increasing freight volume handled by the port and the subsequent increasing demand for warehousing as indicated in Table 13.2-1.

Table 13.2-1 Urgent Project for Polloc Port

No.	Description	Cost (Mil. PhP)
1	Construction of 1-unit industrial warehouse of at least 5,520 sq. m. (L = 120 m., W = 46 m.)	120.0
2	Installation of new complete electronics weighbridge station with a capacity of 70 tons	3.0

13.2.3 Timako Port

(1) Securing fund to complete the Timako Port Project

The committed fund of PhP 90 Million from the PPA corporate funds is just for Short-term Development Plan, which only covers the construction of rock causeway (296 m) and a RORO ramp. Securing additional fund for the construction of additional facilities to complete the project is necessary.

(2) Defining the role sharing between Timako Port and Polloc Port

It is important to initiate discussion amongst related government agencies regarding the role sharing between the two ports, with the goal of synchronizing operations. A possible demarcation may involve one port handling international freight (if there is sufficient volume) and the other port handling regional and national freight. Another way of defining the roles of the two ports is by dedicating one port for containerized cargoes, and the other for bulk cargoes. These possible demarcations would highly depend on the volume and type of cargoes imported to/exported from the hinterland area.

13.3 Objectives for Port Development

13.3.1 Polloc Port

- To fully operationalize the Polloc Port as a Freeport by virtue of Proclamation No. 1 dated March 15, 2010 pursuant to MMA Act 154.
- To establish a sound and balanced industrial, economic and social development that will stimulate the flow of business activity at the Polloc Freeport by 2022.

13.3.2 Timako Port

- To substitute Timako Port for Cotabato port
- To support the development of agriculture, fisheries, forestry, industry, trade, tourism, any kinds of investments, etc. in Cotabato city
- To establish access to Timako Port easier than Polloc Port: The access to Timako Port from the city proper via the national road traversing the city and an access road (part of the circumferential road system in the city) is about 10 kms. long. On the other hand, the access to Polloc Port is about 25 kms.

13.4 Strategies for Port Development

13.4.1 Polloc Port

In order to fully operationalize the port, strategies for port development of Polloc Freeport and Ecozone are as below;

1) To operationalize the Freeport of Polloc and utilize the Polloc Special Economic Zone as socio-economic as well as investment hub of BARMM.
2) To improve the commercial image of Polloc Port in the business community.
3) To undertake an aggressive and sustainable marketing program.
4) To increase revenue generation.
5) To maximize the resources and authority of the BARMM in support of the Polloc Port's Plans and Programs.
6) To provide plans and programs that will capacitate and professionalize port's personnel.

13.4.2 Timako Port

The following are considered as strategies/advantages for port development of Timako Port;

1) Prior to the construction of the Polloc Port, Cotabato City has been one of the major trading centers in western Mindanao. The City has been continuously progressing, although its development is being hindered by the lack of a separate and modern port facility in order to attain the progressive economic status of its contemporary cities within Mindanao Island.

2) The port operation at the existing river port continuously deteriorates due to the high rate of siltation of the Rio Grande River. However, the dredging of the river will entail very high cost. This is the main reason why the local officials of Cotabato City stress the need to construct a separate modern port facility at the heart of the city, rather than incur huge cost just to maintain the existing substandard port facility.
3) The Office of the President is pushing the DPWH for the fast tracking of the construction of both the circumferential and diversion road, which would serve as the access road to the proposed Timaco Port project. This serves as a complementary project that would reduce the total implementation cost of the port project with the separate budget for the implementation of the port access road.
4) The land acquisition for the MCRAIC has already been completed and it is expected to be operational in near future. As expected, this would spur the industrial growth of Cotabato City, particularly if provided with a nearest and efficient port facility.
5) The big traders and businessmen in Cotabato City, who are incurring additional hauling costs in shipping their products thru a bigger port in Davao, Cagayan de Oro and General Santos cities, are strongly pushing for the immediate implementation of the project.

13.5 Port Sector Plan and Estimated Cost

13.5.1 Polloc Port Future Development Plans (Short-term plan and Long-term plan)

In 2018, a feasibility study entitled “Technical Feasibility Study and Master Planning for the Upgrading of Polloc Port” was undertaken by a local consultant through the efforts of the DPWH-ARMM. Basically, the study covered short-term and long-term plans. To execute the identified projects in both plans, about PhP 2.21 Billion would be needed to cover construction costs and indirect costs (Detailed engineering cost, Tender assistance cost, Project administration cost, etc.). Accordingly, the number of ship calls in Polloc Port is projected to increase to 380 ships per year by 2028, handling a total annual cargo volume of 1.3 million MT. By 2043, these figures are expected to further increase to 1,152 vessels per year, carrying an annual cargo volume of 3.4 million MT.

In anticipation of the future short-term (2028) demand, an extension of the berthing facilities by around 200 linear meters was proposed. This would allow the port to accommodate four (4) general cargo ships and one (1) container vessel at the same time. In addition, the existing wharf will have to be rehabilitated to facilitate more efficient berthing and cargo handling. The components of the proposed project development include the following:

- *Expansion of existing wharf* – this involves the construction of additional berthing facilities by 200 meters (35 meters of apron) to accommodate projected volume by 2028
- *Rehabilitation and upgrading of existing wharf* – this requires the reconstruction of fender beams, rehabilitation of concrete piles and replacement of worn out bollards

- *Dredging and reclamation works* – dredging along the harbor basin will be carried out to a depth of about 11 meters, allowing the port to accommodate foreign cargo and container vessels of about 20,000 to 25,000 DWT
- *Bulk terminals* – bulk terminals of about two (2.0) hectares each shall support the import and export of bulk commodities such as fuel and other oil products, corn, cement, and sand (commonly exported to BARMM island provinces)
- *Rockworks* – rockworks shall be undertaken to provide the reclaimed land protection and stability from strong waves
- *Gated complex* – two gate complexes with two lanes (width: 3.25 m.) each have been proposed to facilitate easier flow of trucks in and out of the port

The summary of the required port facilities and project cost are shown in Table 13.5-1 and Table 13.5-2 respectively**.** The site development plans for the short and long-term are shown in Figure 13.5-1 and Figure 13.5-2, respectively.

Table 13.5-1 Summary of Required Port Facilities (Both Short-term and Long-term Plans)

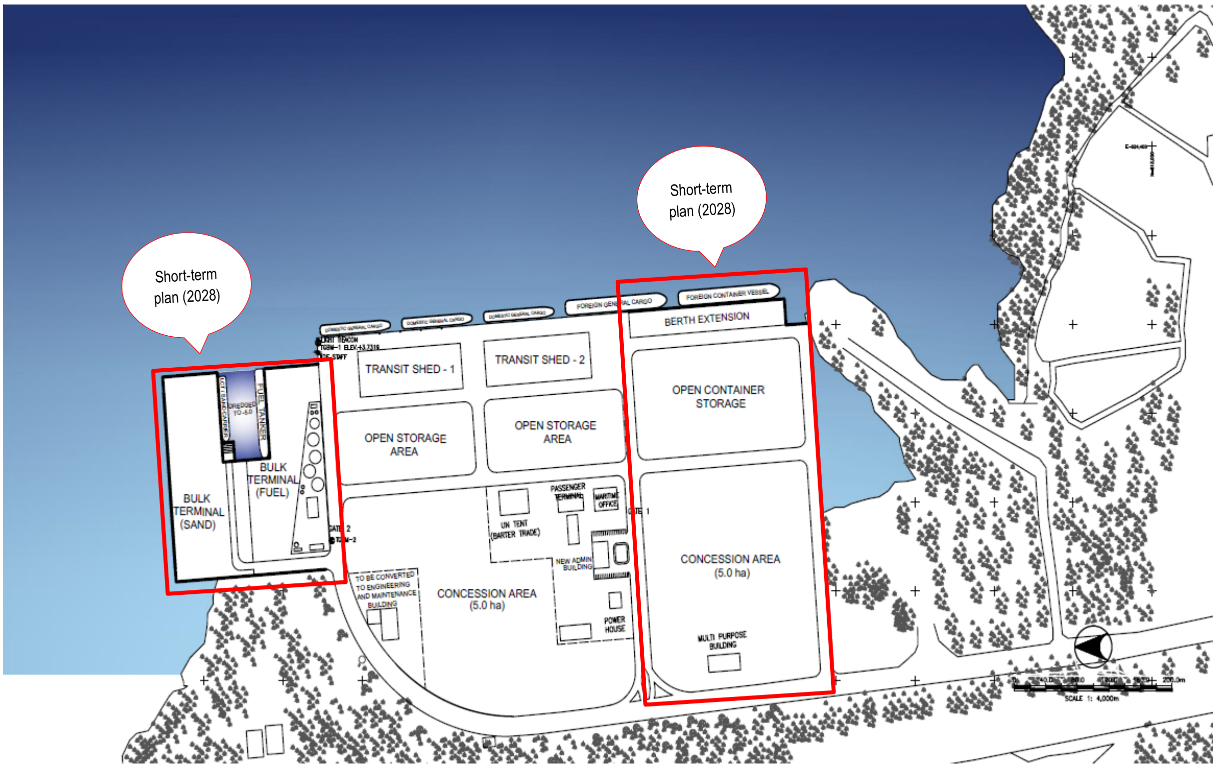
Facilities	**Scale of port development**	
	Short-term plan (design year: 2028)	**Long-term plan (design year: 2043)**
Berth length (meters)		
a. Container berth	88.00	110.00
b. General cargo berth	486.00	780.00
c. Total	574.00	890.00
d. Current facilities	400.00	400.00
e. Required facilities	174.00	490.00
Container yard (TEU slots)		
a. Domestic containers	100.00	140.00
b. Foreign containers	42.00	671.00
c. Total	142.00	811.00
Closed storage (sq. m.)		
a. Domestic cargo	2,200.00	4,400.00
b. Foreign cargo	7,300.00	6,500.00
c. Total	9,500.00	10,900.00
d. Current facilities	13,000.00	13,000.00
e. Required facilities	-	-
Open storage (sq. m.)		
a. Domestic cargo	2,000.00	5,300.00
b. Foreign cargo	6,630.00	7,940.00
c. Total	8,630.00	13,260.00
d. Current facilities	15,000.00	15,000.00
e. Required facilities	-	-
Gated complex		
a. Number of gates	2	2
b. Number of lanes	4	5

Source: Technical Feasibility Study and Master Planning for the Upgrading of Polloc Port (Oct. 2018)

Table 13.5-2 Summary of Preliminary Project Cost (Both Short-term and Long-term Plans)

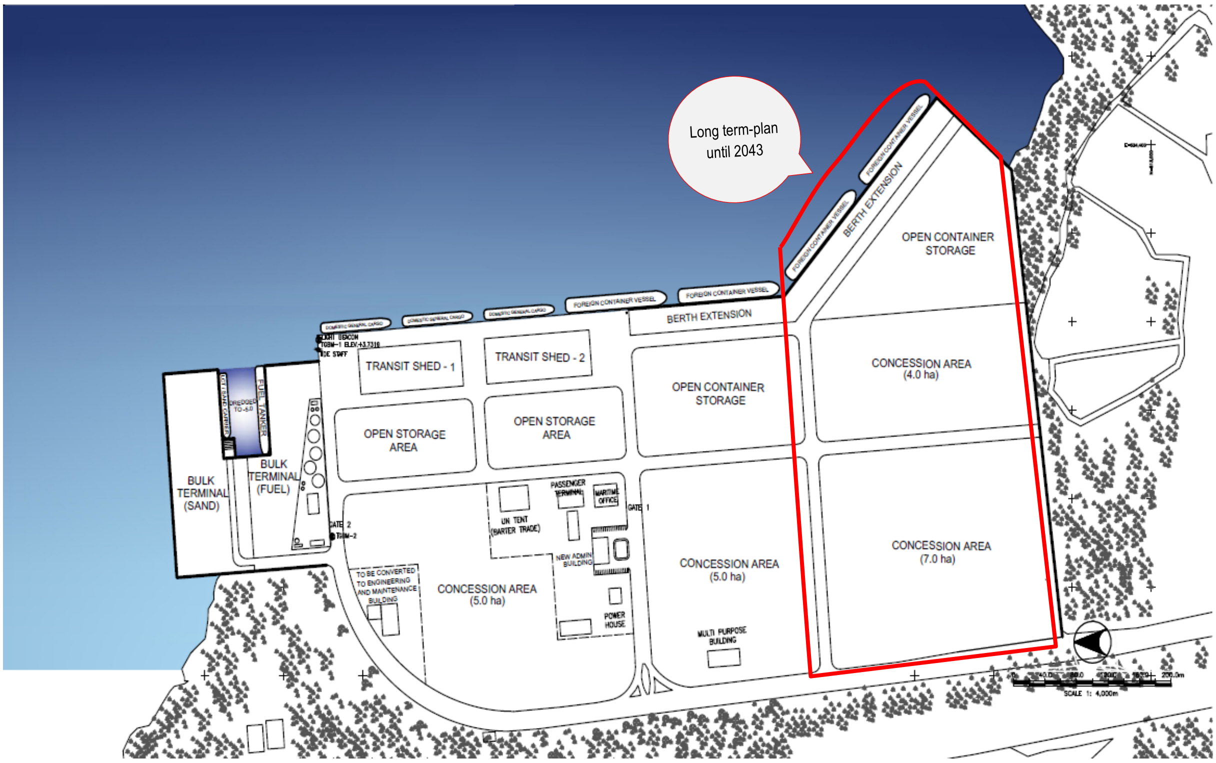
Item of work		Amount (PhP)
I. Preparatory works		**19,746,776.00**
Item 1	Mobilization/Demobilization	8,450,000.00
Item 2	Temporary works	9,946,776.00
Item 3	Site survey	1,350,000.00
II. Basic port facilities		**1,886,894,736.00**
Item 1	Foreign container berth expansion	829,862,900.00
Item 2	Rehabilitation/upgrading of existing wharves	153,500,000.00
Item 3	Bulk vessel berth	206,277,336.00
Item 4	Dredging works	198,750,000.00
Item 5	Reclamation works	175,000,000.00
Item 6	Rockworks	323,504,500.00
III.Civil works		**152,862,025.18**
Item 1	Pavement and landscaping	92,781,250.00
Item 2	Drainage and sewerage system	22,588,464.46
Item 3	Water supply (fresh/sea water)	37,492,310.72
IV. Building works		**52,671,147.80**
Item 1	Administration office building	47,983,372.00
Item 2	Guard house	1,837,775.80
Item 3	Gates	2,850,000.00
V. Port lighting/telecommunication works		**65,000,000.00**
Item 1	Port lighting/telecommunication	65,000,000.00
VI.Detailed Engineering Design		**34,500,000.00**
Item 1	Detailed Engineering Design (inc. site investigation works)	34,500,000.00
Total		**2,211,674,684.98**

Source: Technical Feasibility Study and Master Planning for the Upgrading of Polloc Port (Oct. 2018)



Source: Technical Feasibility Study and Master Planning for the Upgrading of Polloc Port (Oct. 2018)

Figure 13.5-1 Short-term Development Plan for Polloc Port (2028)



Source: Technical Feasibility Study and Master Planning for the Upgrading of Polloc Port (Oct. 2018)

Figure 13.5-2　Long-term Development Plan for Polloc Port (2043)

13.5.2　Timako Port

Port activity at the Cotabato river port has diminished significantly in the last decade due to the problem of sedimentation of Rio Grande de Mindano River. The minimal provision for development and the need of the local government and merchants to have a port capable of accommodating bigger vessels suggested that an alternative port be constructed along the Timako Hill. Based on this, Feasibility Study for Timako Port was conducted in December 2006 by PPA. The development in the Timako Port has been found to be technically, economically and financially feasible in the findings and recommendation of the said Feasibility Study (FS). Brief description from the Timako Port FS is excerpted as follows;

(1)　Natural and Physical Environmental

The major natural and physical environmental is summarized in the table below.

Table 13.5-3 Natural and Physical Environment of the Timako Port

Parameters	Details
a. Wind	According to the wind rose analysis for General Santos, South of Cotabato taken from the daily data for the period 1971–2000, the annual prevailing wind direction is south, 43.5% with a wind speed of 1 to 4 mps. followed by north of 21.4% with a wind speed of 1 to 4 mps. Calm conditions were observed at 0.7 percent of the time.
b. Wave	The proposed site is exposed to wave action from westerly wind (Moro Gulf) and partially exposed from WNW wind also from Moro Gulf. Design wave should be studied for the operational condition of the port and structural of the port facilities as well considering the tropical depression, tropical storm and typhoon.
c. Current	The ebb has a velocity of about 2 knots and the flood about 0.50 knots. Currents on the proposed site (Timaco) will be determined from NAMRIA charts.
d. Water depth of the approach and berth of the port	Water depth around the port is suitable for approach to the port and berthing of 5,000 to 8,000 DWT cargo ship but dredging of seabed is necessary for RORO/Ferry vessels to obtain the required water depth of -6.0m.
e. Siltation issues	The mechanism of Siltation in the entire project (harbor) area should be assessed taking into consideration its direction, volume and supply source. The result of this analysis will essentially be a significant factor in the design and determination of the location and alignment of the entrance channel and berthing direction on the concerned port district.
f. Accessibility to the port	Timako Port is accessible by land from Cotabato City through about 13 km 2-lane concrete paved road except port entrance area.

Source: FS of Timako Port 2006 prepared by PPA

(2) Traffic Projections

Based on the December 2006 FS of Timako Port, traffic projection was conducted to determine the port facilities and cost estimate of the project as well as economic and financial feasibility studies. The identified port hinterlands of Timako Port covers portions of the provinces of Maguindanao, Cotabato and Sultan Kudarat. However, the province of Lanao del Sur is nearer to Iligan and Polloc Ports, thus, it was not included in the Timako Port hinterlands.

The analysis of future port traffic flow for the proposed new Timaco Port is categorized by type of traffic for the purpose of determining appropriate approach and methodology for traffic forecasting. Based on the analysis of the existing traffic flow and the future potentials of the new port project, three types of traffic were identified to compose the total future traffic for the port project: the normal, diverted and generated traffic. The characteristics of each type of traffic are discussed below:

1) Normal Traffic - By definition, normal traffic occurs independently even without the proposed improvement of an existing transport facility. The future traffic demand results from the natural growth in population and economic activities within the project area. Thus, for this analysis, normal traffic is the existing port traffic at the Cotabato river port.

2) Divertible Traffic – This is basically the volume of port traffic that is presently using other ports, in view of the constraints in using the Polloc Port and the limitations of the existing river port, which is expected to divert to Timaco Port project once it is improved.
3) Generated Traffic – This is defined as the new traffic resulting from the implementation of the project, which may be in the form of increased traffic arising from the increased economic activity in the hinterland as a result of construction of the new port. This type of traffic is difficult to quantify in the absence of a concrete basis for estimation. However, the only identified new traffic to be generated in the future upon implementation of the port project is the new traffic that will be created from the opening of the MCRAIC. Although the opening of the MCRAIC operation could not be attributed solely to the implementation of the port project, it is certain that new traffic arising from its operation will be using the port project in the future.

The resulting projected cargo and passenger traffic by port project from 2006 to 2018 is summarized in Table 13.5-4 below.

Table 13.5-4 Summary of Projected Cargo and Passenger Traffic of Timako Port

Year	Total Cargo Throughput (m.t.)	Total Passenger Traffic	Year	Total Cargo Throughput (m.t.)	Total Passenger Traffic
2006	839,379	83,642	**2019**	1,532,542	200,744
2007	846,672	85,541	**2020**	1,634,072	219,973
2008	854,071	87,483	**2021**	1,655,733	228,992
2009	861,580	89,468	**2022**	1,669,339	238,380
2010	869,200	91,499	**2023**	1,697,127	248,154
2011	877,075	93,576	**2024**	1,718,492	258,328
2012	885,072	95,701	**2025**	1,740,358	268,920
2013	971,749	107,926	**2026**	1,763,091	279,946
2014	1,060,738	120,994	**2027**	1,777,368	291,423
2015	1,152,123	134,951	**2028**	1,809,247	303,372
2016	1,246,255	149,850	**2029**	1,834,441	315,810
2017	1,330,522	165,743	**2030**	1,860,387	328,758
2018	1,433,502	182,688			

Source: FS of Timako Port 2006 prepared by PPA

(3) Port Development Plan

1) Site Selection

In order to select the most appropriate location of the port, three potential port sites were selected and analyzed, i.e. opposite Timako Hill, north of Timako Hill and south of Timako Hill. Based on the above analysis, opposite Timako Hill was the best alternative although not an ideal site considering westerly wind generated wave and partially refracted southwest monsoon generated waves regularly enters the potential harbor area.

2) Scale of Port Development (Timako Port Master Plan for Year 2036)

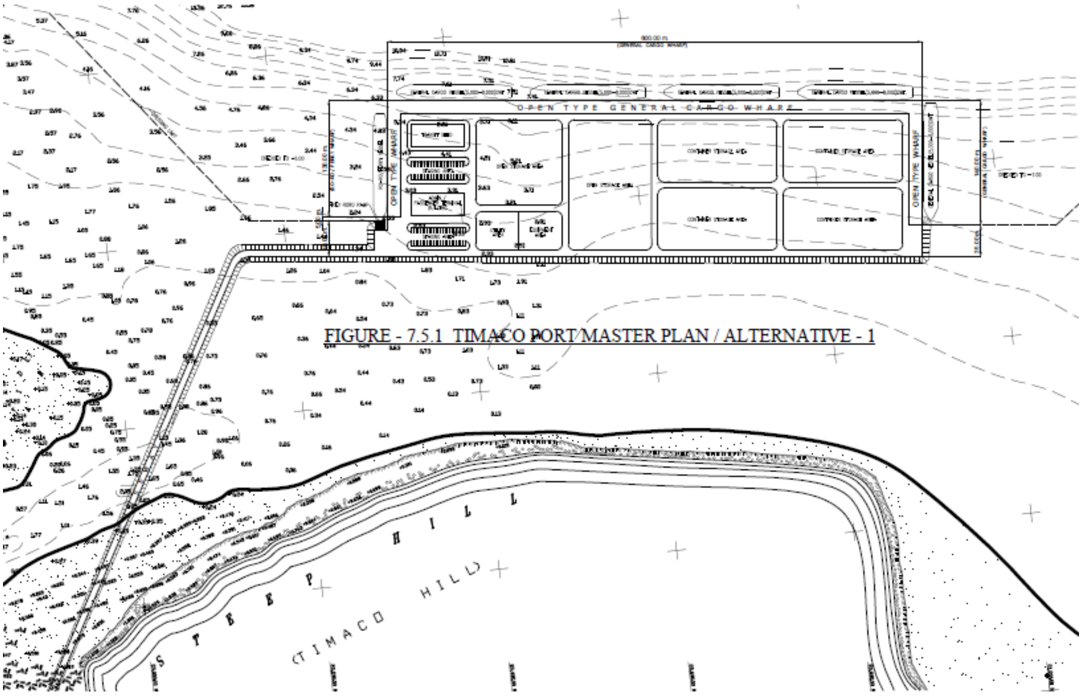
The scale of the facilities of the port will be determined by the parameter of design cargo and passenger traffic volume, vessel type and size, cargo handling equipment, yard stockpile method, utilization of building, necessary utilities, etc. Port Master Plan was made for year 2036.

Three alternative port layouts were developed and designated as Alternative Nos. 1, 2, and 3. Comparative analysis were prepared for all three alternatives citing advantages and disadvantages in terms of efficient port operation, cost of development, flexibility of the port layout, etc. Based on the analysis and considering the advantages and disadvantages of the three alternative port layouts, Alternative-1 has the overwhelming advantage and is therefore recommended as shown in Table 13.5-5 and Figure 13.5-3.

Table 13.5-5 Summary of Required Port Facilities for Year 2036

Description of the Facilities	Scale of the Facilities
1. Port Facilities	
1.1 Open Type Reinforced Concrete Wharf	15.0 m x 870.0 m
1.2 Fixed Ro-Ro Ramp (Reinforced Concrete)	10.0 m x 12.0 m
1.3 Rock Causeway	700.0 lineal meter
1.4 Rock Bulkhead/ Revetment	1,550.0 lineal meter
1.5 Reclamation (Port Back-up Area)	9.20 hectares
2. Support Facilities	
2.1 Passenger Terminal Bldg.(2-Storey)	2,000.0 sq. m.
2.2 Transit Shed	1,500.0 sq. m.
2.3 Equipment/ Maintenance Area	2,100.0 sq. m
2.4 Utility Area	2,100.0 sq. m
2.5 PPA Office/Arrastre	500.0 sq. m
2.6 Port Lighting, Water Supply, Drainage	Lot
2.7 Open Storage Area (Break Bulk)	18,500.0 sq. m.
2.8 Container Storage Area	38,000.0 sq. m.
2.9 Service Roads	19,800.0 sq. m

Source: FS of Timako Port 2006 prepared by PPA



Source: FS of Timako Port 2006 prepared by PPA

Figure 13.5-3 Master Plan of Timako Port Year 2036

3) Scale of Port Development (Timako Port Short-Term Development Plan for year 2012)

Short-term development plan at 2012 was prepared in the FS prepared by PPA in 2006. The scales of the facilities for short-term development plan are enumerated hereunder.

Table 13.5-6 Summary of Short-Term Development Plan for Year 2012

Description of the Facilities	Scale of the Facilities
1. Port Facilities	
1.1 Open Type Reinforced Concrete Wharf	15.0 m x 430.0 m
1.2 Fixed Ro-Ro Ramp (Reinforced Concrete)	10.0 m x 12.0 m
1.3 Rock Causeway	700.0 lineal meter
1.4 Rock Bulkhead/ Revetment	930.0 lineal meter
1.5 Reclamation (Port Back-up Area)	4.50 hectares
1.6 Dredging	87,000 cu.m
2. Support Facilities	
2.1 Passenger Terminal Bldg.(2-Storey)	2,000.0 sq. m.
2.2 Transit Shed	1,500.0 sq. m.
2.3 Equipment/ Maintenance Area	2,100.0 sq. m
2.4 Utility Area	2,100.0 sq. m
2.5 PPA Office/Arrastre	500.0 sq. m
2.6 Port Lighting, Water Supply, Drainage	Lot
2.7 Open Storage Area (Break Bulk)	8,500.0 sq. m.
2.8 Container Storage Area	17,000.0 sq. m.
2.9 Service Roads	8,900.0 sq. m

Source: FS of Timako Port 2006 prepared by PPA

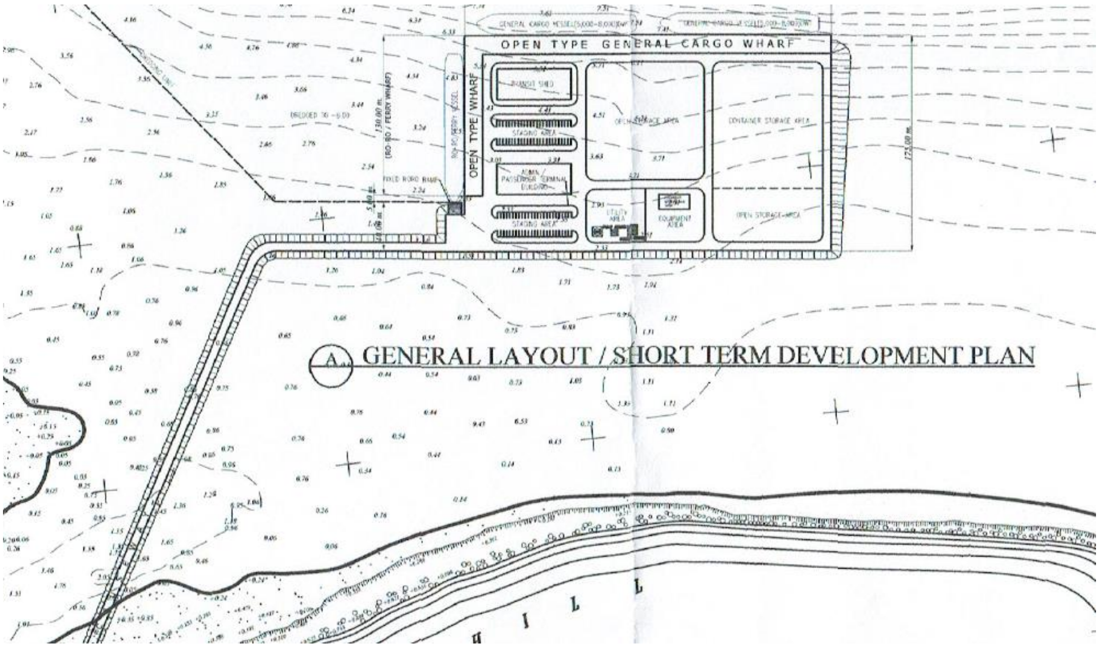
4) Project Cost

The project cost and development plan for short-term for 2012 are shown in Table 13.5-7 and Figure 13.5-4, respectively.

Table 13.5-7 Construction Cost of Short-Term Development of Timako Port

Item No.	Description	Unit	Qty	Unit Cost	Amount (Pesos)
1.0	General Requirements	l.s.	1	21,000,000	21,000,000
2.0	Rockworks (Bulkhead/Causeway)				
2.1	1.00 Ton/pc. Armor Rocks	m^3	16,860	3,750	63,225,000
2.2	0.60 Ton/pc. Armor Rocks	m^3	11,320	3,050	34,526,000
2.3	100 Kg/pc. Secondary Rocks	m^3	7,050	2,200	15,510,000
2.4	60 Kg/pc. Secondary Rocks	m^3	4,930	2,000	9,860,000
2.5	1-5 Kg/pc. Core Rocks	m^3	58,520	1,050	61,446,000
2.6	Retaining Wall/Concrete Curb				
2.6.1	25 Mpa Concrete	m^3	2,180	7,700	16,786,000
2.6.2	275 Mpa Reinforcing steel	Ton	220	67,000	14,740,000
2.6.3	15 Mpa Levelling Concrete	m^3	65	4,000	260,000
2.7	Filter Fabric	m^2	4,830	500	2,415,000
2.8	200 mm thick Conc. Pavement	m^2	5,070	2,800	14,196,000
3.0	Dredging and Reclamation				
3.1	Dredging of Harbor Basin (Ro-Ro/Ferry Berth)	m^3	87,000	250	21,750,000
3.2	Dry Fill	m^3	190,000	370	70,300,000
4.0	Wharf Works (General Cargo and Ro-Ro/Ferry)				
4.1	Fabricate 0.45 m x 0.45 m PSC Pile	l.m	22,400	4,250	95,200,000
4.2	Pitch and Drive 0.45 m x 0.45 m PSC Pile	l.m	22,400	2,250	50,400,000
4.3	Reinforced Concrete Deck				
4.3.1	25 Mpa Concrete	m^3	3,400	8,700	29,580,000
4.3.2	275 Mpa Reinforcing Steel Bars	Ton	550	67,000	36,850,000
4.4	V- Type Rubber Fender (V500 x 2000mm)	Set	70	230,000	16,100,000
4.5	T-Type Mooring Bitts / Bollards	Set	26	95,000	2,470,000
4.6	Fixed Ro-ro Ramp	l.s.	1	5,500,000	5,500,000
5.0	Buildings				
5.1	Administration / Passenger Terminal Building	m^2	2,400	24,000	57,600,000
5.2	Transit Shed	m^2	1,500	14,000	21,000,000
5.3	Equipment / Maintenance Shed	m^2	300	14,000	4,200,000
6.0	Roads and Pavement				
6.1	200 mm thk PCCP incl. Base, Sub-base Course	m^2	9,500	2,750	26,125,000
6.2	Std. Road Curb and Gutter incl. 1.50 m. sidewalk	l.m	2,900	3,000	8,700,000
7.0	Utilities				
7.1	Water Supply	l.s.	1	19,500,000	19,500,000
7.2	Drainage System	l.s.	1	16,500,000	16,500,000
7.3	Port Lighting	l.s.	1	14,600,000	14,600,000
8.0	Landscaping, Fence, Gate and Misc.	l.s.	1	16,000,000	16,000,000
	TOTAL CONSTRUCTION COST				**766,339,000**

Source: FS of Timako Port 2006 prepared by PPA



Source: FS of Timako Port 2006 prepared by PPA

Figure 13.5-4 Short-Term Development Plan of Timako Port

5) Economic Analysis

Economic analysis was conducted in the Timako port FS report. The purpose of the economic analysis is to determine the economic feasibility of the project from the viewpoint of the national economy. The economic feasibility of the project is measured through the three basic economic feasibility indicators: Economic Internal Rate of Return (EIRR), Net Present Value (NPV), and benefit-cost ratio (B/C Ratio).

Sensitivity analysis was also undertaken for the project to help identify the key variables that can influence the economic viability of the project. It involves recalculating the project economic evaluation results for different values of major variables to which the project viability may be sensitive. The sensitivity analysis on the changes in costs and benefits was performed under the following scenarios:

1) Base costs plus 10% and base benefits;
2) Base costs and base benefits minus 10%; and
3) Base costs plus 10% and base benefits minus 10%.

The result of sensitivity analysis showed the following results:

Table 13.5-8 Results of the Economic Feasibility of Timako Port

	EIRR	NPV	B/C
Scenario 1)	20.0	224.98	1.41
Scenario 2)	18.6	187.00	1.38
Scenario 3)	17.4	107.18	1.22

Source: FS of Timako Port 2006 prepared by PPA

Based on the above result of economic evaluation, the proposed construction of the Timaco Port is found to be highly economically viable and that it would provide substantial contribution to the national economy.

6) Financial Analysis

Financial analysis was conducted in the Timako Port FS report a) to determine the financial viability of the Timako Port from the total project investment approach; and b) to determine the extent to which private sector participation can be feasible from the private sector's point-of-view. The financial evaluation involves an analysis of the existing financial revenues, expenditures of the port, tariff rates being charged, project scope and costs, potential investment/financing plan, revenue stream analysis, operation and maintenance cost, financial projections and results and sensitivity analysis. Two major financial indicators are used to determine the viability of the port using the following: 1) Financial Internal Rate of Return (FIRR), and 2) Financial Net Present Value (FNPV). Sensitivity analyses will also be conducted for financially viable ports under the following scenarios:

1) Costs increase by 10%
2) Revenues decrease by 10%
3) Costs increase by 10%; revenues decrease by 10%

The Financial Internal Rate of Return of the proposed development of the Port of Timako is 5.19% for project viewpoint. This is greater than the weighted average cost of capital of 1.9% and therefore considered financially viable. Sensitivity analyses were likewise conducted as shown in Table 13.5-9. And the results of FIRR for 10% of PPA's equity potion is presented in Table 13.5-10.

Table 13.5-9 Results of the Financial Evaluation (Project Viewpoint)

Scenario	FIRR	NPV
Base Case	5.19%	569,942
1) 10% Increase in Costs	4.14%	408,416
2) 10% Decrease in Revenues	4.03%	351,422
3) Costs + 10%; Revenues less 10%	3.00%	189,895

Source: FS of Timako Port 2006 prepared by PPA

Table 13.5-10 Results of the Financial Evaluation (Equity Viewpoint)

Scenario	FIRR	NPV
Base Case	3.70%	297,207
1) 10% Increase in Costs	2.68%	135,681
2) 10% Decrease in Revenues	2.41%	78,686
3) Costs + 10%; Revenues less 10%	1.39%	(82,840)

Source: FS of Timako Port 2006 prepared by PPA

i. Even in the worst-case scenario where costs increase by 10% and revenues decrease by 10%, the project is still financially viable.

ii. From the equity viewpoint, the base case still produces an FIRR greater than the 1.9% WACC and is considered viable but only marginally as the analysis shows that this perspective makes the project less profitable when costs increase by 10% and/or revenues decrease by 10%

However, since the economic impact of the project (see Economic IRR) is very desirable, the project is deemed also financially viable and the proponent can absorb the financial risks in order to promote the economic gains.

13.6 Selection of High Priority Project

13.6.1 Project Development Prioritization Criteria

Followings are the points of the project prioritization criteria:

a. There is a new demand to be handled in the hinterland such as new industrial or commercial development.
b. In case the actual cargo volume handled is expected more than the capacity of the port and congested the traffic in the port.
c. Berth occupancy rate is more than recommended ratio and increasing the waiting time of vessels to berth.
d. Handling capacity of each facility is more than its capacity.
e. New type of cargoes to be handled in the port.
f. Due to the deterioration of the facilities, modernization is needed to meet the future demands of the increasing size of vessel or equipment is necessary.
g. To increase the port efficiency and productivity such as containerization.

13.6.2 Project Profile of High Priority Projects

(1) Polloc Port

1) Necessity of the expansion project

Berth occupancy is a one of the parameters to determine the utilization of port facilities. It is expressed in terms of the ratio between the actual meter-hours spent by vessels at the berth, and the maximum available meter-hours per year. The berth occupancy rate (BOR) is computed through the following equation:

$$\mathrm{BOR} = \frac{\text{actual service time}}{\text{maximum berth time}} = \frac{\text{ship calls * ave. service time * ave. length of vessels * spacing factor}}{\text{effective total berth length * 8,760 hours per year}}$$

The United Nations Conference on Trade and Development (UNCTAD) has released a list of suggested optimal BOR (Table 13.6-1) based on the number of available berths at the port.

Table 13.6-1 Recommended BOR

Number of available berths	1	2	3	4	5	6	7	8	> 9
Recommended BOR (%)	45%	50%	55%	60%	63%	65%	67%	69%	70%

Source: United Nations Conference on Trade and Development (UNCTAD)

The number of available berths at Polloc Port was computed using historical data provided by the PFEZ. The current berth length is 400 meters and has not been extended since the port was completed in 1980. On the other hand, the average length of vessels catered by the port has increased from 90 meters in 2013 to 120 meters in 2017. Using this information, the increased length of ships resulted in a lower effective number of berths (i.e. maximum number of vessels that the berth can accommodate at the same time) from four (4) in 2013 to three (3) in 2017. The computed BOR of Polloc Port in 2013 was 43.51%, while the allowable BOR for ports with four available berths is 60%. This suggests that the port has been underutilized when it reopened.

In 2017 and 2019, BOR increased at 57.76% and 56.83%, which is beyond the optimal value recommended by UNCTAD for ports with three available berths (55%). This indicates that congestion is starting at Polloc Port.

On the other hand, construction of 50 meters extension of marginal wharf is ongoing at Polloc Port in 2020. Due to this extension, the total wharf length will be 450 meters long and four berths are available in Polloc Port instead of three in 2019. Figure 13.6-1 below shows the construction of the extension.

Source: Prepared by the JICA Study Team based on Photo of Polloc Port Administration

Figure 13.6-1 Extension of 50m of Marginal Wharf

Based on the assumption that the cargo volume of 2020 is at the same scale of that in 2019 (about 610,000 metric ton per annum) and effective number of berths will be four (4) due to 50m expansion, the computed BOR of Polloc Port in 2020 is 42.62%, while the allowable BOR for ports with four available berths is 60%. This suggests that the expansion of 50 meters of berth has big advantages for port operation in 2020 as shown Table 13.6-2.

Table 13.6-2 BOR of Polloc Port in 2013 to 2025

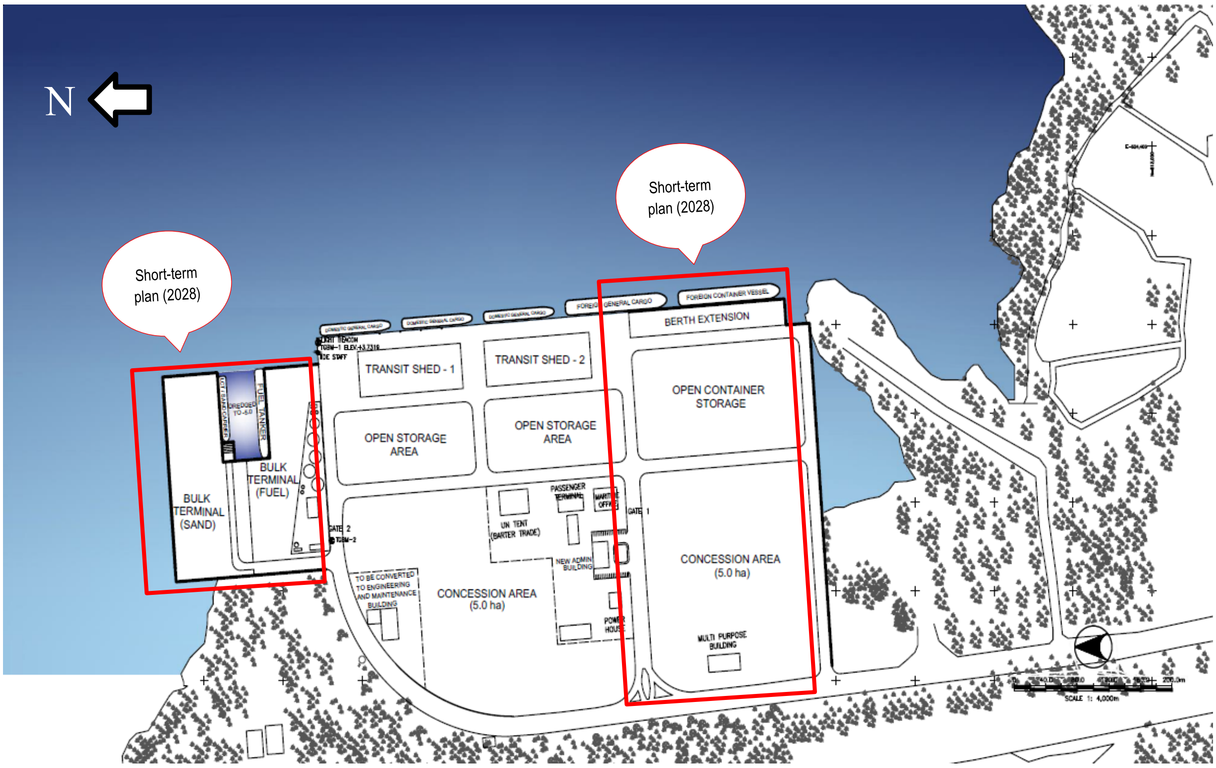
	2013	2017	2019	2020	2025
BOR (%)	**43.51**	**57.76**	**56.83**	**42.62**	**62.88**
Actual service time (m-hr.)	15,246	15,179	14,934	14,934	22,034
Maximum berth time (m-hr.)	35,040	26,280	26,280	35,040	35,040

Source: Updated the FS of Timako Port 2006 by the JICA Study Team

Same calculation for the cargo volume of 900,000 m.t. per annum in the near future (2025?) was made, the computed BOR of Polloc Port is 62.88%, which is more than the allowable BOR of 60%. This suggests that another expansion of berth will be necessary to prevent the low productivity of the port when the cargo volume exceed the 900,000m.t. per annum.

2) Project Profile of High Priority Projects (FS of Short-term Development Project)

As discussed in the previous clause, the throughput of cargoes of Polloc Port will reach 900,000 m.t. around 2025 near future and considering the time of pre-construction period, FS study of Short-Term Development of Polloc Port should be started as soon as possible. According to the Short-Term Development Plan, additional 174 meters berth is required and 50 meters extension have been provided as of now. Reserved area for container yard and open area for sand stockpile have been already available in the existing backup area. Therefore, bulk terminals for sand and fuel which located north of Polloc Port are urgently necessary in order to meet the demand of sand for construction because it is the major transportation commodity to Sulu and Tawi-tawi islands. These prioritization criteria should be taken into account in the FS report.



Source: Technical Feasibility Study and Master Planning for the Upgrading of Polloc Port (Oct. 2018)

Figure 13.6-2 Short-term Development Plan for Polloc Port (2028)

3) Urgent project

As stated before, the urgent additional projects have been identified by the administration of Polloc Port to urgently address the increasing freight volume handled by the port and the subsequent increasing demand for warehousing as below. These facilities are not considered big projects to require an FS but it is indispensable facilities to operate the port as efficient, economical and safely;

Table 13.6-3 Urgent Project for Polloc Port

No.	Description	Cost (Mil. PhP)
1	Construction of 1-unit industrial warehouse of at least 5,520 sq. m. (L = 120 m., W = 46 m.)	120.0
2	Installation of new complete electronics weighbridge station with a capacity of 70 tons	3.0

Source: Administration of Polloc Port

(2) Timako Port

1) Necessity of the development of Timako Port

Based on the FS prepared by PPA, Timako Port is economically and financially feasible, therefore, securing additional fund for the construction of remaining facilities for short-term development plan of Timako Port is necessary not only to complete the project but also enhance the infrastructure, investment, agri-industry and accelerate economic development.

2) Demarcation study of the roles for port operation between Timako and Polloc Ports

Distance between Timako Port and Polloc Port is 16.3 km only. In order to operate the port efficiently and financially feasible, demarcation of the roles of the two ports between Timako and Polloc Port is the most important, therefore, demarcation study should be conducted considering the hinterland, surrounding infrastructures, economy, industry, agri-fishery productivity, etc. with the coordination with the relevant agencies. Considerable roles of two ports are examined and presented as shown in Table 13.6-4 for reference, e.g.

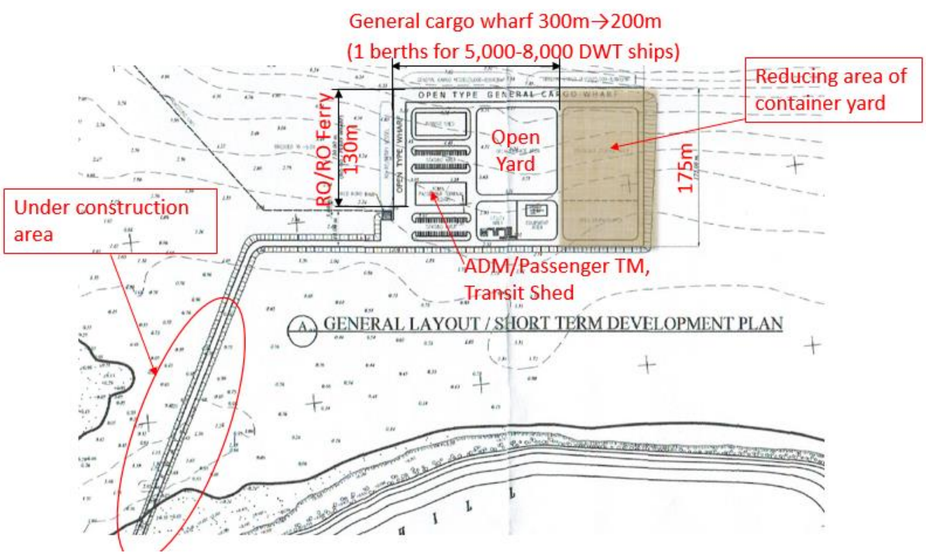
Table 13.6-4 Tentative Demarcation between Timako and Polloc Port

Port	Case 1	Case 2	Case 3
Timako Port	Local	Regional, Passenger	General commodity, break bulk, etc.
Polloc Port	International	International, Domestic	Container

Source: JICA Study Team

3) Scale down of Short-term Development Plan

In order to facilitate the additional fund, scale down of Short-term Development Plan is proposed as indicated in Figure 13.6-3. General cargo wharf of 100 m and container stacking yard are eliminated from Short-term Development Plan because container cargoes will not be handled at the beginning of the project due to the big investment compared with general cargoes for handling equipment such as crane, forklift, chasses as well as liner network. It is recommended that RORO ramp will be provide for general cargo wharf as well to maximize the flexibility of the wharf operation. The proposed Short-term Development Plan will be economical and early completion of the project.



Source: FS of Timako Port 2006 prepared by PPA modified by JICA survey Team

Figure 13.6-3 Scale Down of Short-term Development Plan

4) Updating of FS of Timako Port

Present FS of Timako Port was prepared by PPA in 2006. It is recommended that "Updating of FS of Timako Port prepared by PPA in 2006" should be conducted as soon as possible even when construction is ongoing because many basis/assumptions and circumstances in the 2006 FS have changed now. In the FS the MCRAIC was envisaged to generate new port traffic for the proposed Timako Port upon opening of its operation. The masterplan for the MCRAIC, submitted in 1998, contains the list by type of prospective industries that would eventually establish business operation in the aid industrial center. The implementation of the masterplan of MCRAIC should be surveyed/investigated and incorporated with the development of the Timako Port.

(3) Priority of Selected Projects

Priority of the above selected project will be as follows;

1) Implementation of Timako Port including the securing of additional fund for Short-term Development Project. (766 mil. Pesos for Short-term development plan)
2) FS of Polloc Port for Short-term Development Plan. (20 mil. Pesos)
3) The study of demarcation of roles for Timako Port and Polloc Port in order to maximize the port efficiency of both ports.
4) Updating of FS of Timako Port prepared by PPA in 2006 for Short-term Development Plan (31 mil. Pesos including demarcation of roles for Timako and Polloc port)
5) Urgent project to improve the port operation in Polloc Port (123 mil. Pesos)

13.7 Implementation Schedule

The importance of timing in the development of the port facilities is to avoid the premature provision of the facilities. This will result in the under-utilization of these facilities in the early part of port operations or the delayed provision of the same will result to longer waiting time of vessels at berth. Whether the provision is made premature or delayed, both will result in higher cost in the handling of cargoes.

13.7.1 Polloc Port

Considering the time schedule of more or less five years to undertake the study, design and construction before the port facilities become operational, feasibility study of the Short-term Development Plan of Polloc Port should be conducted as soon as possible because the throughput of cargoes will reach 900,000 m.t. around 2025 near future. Tentative implementation schedule of Short-term Development Plan of Polloc Port is as shown in Table 13.7-1.

Table 13.7-1 Estimated Implementation Schedule of Short-term Development Plan of Polloc Port

Description	2021	2022	2023	2024
1. Feasibility Study				
2. Detailed Design				
3. Preparatory for Contract				
4. Construction of the Port Facilities				

Source: JICA Study Team

13.7.2 Timako Port

As the access cause way to the Timako Port is under construction now, additional fund to complete the Short-term Development Plan should be secured as soon as possible in order to meet the cargo demand. Tentative Implementation schedule of the Short-term Development Plan of Timako Port is shown in Table 13.7-2. (Based on the condition that detailed design and contract documents for the construction of Short-term Development Plan have not been prepared yet.)

Table 13.7-2 Estimated Implementation Schedule of Short-term Development Plan of Timako Port

Description	2021	2022	2023	2024
1. Request the fund to the Government				
2. Demarcation study of the roles				
3. Updating of FS				
4. Detailed Design				
5. Preparatory work for Contract				
6. Construction of the Port Facilities				

Source: JICA Study Team

13.8 Environmental and Social Considerations

13.8.1 Polloc Port

In order to proceed the Short-term Development Project, Initial Environmental and Social Consideration Assessment Matrix is prepared as below.

Table 13.8-1 Initial Environmental and Social Considerations Assessment Matrix for Polloc Port Short-term Development Plan

		Pollution control								Natural				Social environment																Others		Type of Permit	Remarks
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
Project/ Program	Phases	Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment, livelihood	Land use and utilization of local resources	Water usage	Existing social infrastructures and services	Social institutions such as social infrastructure and loca decision-making institutions	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR	
1. Short-term Development Plan 2028	Pre-construction	N/A								N/A				N/A																N/A			
	Construction	B+	D	B+	C	B+	C	C	C	C	C	D	B+	A+	A+	C	B+	B+	B+	B-	C	B+	C	D	C	D	D	C	C	C	C	ECC	
	Operation & Maintenance	B+	D	B+	C	B+	C	C	C	D	D	D	D	D	D	C	B+	B+	B+	B-	C	B+	C	D	C	D	D	C	C	C	C		

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.
D: No impact is expected.
N/A: Not applicable (for exaple, Capacity Building Project)

ECC: Environmental Compliance Certificate
CNC: Certificate of Non-Coverage

13.8.2 Timako Port

Certificate of Non-Coverage (CNCV) for Timako Port issued by the Environmental Management Bureau-DENR provided by PPA is attached below.

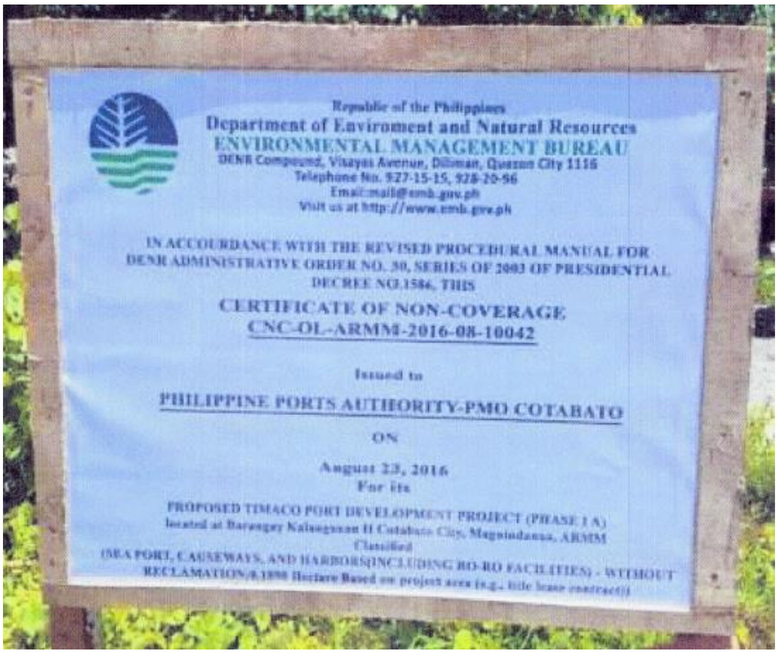


Figure 13.8-1 Certificate of Non-Coverage for Timako Port Provided by PPA

13.9 Peacebuilding

As highlighted in Section 11.11 of Chapter 11 and Section 12.10 of Chapter 12 further and elaborated further in Chapter 19 (Peacebuilding), infrastructure project may contribute to peacebuilding through improving the living condition of the people in the community by way of addressing economic disparity and employment deprivation among others. On the other hand, it may contribute to prolonging the instability if it failed to account the complex interactions that infrastructure has with fragility.

Like other large infrastructure projects discussed in this report such as airport and road, some of the aspects of port project that may contribute to instability may include land taking to construct the port project, relocation of project affected people (PAP), access to jobs created by the project among others. Since the above have been thoroughly discussed both in Chapters 11 and 12 under the Peacebuilding, the focus here instead will be the positive contribution of the two port projects (i.e. expansion of the Polloc Port and competion of Timako Port in Cotabato City) in peacebuilding. The following are possible contributions of the two projects:

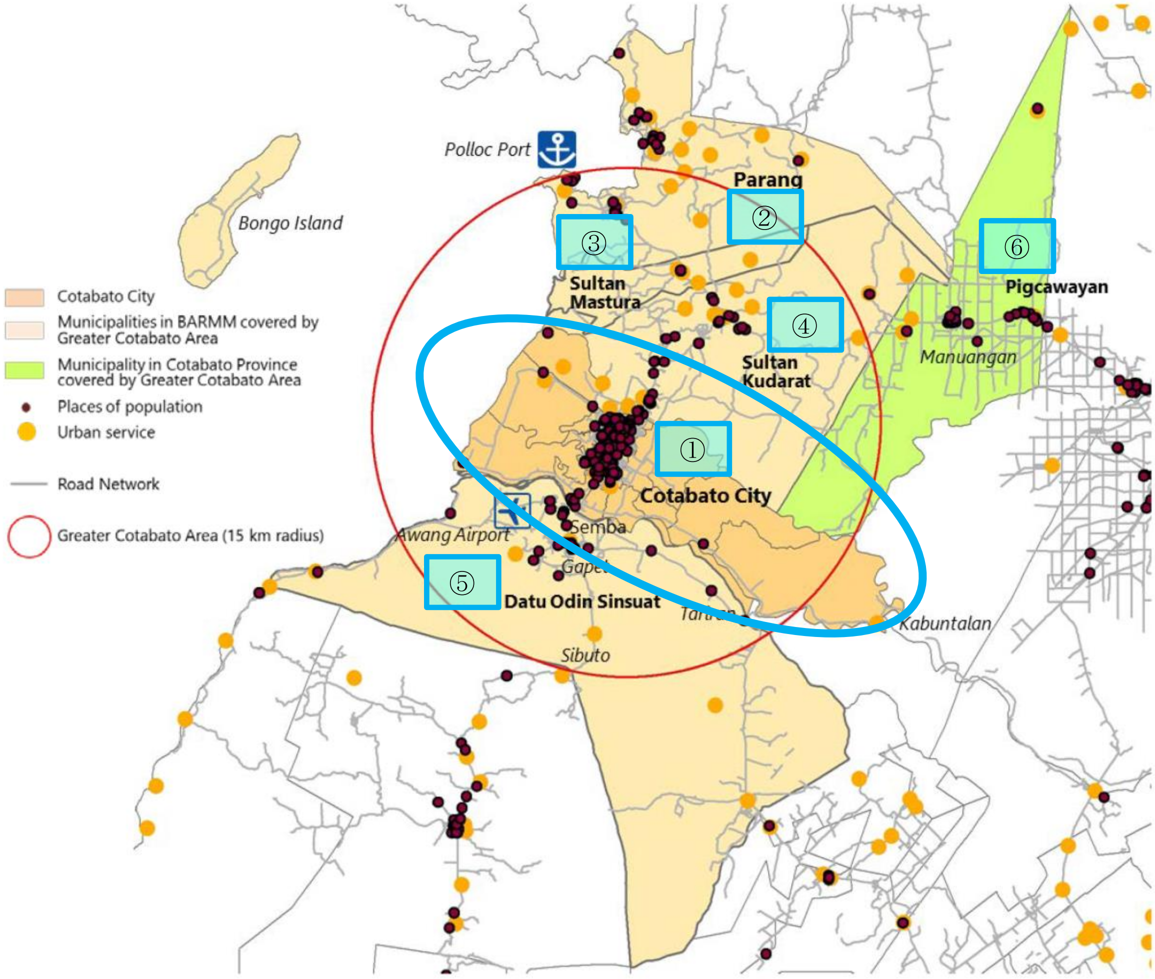
- Construction stage – RA No. 6685 requires private contractors to hire at least fifty percent (50%) of the unskilled and thirty percent (30%) of the skilled labor requirements from the available bona fide residents in the project area. Hence the two projects will contribute to the number of jobs available to the local communities.
- Operation and maintenance stage – there will be some jobs created to operate the port and additional jobs created due to emerging new businesses. The people in the area will benefit from these new job opportunities and will contribute to improve their socioeconomic condition.
- Increased Revenue of the local government units – two of the biggest tax collectors which are the Bureau of Customs and Ports Authority are related to port operation. Polloc Port is currently under the BARMM while the Timako Port is under the national government (Philippine Port Authority). However, the Port Management Office (PPA PMO) in Cotabato City was officially handed to the Bangsamoro Ports Management Authority (BPMA) by the PPA PMO-Region XII last November 10, 2021. Hence there is a high probability that the incomplete Timako Port will be handed to BARMM as well. Once the two ports are in full operation, taxes collected by the port authorities will contribute to the revenue of the local government. This will increase the budget of the local government which would result to addition of projects for the people in the area.

CHAPTER 14
WATER SUPPLY DEVELOPMENT PLAN

14.1 Background on Water Supply Sector

14.1.1 Water Supply Study Area for Greater Cotabato

The main study area of water supply sector located in ① Cotabato City for Greater Cotabato. A part of five municipalities of ② Parang, ③ Sultan Mastura, ④ Sultan Kudarat, ⑤ Datu Odin Sinsuat and ⑥ Pigkawayan are considered as potential satellite towns within the Greater Cotabato area. Total six (6) study areas are shown as follows.



Source: JICA Study Team based on the open-source data

Figure 14.1-1 Water Supply Study Area

14.1.2 Water Supply Users in Cotabato City

Potable water in Cotabato City is provided by the Metro Cotabato Water District (MCWD), a Government Owned and Control Corporation (GOCC).

Over 80% of the water supplied by the MCWD is consumed by the residents of Cotabato City which is about 8.5 Million cubic meter in 2018. This volume of water consumption is higher by 1.25 Million cubic meters compared to the consumption in 2016 which might be attributed to the increase of water connection by 3,259 in the same period.

Share of commercial uses (both Pure Commercial and Semi Commercial) on the other hand is about 12% and the trend is rising (11.7% in 2016 and 12.5% in 2018). The city's economy is experiencing rapid growth trade and commerce is one of the primary drivers. In the last five years, two shopping malls (Al Nor Mall and Citi Mall) and a number of hotels commenced their operation. Construction of another large shopping is on-going hence the demand for water supply will continue to increase. Similarly, since Cotabato City is serving as the seat of the BARMM Regional Government, water consumption from government offices is also significant which is between 8% to 9%. The remaining share of less than 1% is consumed by industry sector (Table 14.1-1).

Table 14.1-1 Annual Water Consumption (cu. m.)

Consumer	2016 (a)		2018 (b)		Difference (b-a)
	Consumption (cu.m.)	Share (%)	Consumption (cu.m.)	Share (%)	
1. Residential	7,260,187	83.3%	8,512,498	82.0%	1,252,311
2. Government	411,817	4.7%	561,453	5.4%	149,636
3. Pure Commercial	710,779	8.2%	919,850	8.9%	209,071
4. Industry	24,072	0.3%	13,903	0.1%	(10,169)
5. Semi Commercial	308,321	3.5%	379,052	3.6%	70,731
Total	**8,715,176**	**100.0%**	**10,386,756**	**100.0%**	**1,671,580**

Source: 2016 and 2018 Annual Report, Metro Cotabato Water District

14.1.3 Water Supply Service Coverage Area in Cotabato City

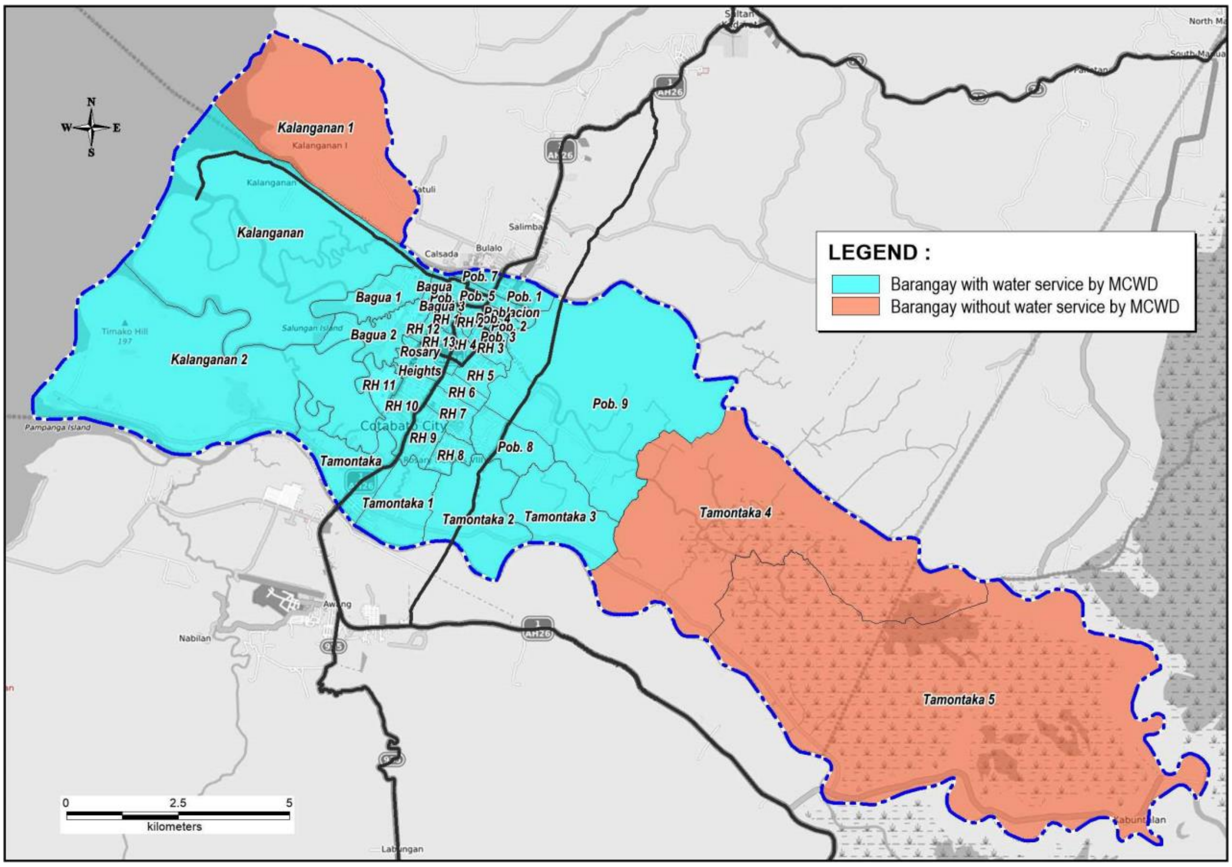
In general, there is more demand than available supply of water in Cotabato City as illustrated by water rationing in the franchise area of MCWD and limited service area.

- In 2015, Cotabato City had 57,944 households while the service connection of MCWD was only 29,960 which represent 52% of the household number. This number means that about 27,984 households has to avail of water supply by other means.
- Three barangays which are Kalanganan 1, Tamontaka 4, and Tamontaka 5 are out of the franchise area of MCWD (Figure 14.1-2).
- In terms of growth in the number of water concessionaires, from 2014 to 2018, the MCWD had provided additional new service connection of over 1,000 per year.

Table 14.1-2 Number of Service Connection (2009-2018)

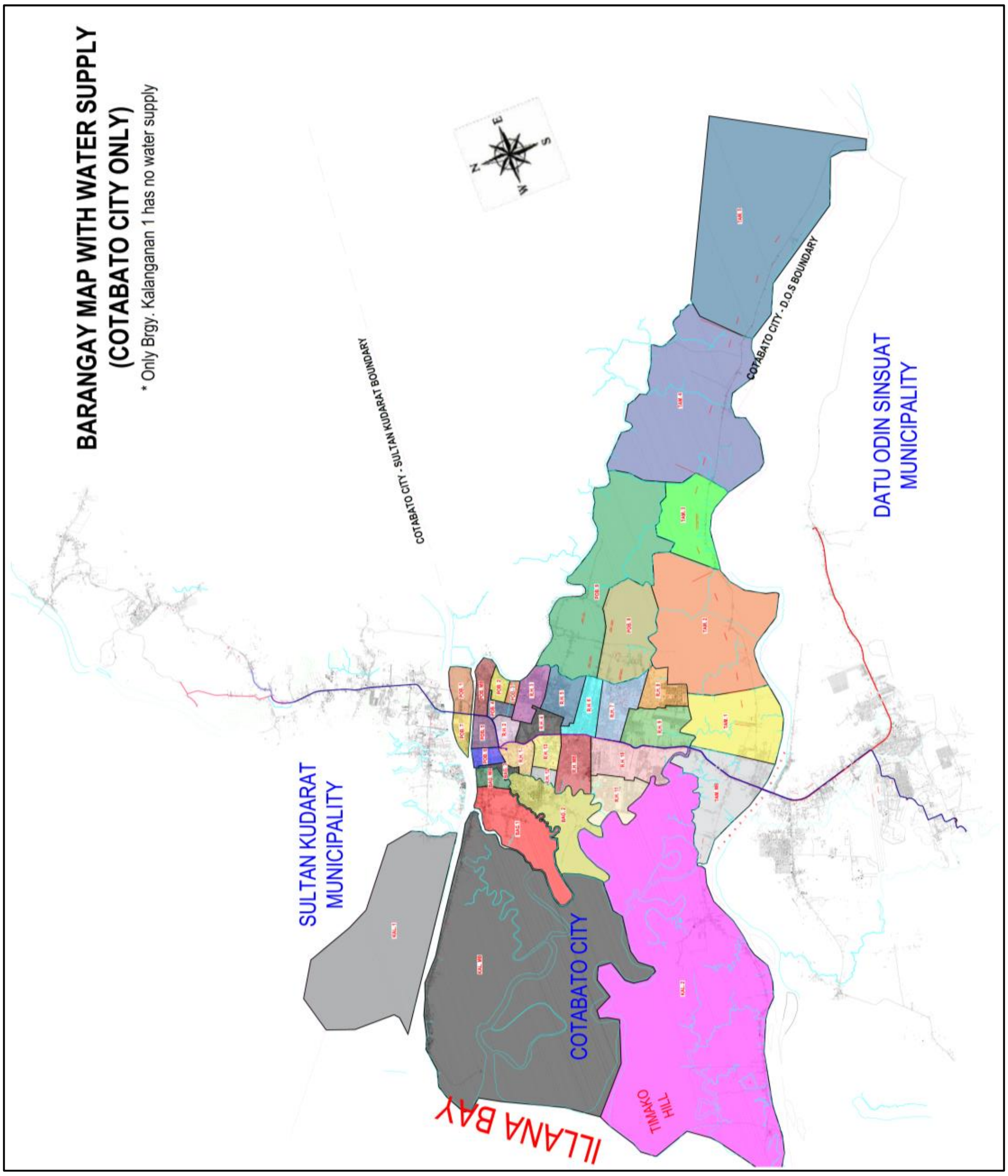
Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
No. of service connection	24,142	25,094	26,061	26,862	27,774	28,854	29,960	31,517	33,069	34,776
Growth Rate (%)	4.2%	3.9%	3.9%	3.1%	3.4%	3.9%	3.8%	5.2%	4.9%	5.2%

Source: 2018 Annual Report, Metro Cotabato Water District



Source: JICA Study Team

Figure 14.1-2 MCWD Service Area



Source: Metro Cotabato Water District

Figure 14.1-3 Water Supply Barangay Map (Cotabato City Only)

14.1.4 Organization and Budget of Offices/Agencies involved in Water Supply

(1) Brief History of Metro Cotabato Water District

As stated in its official website, the original water system of Cotabato City was constructed in 1939 and was operated and managed by the Provincial Government of Cotabato. At that time, Dimapatoy River was the sole water supply source and water was transmitted to the population by way of a gravity feed system.

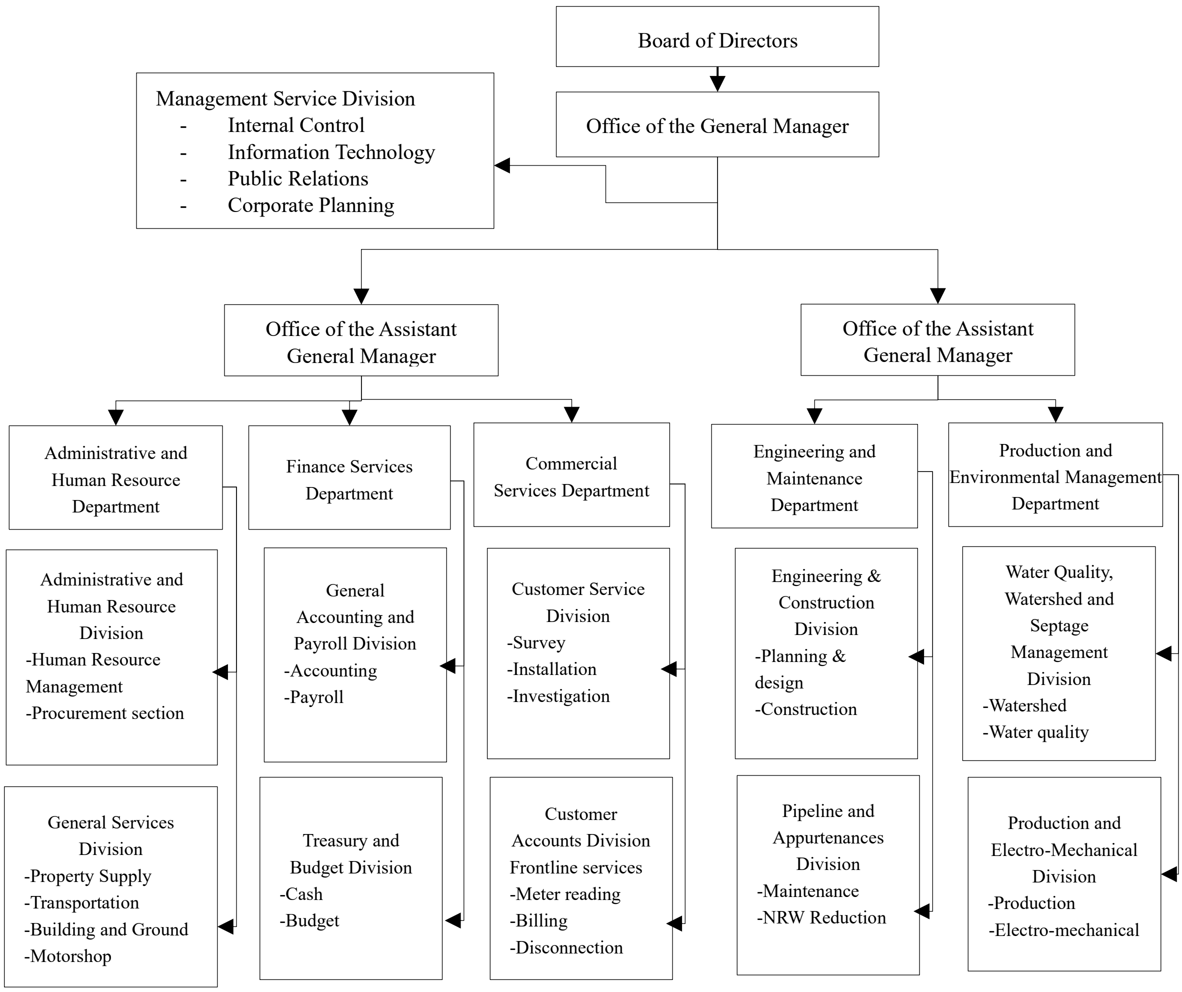
In 1976, the City Government of Cotabato passed a resolution creating the Cotabato City Water District (CCWD). The ownership and the management of the water utility was all transferred to CCWD by virtue of Sangguniang Panlungsod Resolution No 035, dated March 9, 1976. This was later renamed as Metro Cotabato Water District (MCWD), pursuant to CCWD Board Resolution No. 030B-03, dated August 8, 2003, and in accordance with LWUA (Local Water Utilities Administration) Board of Trustees Resolution No. 186, series of 1997.

The MCWD derived its legal mandate to serve the populace from Presidential Decree No. 198, otherwise known as the Provincial Water Resources Act of 1973. The District was formed on October 12, 1976. On November 5, 1976, the LWUA issued the Certificate of Conformance No. 30 to the MCWD. Aside from Cotabato City, MCWD also supply water to some of the barangays of the municipalities of Maguindanao Province namely Sultan Kudarat and Datu Odin Sinsuat.

(2) MCWD Organization

The organization chart of MCWD is depicted in Figure 14.1-4. In 2006, the agency had a total of 166 employees. This number increased to 189 in 2018. Since break down of 2018 data is not available, breakdown of 2016 is as follows:

- Office of the General Manager (10)
- Administrative Services Department (34)
- Finance Department (16)
- Commercial Services Department (34)
- Engineering & Operations Department (72)
- Total (166)



Source: Official website of Metro Cotabato Water District

Figure 14.1-4 Organization Structure of MCWD

(3) Budgetary Framework

In general, there was a gradual increase of the MCWD's annual budget from 2014 to 2018 as indicated in Table 14.1-3. But perhaps the most interesting number is the increase of Capital Outlay which represent dedicated fund to execute projects. Below are some of the observations derived from the budget data:

- In the last five (5) years (2014-2018), it was observed that the total budget increased by 7.98% annually.
- In the same time span, Capital Outlay had an annual average increase of 15.97%. However, there was a sharp decrease from 2017 to 2018 by PhP 10.16 Million. Around 5% to 11% of the budget was dedicate to project represented by the Capital Outlay.

Table 14.1-3 Summary of Annual Budget in Million PhP (2014-2018)

Particulars		2014	2015	2016	2017	2018
Office of the Board of Directors		4.56	5.16	5.67	6.91	6.63
Office of the General Manager		5.18	9.99	9.54	13.65	15.14
Finance Services Department		5.82	5.62	6.47	9.57	9.85
Commerce Services Department		12.41	12.71	17.53	21.17	22.41
Administrative Services Department		43.91	35.95	33.02	51.83	49.57
Engineering/ Operation Department		59.41	69.84	70.90	67.10	78.24
Debt Service		26.46	26.68	26.89	26.95	27.05
Reserves		0.30	0.30	0.30	0.30	0.30
Materials for New Water Connections/ Installations		1.80	3.87	4.50	4.50	4.00
Capital Outlay (Budget for project)	Real value	9.13	18.64	23.48	26.66	16.50
	% to Total	5.4%	9.9%	11.8%	11.7%	7.2%
Total		**168.97**	**188.77**	**198.29**	**228.65**	**229.68**

Source: 2018 Annual Report, Metro Cotabato Water District

(4) Gross Revenue

The gross revenue of MCWD which comes mostly from the sales of water in 2016 was about PhP 223 Million. This revenue rose to almost PhP 280 Million in 2018 which represents about PhP 46 Million increase compared to 2016. Operation expense (budgetary outlay) however both in 2016 and 2018 was larger than the gross revenue hence the deficit. The positive to note however was the substantial reduction of deficit from about PhP 158 Million in 2016 to merely PhP 4.36 Million in 2018.

Table 14.1-4 Budgetary Outlay and Gross Revenue (PhP)

Items	Year	
	2016	2018
I. Total Budgetary Outlay		
a. Operating Outlay (Original Budget)	147,648,866.40	185,928,822.70
b. Capital Outlay (Original Budget)	23,480,080.00	16,499,000.00
c. Special Budgets, if any (additional budget)- Contingency	193,375,451.64	54,400,939.33
d. Debt Service	26,885,819.65	27,045,412.73
e. Reserves	300,000.00	300,000.00
Total	**391,690,217.69**	**284,174,174.76**
II. Gross Revenue		
a. Collection for Water Sales	223,239,384.32	268,498,147.95
b. Other Revenues	10,304,474.96	11,315,552.66
Total	**233,543,859.28**	**279,813,700.61**
Deficit (II-I)	**-158,146,358.41**	**-4,360,474.15**

Source: 2016 and 2018 Annual Report, Metro Cotabato Water District

14.2 Issues on Water Supply Development

The MCWD could only supply about 52% of the households in Cotabato City in 2015. This leaves about 27,984 household without the supply of water and have to find other means to acquire potable water. In the coming years, demand of water supply will only increase in view of rapid growth of population and continuing expansion of economic activities such as on-going construction of shopping malls and hotels.

The following are the summary of identified issues affecting supply of potable water:

- Lack of financial capital to procure necessary projects and programmes
- Dilapidated pipes/old pipes (30-35 years old) both at the plants and distribution sites
- Scaling which reduces diameter of pipe by 25% (from 16 inches to 12 inches) which occur to even new pipes
- Erosion of Dimapatoy river which is the primary source of water hence riverbank protection is urgently needed
- Recurring power supply shortage in Cotabato City and surrounding municipalities affect water production

The issues in the five surrounding municipalities

- Inadequate budget allocation of funds, LGUs usually allocate small budget to water supply facilities
- Non-prioritization of Water Supply System by LGUs, LGUs put the Implementation of water facility projects in the less priority, LGUs have less concern on the danger of health related economic instability posed by water scarcity
- Poor Management of Water Supply System Facilities, organization of BAWASA is not enjoined among consumers, no collection of tariff for sustainability of the facility
- Less protection of the environment and climate change, Aside from climate change, the lack of efforts to protect the environment particularly water resources may result to shortfall between demand and availability of water supply in the near future

Additionally, there is the issues to respond to the water supply in the COVID-19 Crisis “The Present Water, Sanitation and Hygiene (WASH)”

14.3 Objectives for Water Supply Development

The objectives of water supply development are as follows:

14.3.1 Corresponding to the Increase in Water Demand due to Population Growth and Urbanization

Both Cotabato City and the five surrounding municipalities are planning to expand water supply at Level 3 (water supply to each household by pipeline). At present there are still many residents cannot access enough piped water.

14.3.2 To Repair and Renew Existing Water Treatment Facilities and Water Pipe Networks

Since 20 to 30 years have passed since the water pipe network was constructed, there are concerns about the deterioration of the water pipe network. Therefore, it is necessary to carry out repairs and renewals.

14.3.3 To Improve and Strengthen the Management of the Water Supply Business

At present, MCWD and cannot provide a stable and adequate supply of clean water.

Moreover GWCL has not been able to ensure a proper income because of the large amount of non-revenue water. It is necessary to seek to improve the management of the water supply business by 2040 by increasing the volume of water supply and by reducing the volume of non-revenue water by 2040.

14.3.4 To Reducing Water-borne Diseases

Properly treated water is supplied through the water network, providing access to safe water and reducing water-borne diseases.

14.4 Strategies for Water Supply Development

1) Strategy to Respond to the Water Supply in the COVID-19 Crisis
   "The Present Water, Sanitation and Hygiene (WASH)"
2) Strategy to Develop the New Master Plan for Cotabato City and Surrounding Municipalities
3) Strategy to Strengthen the Capacity of Water Service Management Body
4) Strategy to expand Water Supply Services

14.4.1 Present Situation of Water Supply System

(1) Cotabato City Water Supply Service Area

In general, there is more demand than available supply of water in Cotabato City as illustrated by water rationing in the franchise area of MCWD and limited service area.

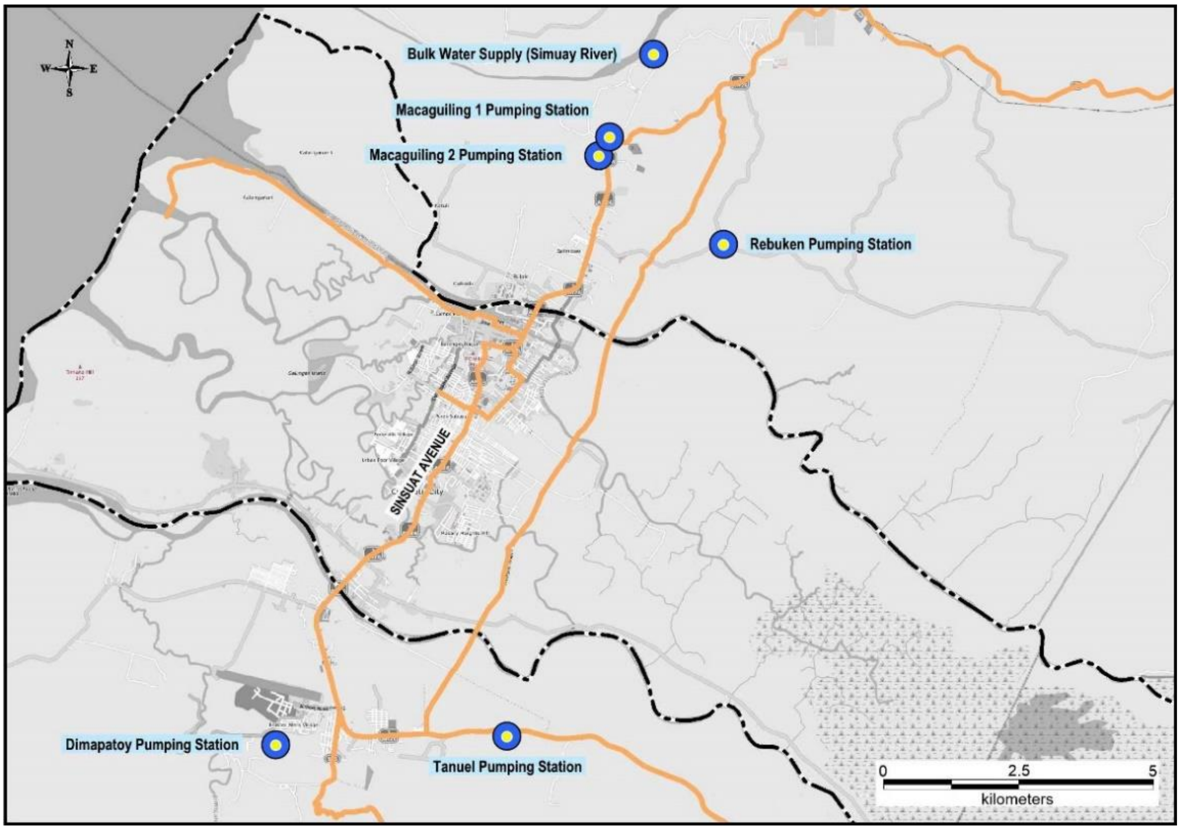
- In 2015, Cotabato City had 57,944 households while the service connection of MCWD was only 29,960 which represent 52% of the household number. This number means that about 27,984 households have to avail water supply by other means.
- Three barangays which are Kalanganan 1, Tamontaka 4, and Tamontaka 5 are out of the franchise area of MCWD (Figure 14.1-2).
- In terms of growth in the number of water concessionaires, from 2014 to 2018, the MCWD had provided additional new service connection of over 1,000 per year.

Table 14.4-1 Number of Service Connection (2009-2018)

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
No. of service connection	24,142	25,094	26,061	26,862	27,774	28,854	29,960	31,517	33,069	34,776
Growth Rate (%)	4.2%	3.9%	3.9%	3.1%	3.4%	3.9%	3.8%	5.2%	4.9%	5.2%

Source: 2018 Annual Report, Metro Cotabato Water District

Potable water in Cotabato City is provided by the Metro Cotabato Water District (MCWD), a Government Owned and Control Corporation (GOCC). The five (5) pumping stations and treatment plans which produced about 13.3 Million cubic meter (excluding production by bulk water supplier) are located in the nearby municipalities of Datu Odin Sinsuat (DOS) and Sultan Kudarat both in the province of Maguindanao (Figure 14.4-1). Over 80% of the water supply come from Tanuel Pumping Station and Dimapatoy Pumping Station both located in DOS, Maguindanao. Production output in 2018 is larger by 3.01 Million Cubic meter compared to 2016 which is primarily due to improved production at Dimapatoy Pumping Station and the additional support of bulk water supplier (Table 14.4-2) which produced about 1.5 Million cubic meter of water.



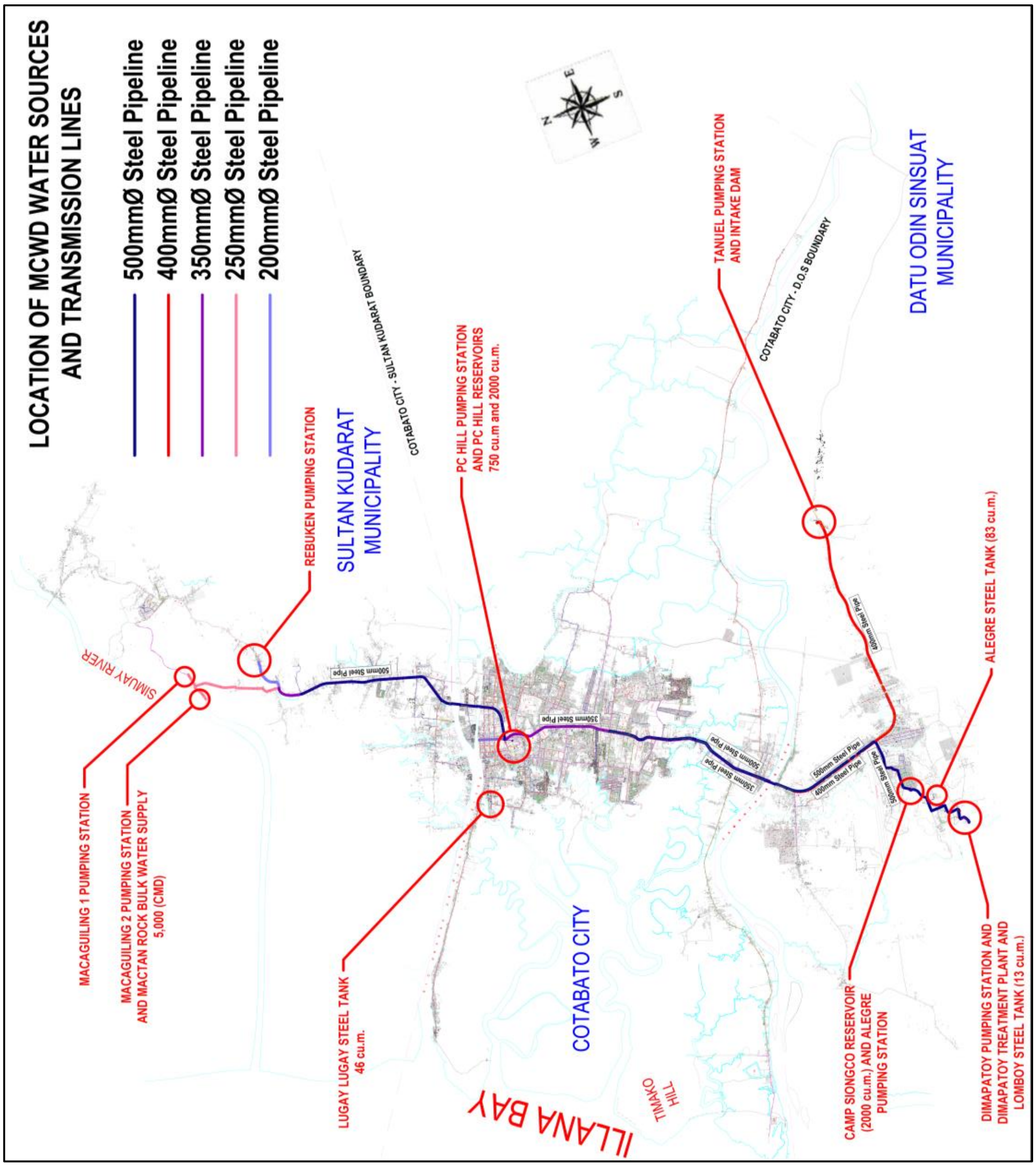
Source: Metro Cotabato Water District

Figure 14.4-1 Location Map Showing Source of Water by MCWD

Table 14.4-2 Sources of Water and their Production Volume

Water Sources	Source of water	Location	Production (cu. m.)	
			2016	2018
1. Tanuel Pumping Station	Spring	DOS Municipality	5,702,550	5,765,981
2. Rebuken Pumping Station	Deep well	Sultan Kudarat Municipality	886,948	798,965
3. Macaguiling Pumping Station 1	Deep well	Sultan Kudarat Municipality	583,463	472,126
4. Macaguiling Pumping Station 2	Deep well	Sultan Kudarat Municipality	235,745	187,691
5. Dimapatoy Pumping Station	Surface	Sultan Kudarat Municipality	4,288,406	5,975,846
6. Bulk Water Supply (Mactan Rock-TGV Corporation)	Surface	Sultan Kudarat Municipality	-	1,506,584
Total			**11,697,112**	**14,707,193**

Source: 2016 and 2018 Annual Report, Metro Cotabato Water District



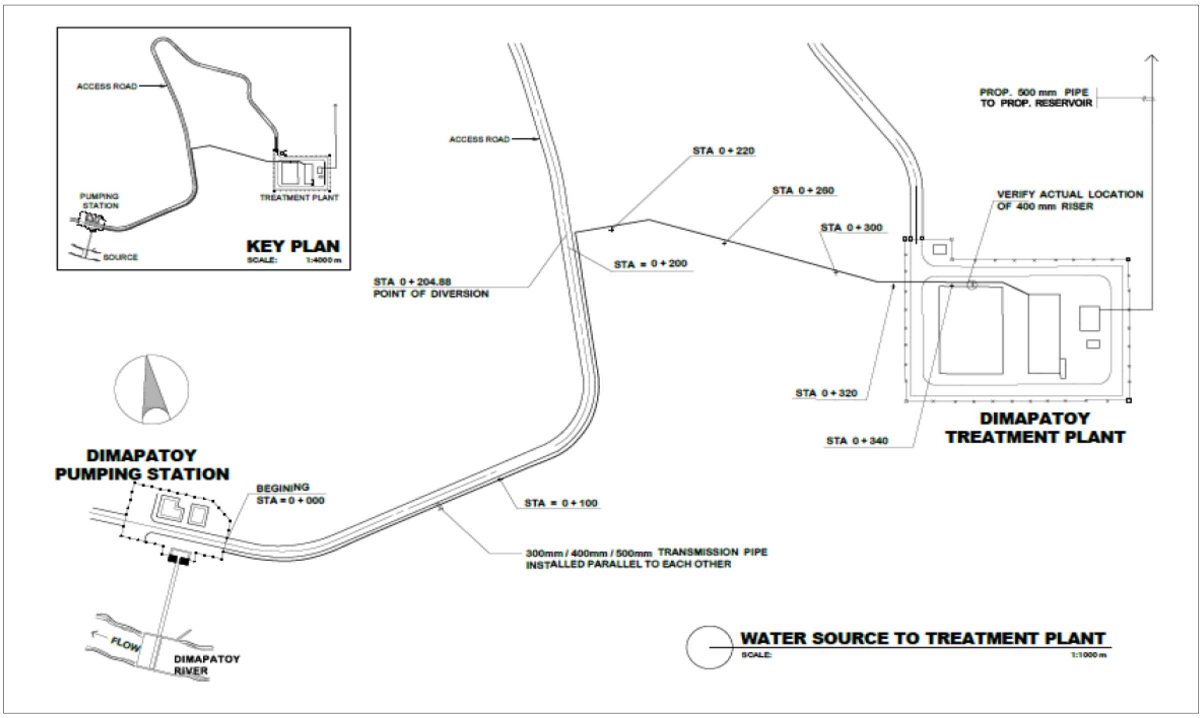
Source: Metro Cotabato Water District

Figure 14.4-2 Location of MCWD Water Source and Transmission Water Pipe Line

1) Existing Facilities

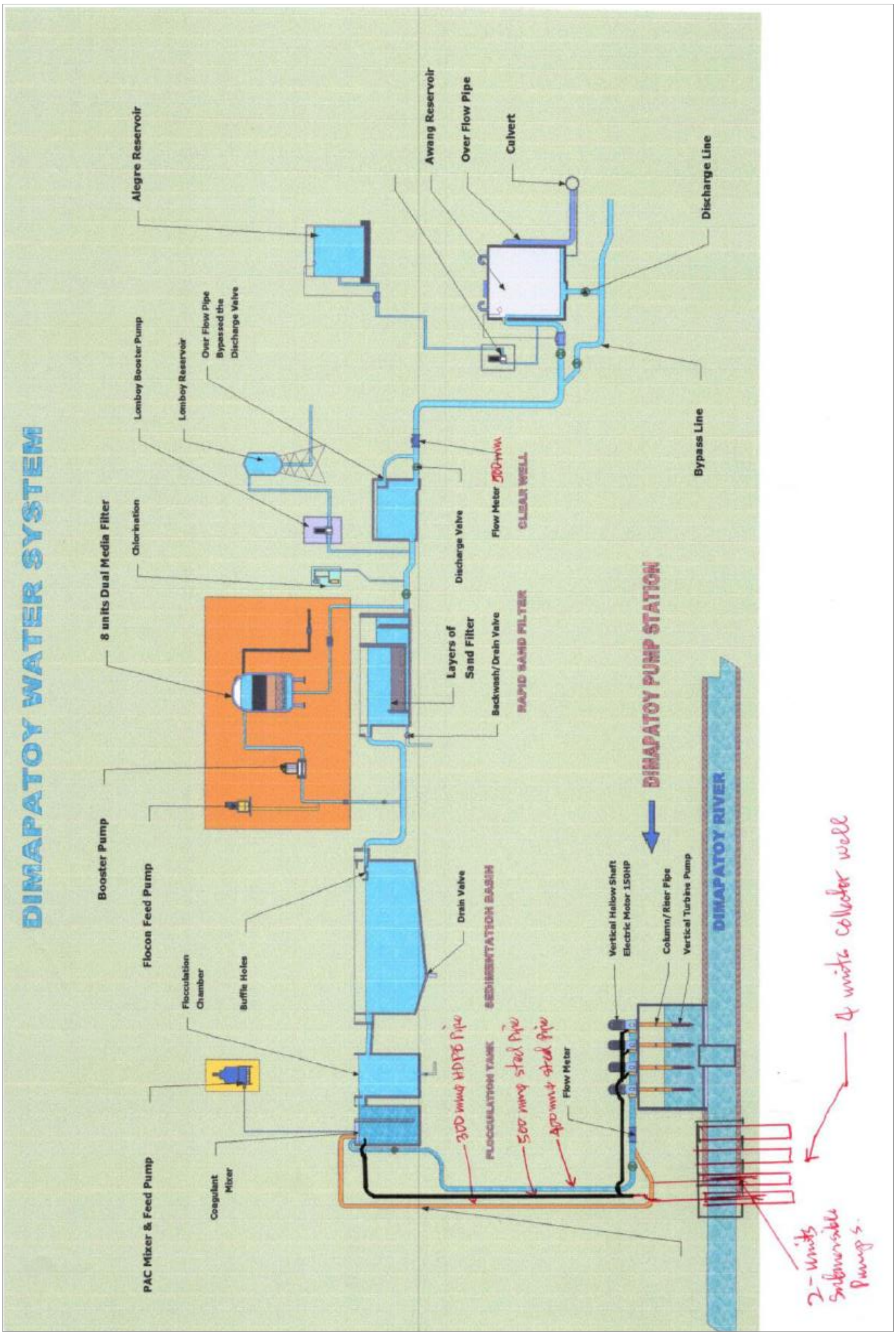
The facility of MCWD at Dimapatoy produces the largest volume of water which was about 6.0 Million cubic meter in 2018. Its main water source is the Dimapatoy River located in Datu Odin Sinsuat (DOS) Municipality, about 9km south of Cotabato City. The facility is experiencing several issues which affect its ability to produce maximum water output. For instance, both sides of the river in the immediate vicinity of the facility are exposed to erosion. Although at the downstream of the river, construction work is on-going to protect the about 14 meters bank of the river, the upper stream requires protection wall as well. Due to limited budget of MCWD however, the proposed protection wall at the upper stream has not been touched. Another issue confronting the facility is some of its pipes particularly at the pumping station is already very old (over 30 years) hence replacement is necessary to eliminate leaking water.

Similarly, since recurring power supply shortage in Cotabato City and surrounding municipalities affect water production, MCWD is planning to construct a solar panel for electricity power production which could produce about 2000 kw. Additional modular water treatment plan to place beside the existing water treatment plan with a capacity between 5,000 to 8,000 cubic meter/day is being considered as well by MCWD to boost its water production. Schematic diagram of the water system and photos showing its present condition is illustrated in the succeeding figures.



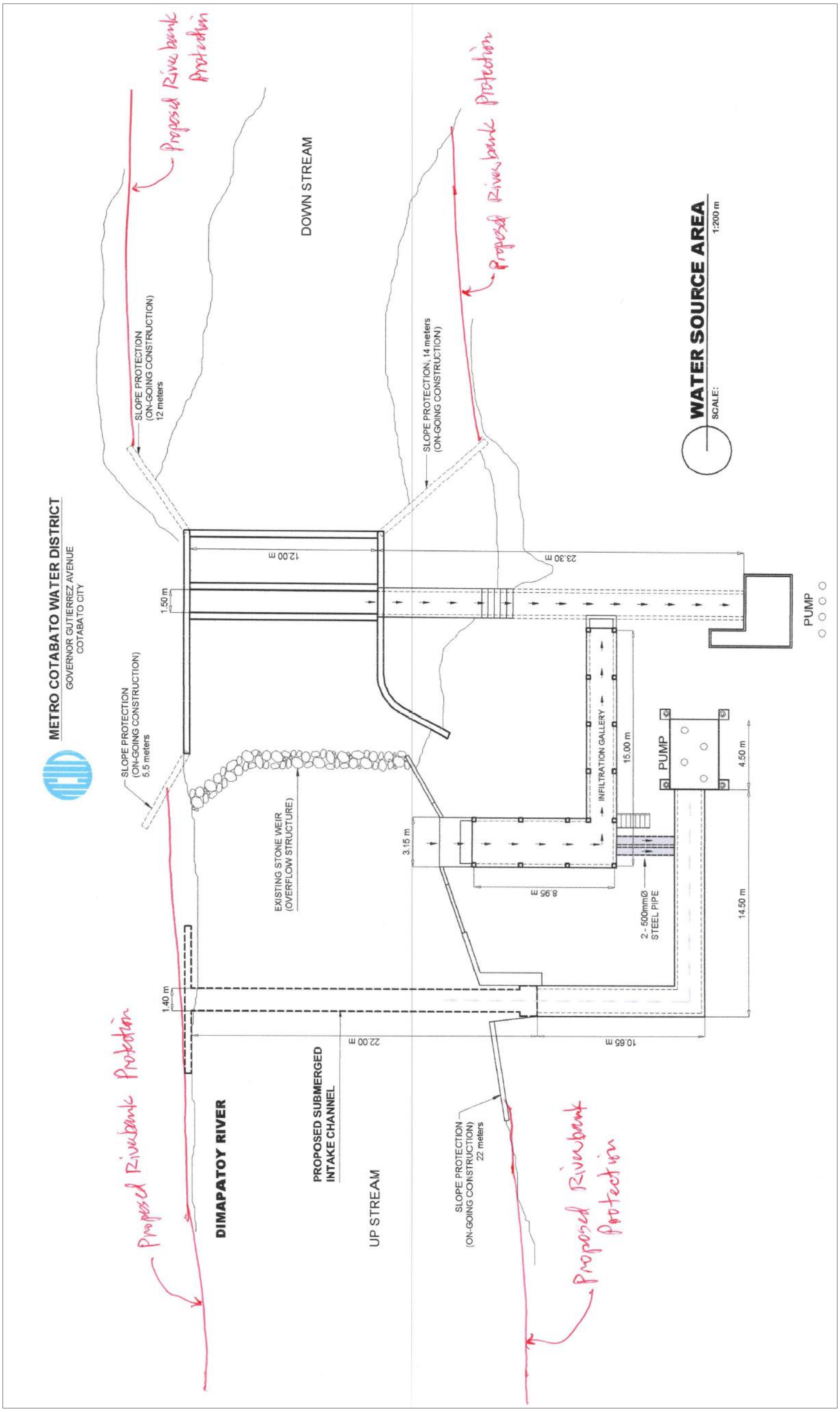
Source: Metro Cotabato Water District

Figure 14.4-3 Vicinity Map of Water Source to Treatment Plan in Dimapatoy, Awang, DOS



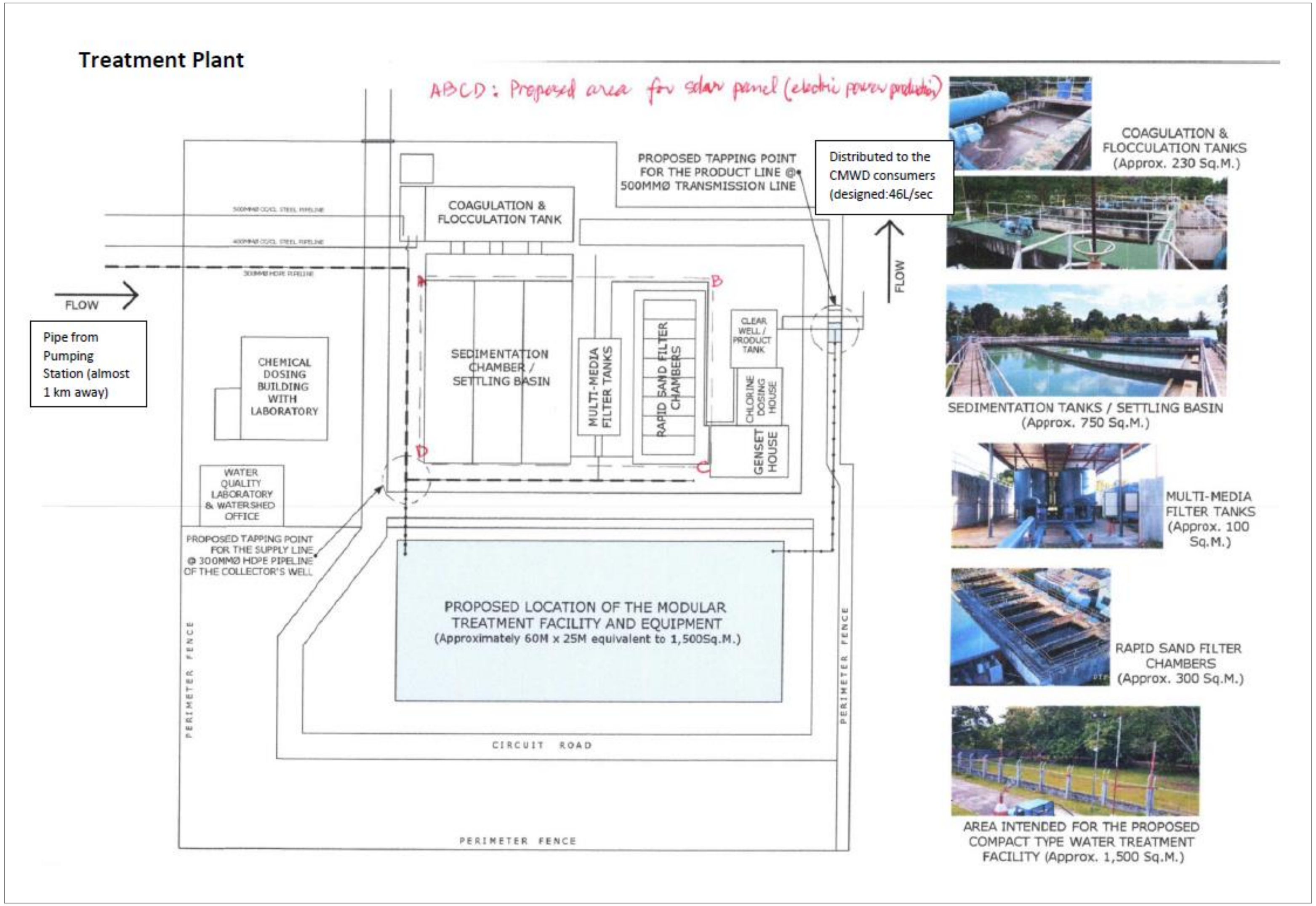
Source: Metro Cotabato Water District

Figure 14.4-4 Schematic Diagram of Dimapatoy Water System



Source: Metro Cotabato Water District

Figure 14.4-5 Location of the Proposed Riverbank Protection of Dimapatoy River



Source: Metro Cotabato Water District

Figure 14.4-6 Schematic Diagram of the Treatment Plan in Dimapatoy

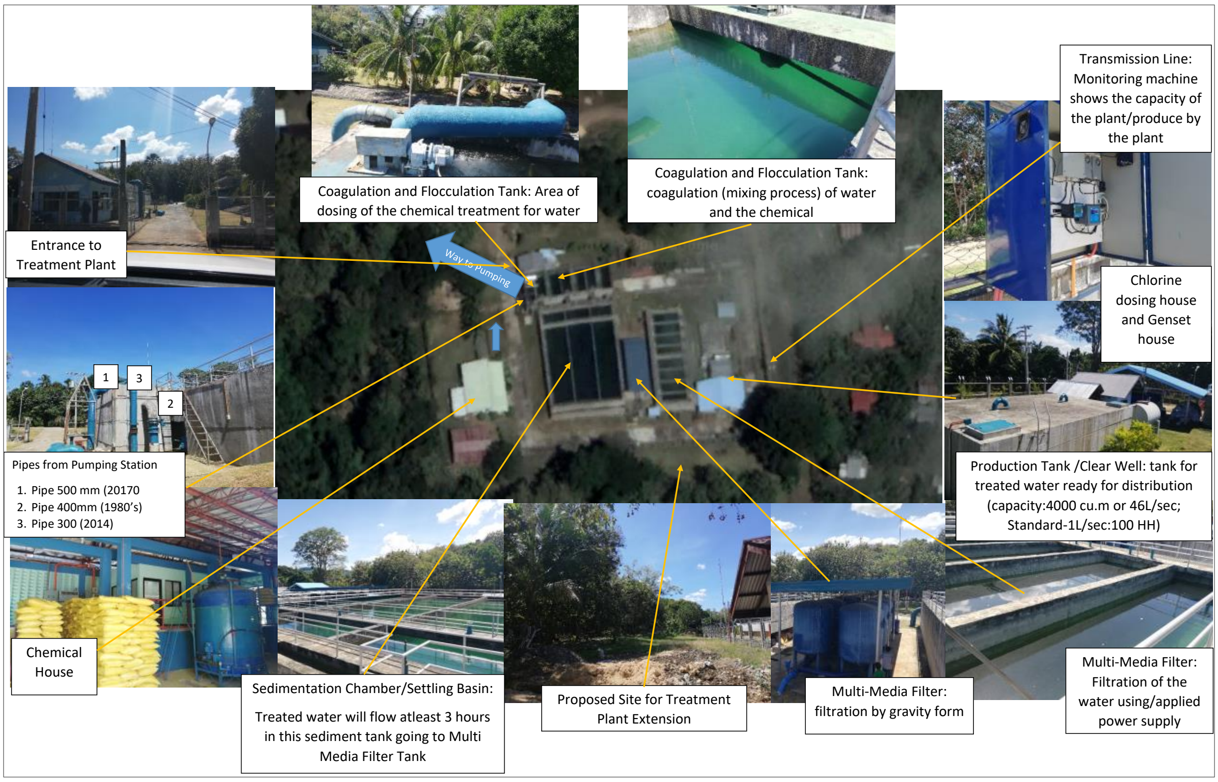
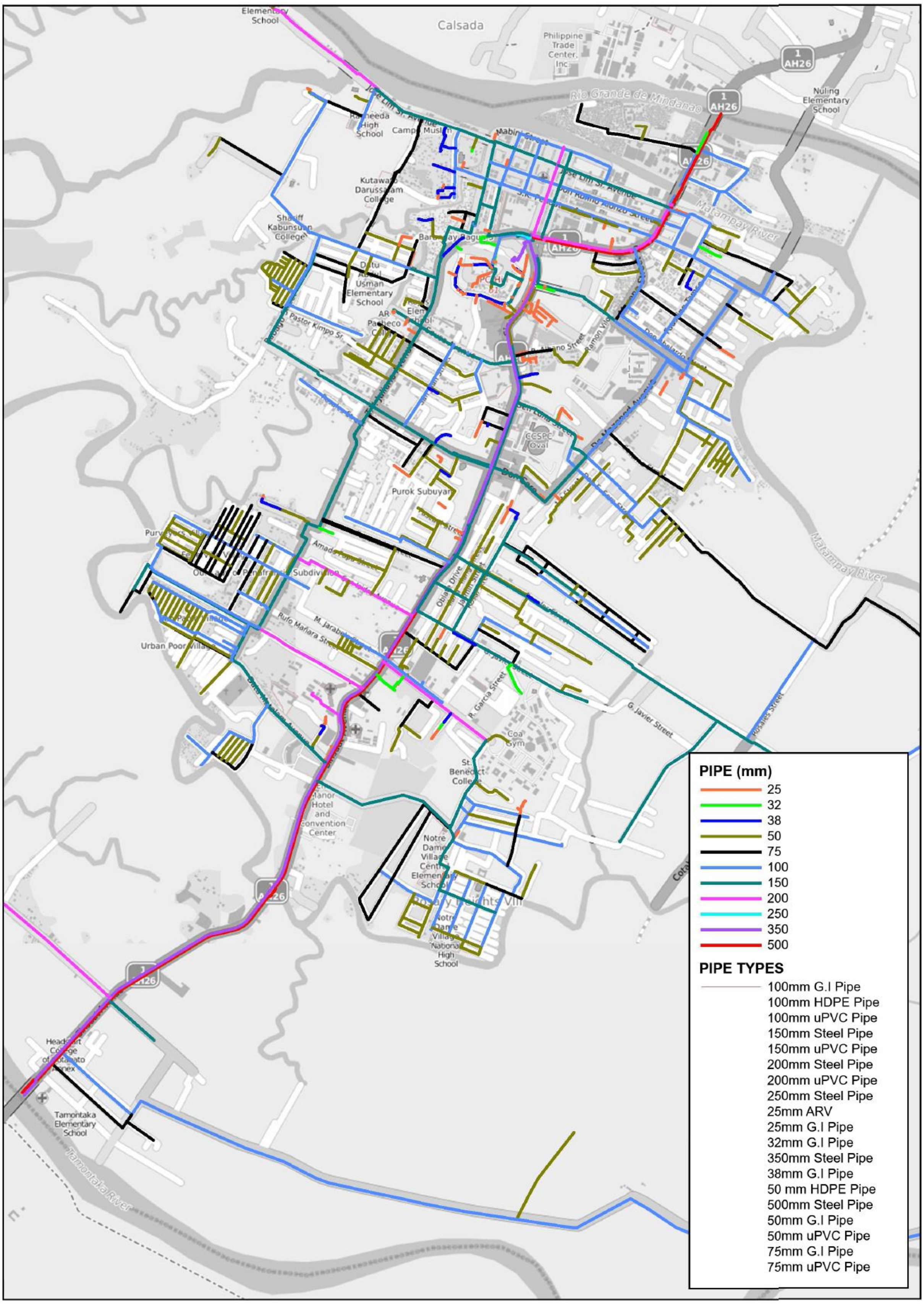


Figure 14.4-7 Photos of the Treatment Plan in Dimapatoy

Figure 14.4-8 Photos of Pumping Station in Dimapatoy



Source: Metro Cotabato Water District

Figure 14.4-9 Existing Pipeline of MCWD in Dimapatoy

2) The Five Surrounding Municipalities Water Supply Situation

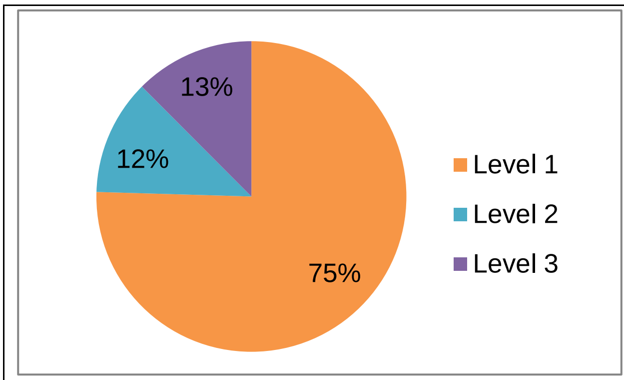
The five surrounding municipalities of Cotabato City have abundant natural resources such as rivers, lakes, creeks, springs, underground water, and other bodies of water suitable for domestic and agricultural purposes which if managed properly, can more than enough sustain the needs of the residents presently and in the future. However, with the fast growing increase of population, agricultural production uses and potable water withdrawals had put an unprecedented pressure on the water resources of said municipalities. Beside the increasing demand, source of water supply had undergone depletion due to water pollution, siltation of bodies of waters, deforestation, and climate change.

Based on data collected as reflected in Table 14.4-3, majority of the households lacks access to improved water supply services. On average, about 75.60% still sourced their potable water supply from level 1 system or unprotected surface waters, shallow dug wells and deep wells; while others bought by container from peddlers or water hauling trucks with a higher cost.

On the other hand, around 12.07% of the households sourced their potable water from level 2 system, while about 12.50% of households have access to clean water thru a level 3 water system. However, some households with access to improved water supply system still suffer low water quality and scarcity due to decades of poor management and inadequate financing by responsible units.

Table 14.4-3 Water Supply Level System in the Five Surrounding Municipalities

Municipality	Total No. of Households (HH)	Water Supply Level system					
		Level 1		Level 2		Level 3	
		No. of HH	*% to Total*	*No. of HH*	*% to Total*	*No. of HH*	*% to Total*
Datu Odin Sinsuat	16,880	11,452	17.22	1,950	2.93	3,478	5.22
Sultan Kudarat	15,331	8,331	12.52	4,100	6.16	2,900	4.36
Sultan Mastura	3,837	3,166	4.76	450	0.68	221	0.33
Parang	15,261	14,170	21.30	457	0.69	755	1.14
Pigcawayan	15,201	13,164	19.79	1,070	1.61	967	1.45
Total	**66,510**	**50,283**	**75.60**	**8,027**	**12.07**	**8,321**	**12.50**



Level 1: **Water supply from wells, surface water, and spring water in villages**	**50,283 HH (75.60%)**
Level 2: **Water supply from public water Tap**	**8,027 HH (12.07%)**
Level 3: **Water supply to each house by water supply pipeline**	**8,321 HH (12.50%)**
Total	**66,510 HH**

Figure 14.4-10 Number of Households by Water Supply Level in the Surrounding Municipalities

14.4.2 Future Prospect for Water Demand

Total water demand in the target years 2028 and 2040 are estimated by using following parameters.

- Future population predicted by the JICA study team is adopted
- The parameters of per capita water demand is set at 150 lcd (MCWD design condition)
- The rate of non-domestic (Including industry growth and commercial growth) water demand are set as Cotabato City 23%, Other 20% in 2028, Cotabato City 30%, Other 25% in 2040 by future forecast.

In these conditions, future projections for total water demand are assumed to be 176,200m^3/day in 2028 and 244,900m^3/day in 2040 as shown in Table 14.4-4 below.

Table 14.4-4 Future Projections for Total Water Demand

year	2028					2040				
	Population	Domestic		Non-Domestic	Total Demand	Population	Domestic		Non-Domestic	Total Demand
Area	Nr	lcd	m3/day	%	m3/day	Nr	lcd	m3/day	%	m3/day
Cotabato City	380,500	150	57,075	23	70,202	474,700	150	71,205	30	92,567
Others	589,000	150	88,350	20	106,020	812,400	150	121,860	25	152,325
Total	969,500		145,425		**176,222**	1,287,100		193,065		**244,892**

Source: JICA Study Team

The current 22% to 30% rate of NRW will be improved, therefore, the rate of NRW set 20% in 2028 and 15% in 2040 improved and 2% In-plant losses are set, the required water production is estimated to be 215,000m^3/day in 2028 and 286,00m^3/day in 2040 as shown in Table 14.4-5.

Table 14.4-5 Required Water Projection

Conditions	unit	2028	2040
Total Water Demand	m3/day	176,222	244,892
NRW	%	20	15
In-Water Treatment Plant Losses	%	2	2
Required Water Production Capacity	m3/day	**215,000**	**287,000**

Source: JICA Study Team

Note that this water demand projection is based on the whole population of Cotabato City and other five surrounding municipalities. However, to set a target for service population, practical percentage of service population shall be considered especially for low-income areas or remote areas from city center. Therefore, regarding water supply systems, it is necessary to consider the strategies and new master plan for the period up to the year 2028 and 2040.

14.5 Water Supply Sector Plan

14.5.1 Cotabato City Priority Projects

a. Project Title: Water supply capacity expansion of Metro Cotabato Water District (MCWD)
b. Location: Brgy. Dimapatoy, Datu Odin Sinsuat and Maguindanao
c. Implementing Agency: Metro Cotabato Water District (MCWD)
d. Objectives:
    1) To improve and increase the water services of Metro Cotabato Water District and ensure safer operation.
    2) To sustain the good quality of potable water to its consumers
    3) To provide sustainable power supply to the system for efficient delivery of water service
    4) To provide riverbank protection at the upstream portion of Dimapatoy River (one of the source of water of MCWD) to prevent erosion.

e. **Expected Effects:**

Improved water services in Cotabato City and neighboring municipalities of DOS and Sultan Kudarat; Continuous supply of potable water; uninterrupted power supply to run the water pumps for continuous supply of potable water; and riverbank protected from erosion

f. **Project Description**

Metro Cotabato Water District (MCWD) created in 1976 is the sole utility company supplying potable water in Cotabato City and neighboring areas of Sultan Kudarat and Datu Odin Sinsuat in Maguindanao. It has a capacity of producing 40,000 m^3/day from three (3) sources, namely: 1) Deep Well – three (3) deep wells located in Sultan Kudarat municipality producing 30 m^3, 16 m^3, and 6 m^3/day, respectively; 2) Spring Water in Brgy. Tanuel, Datu Odin Sinsuat municipality. That can produce 16,000 m^3/day; and 3) Surface Water in Dimapatoy River that can produce 200 liters/sec with treatment plant. However, 30% of the water production are wasted (Non-Revenue Water), hence only 28,000 m^3 are produced for 34,640 HH. Currently only 49% of household are supplied with water from MCWD while 51% are not supplied. These households, however, get their water from bulk water suppliers (private companies) which produces 5,000 m^3/day. Incidentally, this is not enough to supply the total service area of MCWD which covers Cotabato City and parts of Sultan Kudarat and DOS. Hence, this project proposal.

Most of the projects identified by the MCWD respond to the existing problems of their facility in Dimapatoy as shown in Table 14.5-1 below.

The project include four (4) major components:

1) Replacement of dilapidated pipes, which are 30-40 years old;
2) Construction of additional Water Treatment Plant with capacity of 5,000-8,000 cu.m. a day;
3) Installation of 2,000KW Solar Panel for Electric Power Production with accessories;
4) Riverbank Protection at Dimapatoy River (50 meters upstream)

Table 14.5-1 Priority Projects of MCWD

Project Name
1). Replacement of Dilapidated Pipes (30-40 years old)
2). Modular Water Treatment Plant (with capacity of 5,000-8,000 cu.m. a day)
3). Solar Panel for Electric Power Production (with accessories 2,000KW)
4). Riverbank Protection for Dimapatoy River (50 meters)

Source: Metro Cotabato Water District

g. Considerations

Proper coordination and collaboration with LGUs Cotabato City, Datu Odin Sinsuat and Sultan Kudarat and concerned agencies, such as, DPWH Cotabato City District Engineering Office (for the excavation of dilapidated pipes and layout of new pipes along the National Highway), DOH for the portability of water and Cotabato Light and Power Company (if necessary), is necessary for smooth implementation of the project.

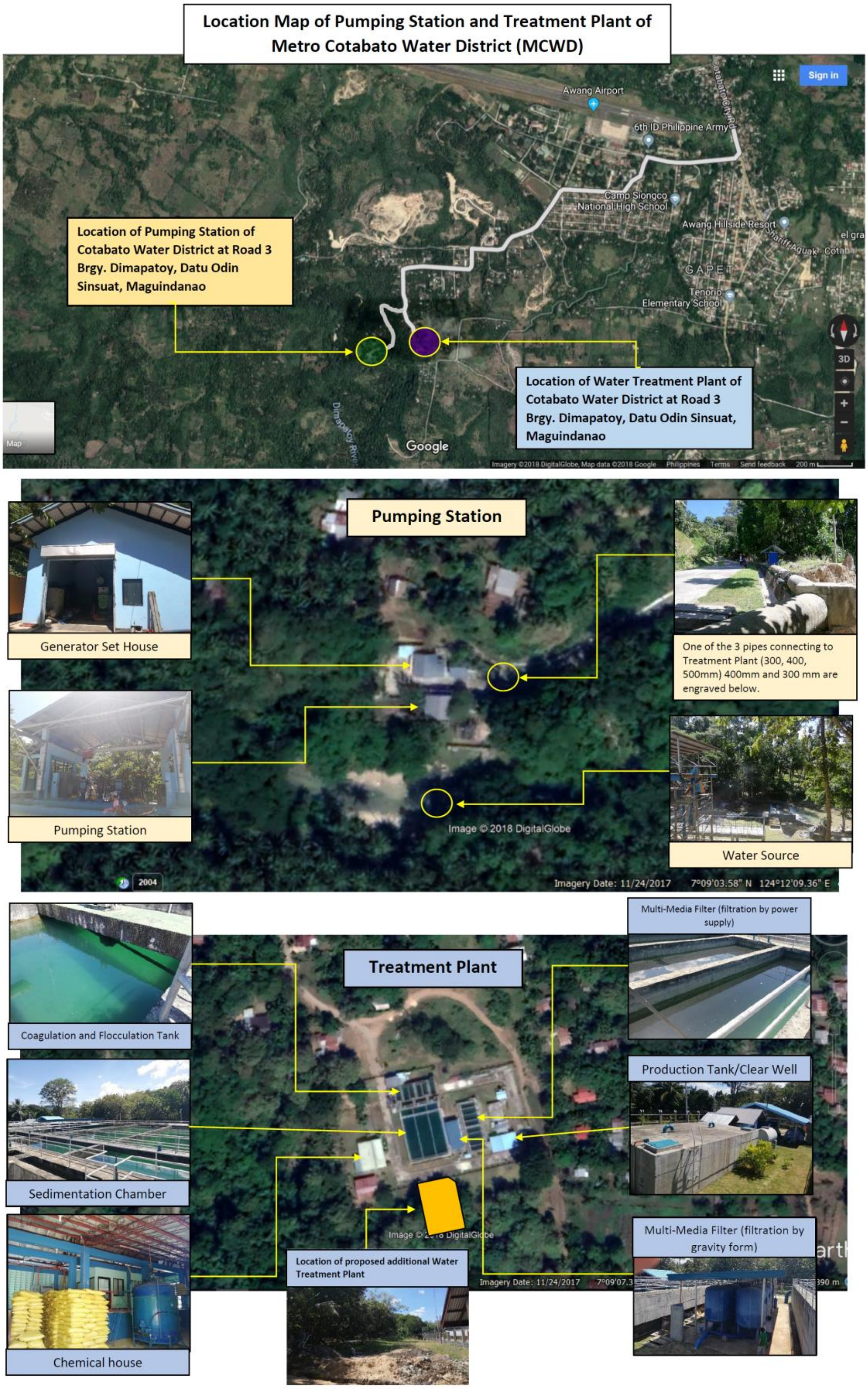


Figure 14.5-1 Location of MCWD Proposed Projects

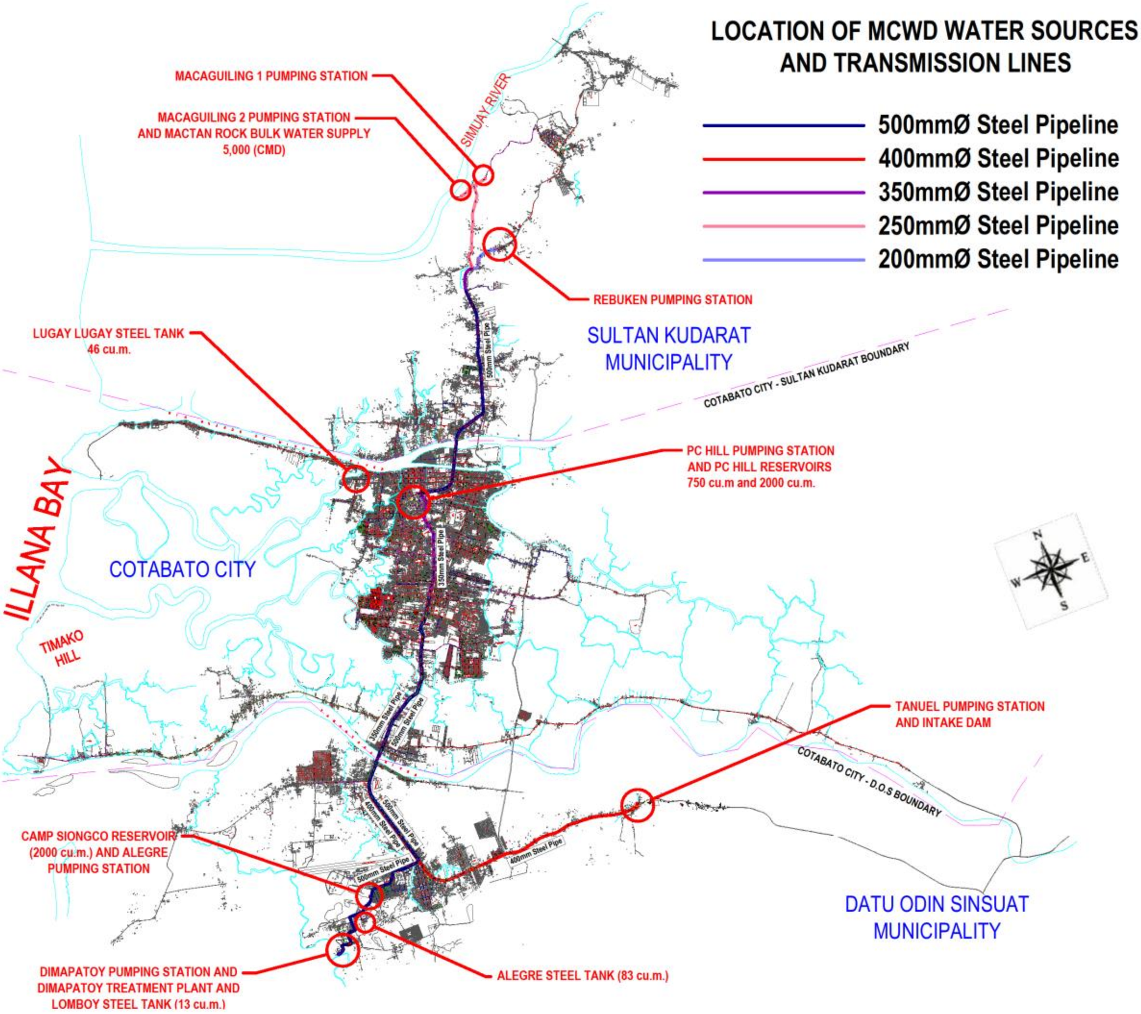


Figure 14.5-2 Location of MCWD Water Sources and Transmission Lines

14.5.2 Priority Projects in the Five Surrounding Municipalities

Summary of Issues on Water Supply System in the Five Surrounding municipalities and Priority Projects are as shown in the following table:

Table 14.5-2 Summary of Issues and Priority Projects of LGUs

Issues	Plans
- Inadequate funds to improve water systems particularly in the remote barangays	- Will seek assistance from other line agencies or foreign funding agencies
- Non-prioritization of water supply systems by some LGUs	- LGUs will allocate budget for water system projects from the 20% annual development plans
- no collection of tariffs for sustainability of the facility	- Will organize and strengthen BAWASA or Water Concessioner’s Cooperatives to facilitate collection of tariffs
- Poor management of existing water supply systems	- Will enjoin concerned barangay officials to assign personnel that will oversee proper management of project including water supply systems
- Less protection of the environment and climate change impact resulting to disappearance of forests in the barangays that may result to depletion of water resources	- Reforestation program will be included in the Annual Investment Plan of LGUs

Source: The Five Surrounding Municipalities

14.6 Selection of High Priority Projects

14.6.1 Project Prioritization Criteria

Project priorities are proposed based on the following conditions and considerations:

(1) Corresponding to the Increase in Water Demand due to Population Growth and Urbanization

Both Cotabato City and the five surrounding municipalities are planning to expand water supply at Level 3 (water supply to each household by pipeline). At present there are still many residents cannot access enough piped water.

(2) Repairing and Renewing Existing Water Treatment Facilities and Water Pipe Networks

Since 20 to 30 years have passed since the water pipe network was constructed, there are concerns about the deterioration of the water pipe network. Therefore, it is necessary to carry out repairs and renewals

(3) Improving and Strengthening the Management of the Water Supply Business

At present, MCWD and cannot provide a stable and adequate supply of clean water.

Moreover GWCL has not been able to ensure a proper income because of the large amount of non-revenue water. It is necessary to seek to improve the management of the water supply business by 2040 by increasing the volume of water supply and by reducing the volume of non-revenue water by 2040.

(4) Reducing Water-borne Diseases and Respond to the Water Supply in the COVID-19 Crisis

Properly treated water is supplied through the water supply pipe network, providing access to safe water and reducing water-borne diseases, and it is urgently need to respond to the water supply in the COVID-19 Crisis.

(5) Strategies for Water Supply Development

1) Respond to the Water Supply in the COVID-19 Crisis
2) Develop the New Master Plan for Cotabato City and Surrounding Municipalities
3) Strengthen the Capacity of Water Service Management Body
4) Expand Water Supply Services

14.6.2 Project Profile of High Priority Projects

(1) Outline of the Plan for the Water Supply Sector Project

Following Sub-Plans were prepared.

- **Sub-Plan 1:**
  Strengthening the Capacity of Water Service Management

- **Sub-Plan 2:**
  Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities
- **Sub-Plan 3:**
  Reduction of Non-Revenue Water (NRW) for Cotabato City
- **Sub-Plan 4:**
  Water Supply Development for Cotabato City and Surrounding Municipalities

The project profile for each plan are as follows:

1) Sub-Plan 1: Strengthening the Capacity of Water Service Management

➢ Strategy to Respond to the Water Supply in the COVID-19 Crisis "The Present Water, Sanitation and Hygiene(WASH)"

a. Rehabilitation of water supply facilities in health facilities and schools to keeping taps running

b. Promoting hygienic practices

c. Method development for revenue reduction (e.g. Introduction of Pre-Paid Water Meter (PPWM))

d. Water supply capacity expansion of Metro Cotabato Water District (MCWD)

- Project Title: Water supply capacity expansion of Metro Cotabato Water District (MCWD)
- Location: Brgy. Dimapatoy, Datu Odin Sinsuat and Maguindanao
- Implementing Agency: Metro Cotabato Water District (MCWD)
- Objectives:
  1) To improve and increase the water services of Metro Cotabato Water District and ensure safer operation.
  2) To sustain the good quality of potable water to its consumers
  3) To provide sustainable power supply to the system for efficient delivery of water service
  4) To provide riverbank protection at the upstream portion of Dimapatoy River (one of the source of water of MCWD) to prevent erosion.

- **Expected Effects:**

  Improved water services in Cotabato City and neighboring municipalities of DOS and Sultan Kudarat; Continuous supply of potable water; uninterrupted power supply to run the water pumps for continuous supply of potable water; and riverbank protected from erosion

- **Project Description**

Metro Cotabato Water District (MCWD) created in 1976 is the sole utility company supplying potable water in Cotabato City and neighboring areas of Sultan Kudarat and Datu Odin Sinsuat in Maguindanao. It has a capacity of producing 40,000 m^3/day from three (3) sources, namely: 1) Deep Well – three (3) deep wells located in Sultan Kudarat municipality producing 30 m^3, 16 m^3, and 6 m^3/day, respectively; 2) Spring Water in Brgy. Tanuel, Datu Odin Sinsuat municipality. That can produce 16,000 m^3/day; and 3) Surface Water in Dimapatoy River that can produce 200 liters/sec with treatment plant. However, 30% of the water production are wasted (Non-Revenue Water), hence only 28,000 m^3 are produced for 34,640 HH. Currently only 49% of household are supplied with water from MCWD while 51% are not supplied. These households, however, get their water from bulk water suppliers (private companies) which produces 5,000 m^3/day. Incidentally, this is not enough to supply the total service area of MCWD which covers Cotabato City and parts of Sultan Kudarat and DOS. Hence, this project proposal.

Most of the projects identified by the MCWD respond to the existing problems of their facility in Dimapatoy. The project include four (4) major components:

1) Replacement of dilapidated pipes, which are 30-40 years old;
2) Construction of additional Water Treatment Plant with capacity of 5,000-8,000 cu.m. a day;
3) Installation of Solar Panel for Electric Power Production with accessories; and
4) Riverbank Protection at Dimapatoy River (50 meters upstream)

- **Considerations**

Proper coordination and collaboration with LGUs Cotabato City, Datu Odin Sinsuat and Sultan Kudarat and concerned agencies, such as, DPWH Cotabato City District Engineering Office (for the excavation of dilapidated pipes and layout of new pipes along the National Highway), DOH for the portability of water and Cotabato Light and Power Company (if necessary), is necessary for smooth implementation of the project.

Necessary cost of above listed components is roughly estimated as shown below, if those are implemented by JICA grant aid/loan. However, detail scope of those components shall be examined in upcoming study to match with the urban development framework in this study, hence the estimated cost shall be revised.

Table 14.6-1 Priority Projects of MCWD

Project Name	Cost (PhP M)
1.Replacement of Dilapidated Pipes (30-40 years old):300-500 mm Steel Pipe	200,000,000
2. Modular Water Treatment Plant (with capacity of 5,000-8,000 cu.m. a day)	300,000,000
3. Solar Panel for Electric Power Production	50,000,000
4. Riverbank Protection for Dimapatoy River (50 m)	50,000,000
Total	**600,000,000**

Source: JICA Study Team

		
Existing Treatment Plant	Area of the proposed additional Treatment Plant (owned by MCWD)	Pumping Station

Source: Metro Cotabato Water District

Figure 14.6-1 Photos of MCWD Facilities

Followings are JICA's actions to the COVID-19 Pandemic:

1. The COVID-19 Pandemic and the Present Water, Sanitation and Hygiene (WASH) Situation

(1) The COVID-19 and the Issues related to Water, Sanitation and Hygiene

Handwashing with water and soap is one of the most important measures to prevent the spread of coronavirus disease 2019 (COVID-19) (WHO/UNICEF 2020). Therefore, keeping the taps running and promoting hygienic practices are essential.

However, some 3 billion people, equivalent to 40% of the world's population, do not have access to both water and soap at home (WHO/UNICEF 2019), and many health facilities and schools do not have water and handwashing facilities in place. Besides, about 1 billion people in developing countries live in high-density informal settlements (Satterthwaite et al. 2020), and the access to water and handwashing facilities in informal settlements is very limited since these areas often fall outside the city's water and sanitation service areas. Thus, the risk of COVID-19 infection in informal settlement areas is critically high.

Moreover, water utilities are facing financial challenges due to the stagnation of economic activities and the draconian measures, such as the blockade of cities and the strict imposition of curfew hours during lockdowns, which have been ongoing for several weeks up to the present. Many water utilities in developing countries have reported significant revenue reductions because of the difficulty of tariff collection, the decrease of industrial and commercial water usage, and the government's remission policy on water tariff. There is then a strong concern that the substantial decrease in tariff revenue will lead to the shortage of liquidity in the immediate future, and might have a profound negative impact on water utility management in the medium to long term aspect.

(2) The Response

In the circumstances, many development partners, including JICA, are responding to prevent and curb the spread of COVID-19 by providing a supply of chemicals, equipment, and technical support to water utilities, as well as emergency water supply in areas where residents do not have access to water facilities.

(3) Recovery

JICA considers that support aimed at both achieving the Sustainable Development Goals (SDGs) and building of a resilient social system are necessary.

For example, as reported by Curtis and Cairncross (2003), handwashing with soap and water can reduce diarrheal diseases by 47 percent, one of the main objectives of the Water, Sanitation and Hygiene (WASH) is to "improve public health and ensure healthy living conditions." Therefore, building on the understanding of WASH's fundamental contribution to people's health, it is essential to examine measures to prevent the spread of COVID-19, especially with vulnerable groups, and to strengthen the response in terms of WASH. Furthermore, there is a need to identify countermeasures for water utilities that are severely affected and promptly implement them.

2. Challenges faced by Water Utilities

The World Bank (2020) has pointed out that the COVID-19 crisis poses three main challenges to water utilities: i) Loss of revenue; ii) Reduced availability of critical elements for operation, such as chemicals and fuels; and iii) Delay of significant investments. It goes without saying that the second and third challenges are rooted in the first challenge.

(1) Revenue Loss in Developing Countries

Figure 2 shows the transition of billed and collected amounts of the Water and Sanitation Corporation (WASAC) in Rwanda from July 2019 to May 2020. WASAC has been achieving almost 100% of collection efficiency before the COVID-19 pandemic, but the collection declined drastically to 42% in May 2020. In the past four months (from February to May 2020), WASAC estimated a USD 3 million loss in revenue compared to the previous year. According to WASAC, revenue reduction is attributed to the non-payment of large customers, such as business offices, and restraints.

In the case of Guinea Water Company (Société des Eaux de Guinée: SEG), Guinea's government announced six months of water tariff exemption (from April to September 2020) for individual customers. Consequently, SEG will not be able to accumulate income of approximately USD1.5 million from its customers during that period. Several reports related to revenue loss have been received, and JICA has confirmed revenue reduction from its counterparts.

(2) Types of Request from JICA's Counterparts

In developing countries, sudden revenue decreases have affected the cash flow for many water utilities, resulting in efforts to procure necessary materials for water supply systems' operation. This is very clear from the fact that of the 11 requests at present, 10 are for chemicals such as chlorine. The supply of chemicals is essential because they are vital for ensuring proper water treatment, safety and reliability of tap water, as well as alleviation of the financial burden.

(3) Cases of Water Utilities in Japan

As far as revenue is concerned, water utilities in Japan are also experiencing a similar challenge. According to the Ministry of Health, Labor and Welfare, as of June 2020, 423 out of the 1,287 water utilities have introduced, or are planning to introduce, tariff mitigation or remission measures. These measures aim to provide continuous water access for handwashing by both individual and business customers affected by the COVID-19 pandemic and to address the impact of income reduction. Customers may welcome these measures, but the water utilities need to confront the revenue reduction.

The Yokohama Waterworks Bureau, the second largest utility in Japan in terms of service population, has not applied any of the measures mentioned above. However, the utility is also confronted with the revenue reduction. In April and May, household consumption increased by 6.4% (about 315 million cubic meters) compared to the same period in the previous year, while commercial usage fell by 18.6% (about 225 million cubic meters). As a result, the total distributed volume have increased, but the total revenue went down. The drop in commercial usage, which sets a higher tariff than households, has harmed revenue.

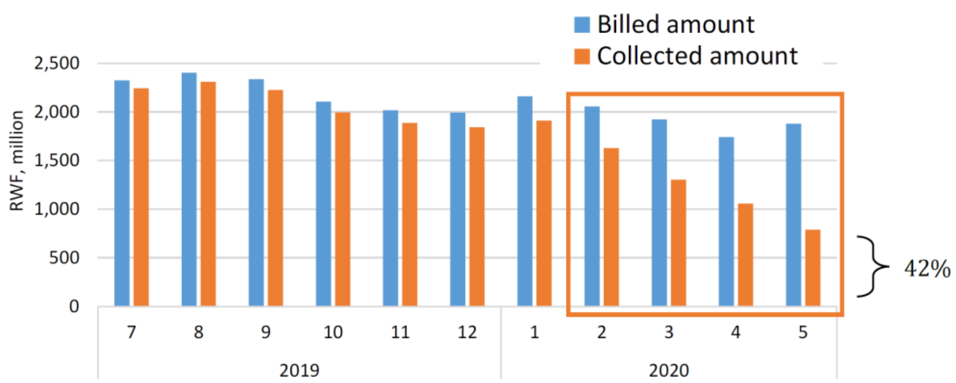


Figure 2: Comparison of Billed and Collected Amounts, WASAC, Rwanda
Source: WASAC and Nihon Suido Consultants Co., Ltd.

(4) A Case of Avoided Revenue Reduction

A water utility in Jenin Municipality had introduced a Pre-Paid Water Meter (PPWM) (Figure 3) for 1,850 of its 8,350 customers under the "Project for Strengthening the Capacity of Water Service Management in Jenin Municipality". This is a case where the drop in collection efficiency is avoided and revenue is kept stable even during the COVID-19 pandemic.

Figure 4 indicates the collection efficiency of those equipped with PPWM and those using conventional water meters from February to May 2020. The conventional meters' collection efficiency is as low as 40% in Feb 2020, then shows a downward trend below 20%. In contrast, the collection efficiency of the PPWM achieves 100% in February 2020 and keeps its outstanding record even during the COVID-19 crisis.

There may be an argument that the PPWM is forcing payment from the vulnerable groups and the poor whose incomes are affected by COVID-19, or, the poor cannot afford to charge it so they have difficulty in obtaining potable water. Given these situations, Jenin allowed customers, based on the application, to defer payments and make water available.

Figure 3：Photo of a Pre-Paid Water Meter

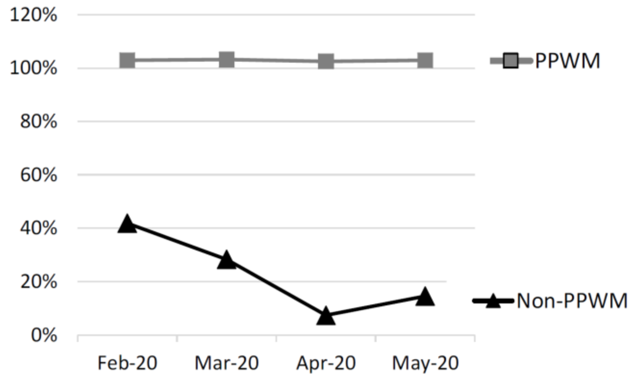


Figure 4: Collection Efficiencies of PPWM and Non-PPWM in Jenin

Source: Jenin Municipality and TEC International Co., Ltd.

Based on the remarkable fact mentioned above, Jenin decided to procure an additional of 6,500 PPWMs for the remaining customers. PPWMs might be the key to achieving a high collection efficiency and help water utilities ensure a stable revenue even under a crisis when fee collectors cannot work in the cities. JICA and Jenin are then working closely together to conduct further studies on the possibility of PPWMs for the management of water utilities.

3. Moving Forward

JICA considers that the main areas of support needed in WASH in relation to the COVID-19 crisis are as follows:

- *Security of income of water utilities and continuity of water services.*
- *Provision of water and sanitation services to vulnerable areas, such as informal settlements and urban slums.*
- *WASH for essential facilities, such as schools and health facilities.*
- *Mainstreaming of handwashing.*
- *Knowledge sharing of lessons learned and experiences on countermeasures related to COVID-19.*

JICA is committed to respond timely and properly to meet these needs through partnership with NGOs, comprehensive multi-sector support, enhancement of handwashing awareness activities, surveys, and research.

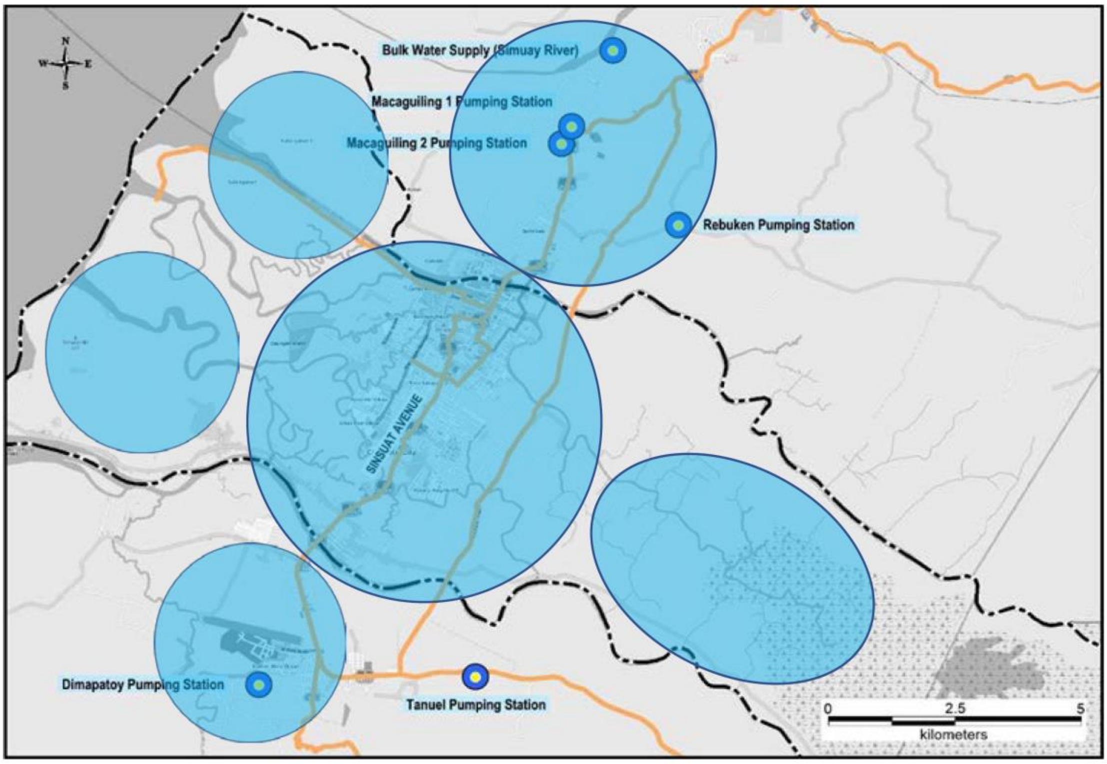
2) Sub-Plan 2: Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities by Technical Cooperation

- Strategy to Develop the New Master Plan for Cotabato City and Surrounding Municipalities, Figure 14.6-2 shows image of water supply master plan area

  a. Improvement and additional development plan for water resources and water treatment plant

  b. Rehabilitation and development plan for water pipe networks

  c. PPP business possibility examination



Source: JICA Study Team

Figure 14.6-2 Image of Water Supply Master Plan Area

3) Sub-Plan 3: Reduction of Non-Revenue Water (NRW) for Cotabato City by Technical Cooperation

- Strategy to Strengthen the Capacity of Water Service Management Body
  - **a. Monitor of the level of NRW of the service area**
  - **b. Establish of Methods, operational procedures for effective NRW Reduction though pilot project at Pilot Metering Areas**
  - **c. A Mid-Term Strategic Plan for NRW Reduction**

NRW consist of water losses divided into apparent and real losses and unbilled authorized consumption. Table 14.6-2 shows International Water Association (IWA)'s NRW.

System input volume	Authorized consumption	Billed authorized consumption	Billed metered consumption (including water exported)	Water sold	Revenue water
			Billed unmetered consumption		
		Unbilled authorized consumption	Unbilled metered consumption	Commercial losses	Non-revenue water (NRW)
			Unbilled unmetered consumption		
	Water losses	Apperent losses	Unathorized consumption	physical losses	
			Customer metering inaccuracies		
		Real losses	Leakage on transmission and/or distribution mains		
			Leakage on service connections up to point of customer metering		
			Leakgae and overflow at utility's storage tanks		

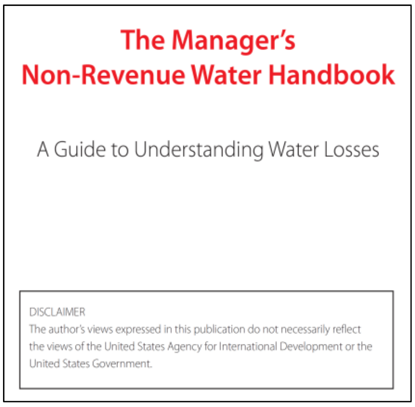
Source: IWA

Table 14.6-2 NRW Defined by IWA

There are some guidelines and handbook to assist understanding NRW such as Figure 14.6-4. Figure 14.6-3 shows photo of water physical losses as a sample image. Figure 14.6-5 shows tap water loss volume.

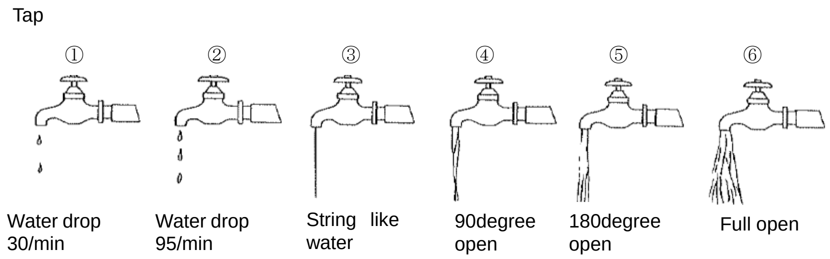
Source: JICA Study Team

Figure 14.6-3 Image Photo of Water Physical Losses



Source: U.S Government

Figure 14.6-4 Sample Handbook



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	①	②	③	④	⑤	⑥
Tap	0.0005	0.0015	0.004	0.129	1.65	2.36

Source: JICA Study Team

Figure 14.6-5 Sample of Water Loss Volume

4) Sub-Plan 4: Water Supply Development for Cotabato City and Surrounding Municipalities by Grant and/or Loan of ODA Project

- Strategy to expand Water Supply Services

a. Water supply pipe extension project (3 Routes)

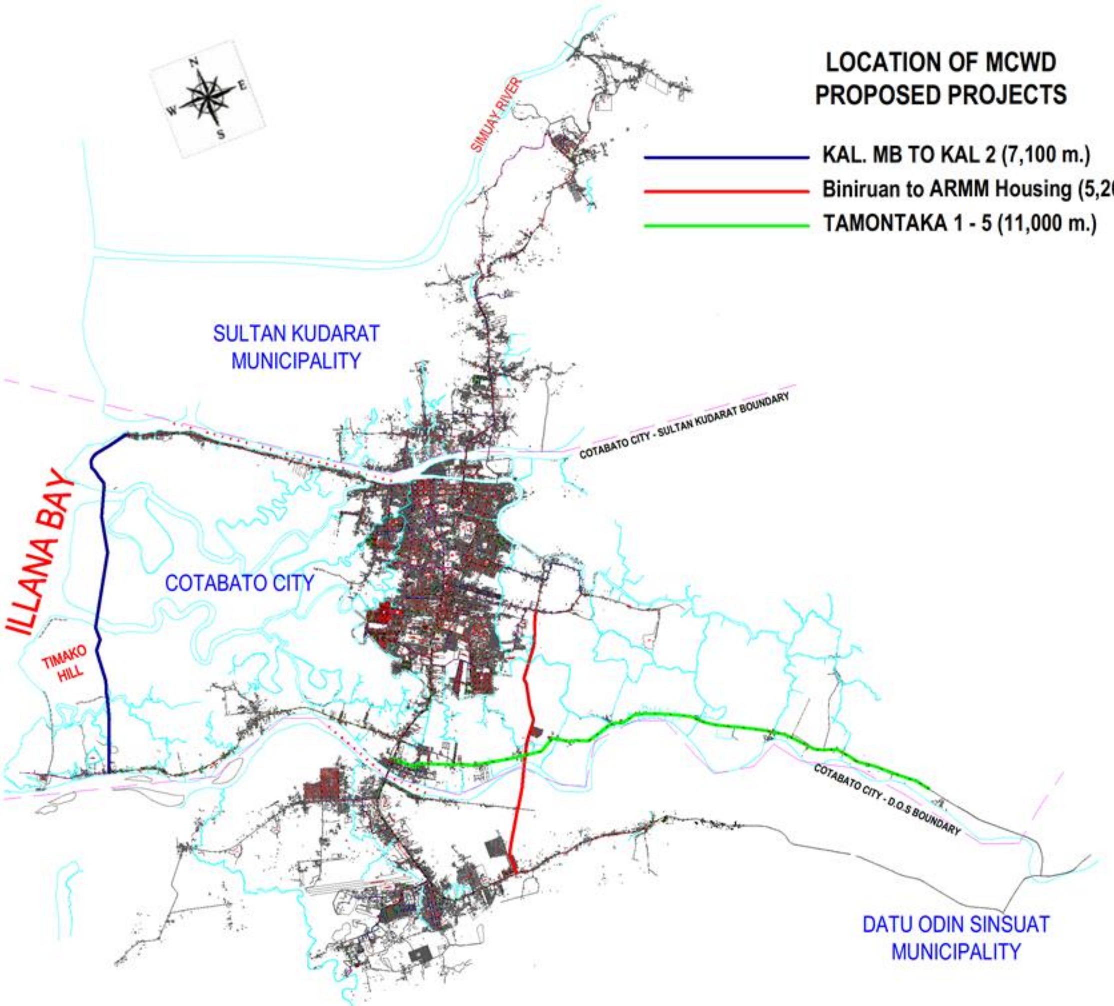
The MCWD planning water supply pipe extension at three (3) locations as shown in Table 14.6-3 and location of area shown in Figure 14.6-6.

b. Construction of Water Supply Facilities for Cotabato City and Surrounding Municipalities by Grant and/or Loan of ODA Project.

Table 14.6-3 Water Supply Pipe Extension Project

Location	Specifications	Remarks
From Kalanganan 1 MB to Kalanganan 2	7,100 m	
From Biniruan to ARMM Housing	5,200 m	
TAMONTAKA 1 - 5	11,000 m	
Total length	**23,300 m**	

Source: Metro Cotabato Water District



Source: Metro Cotabato Water District

Figure 14.6-6 Location of MCWD Proposed Water Supply Pipe Extension Projects

14.7 Implementation Schedule and Project Cost

The Implementation schedule for the water supply projects is shown in Table 14.7-1.

Table 14.7-1 Implementation Schedule for the Water Supply Sector Project

Term Plan	Short-		Mid-Term Plan						Long-Term Plan											
Projects	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Sub-Plan 1: Strengthening the Capacity of Water Service Management by Technical Cooperation and Grant/Loan of ODA Project																				
a. Rehabilitation of water supply facilities in health facilities and schools to keeping taps running	●	→																		
b. Promoting hygienic practices	●	→																		
c. Method development for revenue reduction (e.g. Introduction of Pre-Paid Water Meter (PPWM))	●	→	⇢	⇢	⇢															
d. Water supply capacity expansion of Metro Cotabato Water District (MCWD)	●	→	→	→	→	→	→	→												
Sub-Plan 2: Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities by Technical Cooperation																				
a. Improvement and additional development plan for water resources and water treatment plant	●	→	→																	
b. Rehabilitation and development plan for water pipe networks	●	→	→																	
c. PPP business possibility examination	●	→	→																	
Sub-Plan 3: Reduction of Non-Revenue Water (NRW) for Cotabato City by Technical Cooperation																				
a. Monitor of the level of NRW of the service area				●	→	→														
b. Establish of Methods, operational procedures for effective NRW Reduction though pilot project at Pilot Metering Areas				●	→	→														
c. A Mid-Term Strategic Plan for NRW Reduction				●	→	→														
Sub-Plan 4: Water Supply Development for Cotabato City and Surrounding Municipalities by Grant and/or Loan of ODA Project																				
a. Water supply pipe extension project (3 Routes)	●	→	→	→	→	→	→	→												
b. Construction of Water Supply Facilities for Cotabato City and Surrounding Municipalities by Grant and/or Loan of ODA Project.					●	→	→	→	→	→	→	→	→	→	→	→	⇢	⇢	⇢	⇢

Source: JICA Study Team

The project cost for the water supply development project shown in Table 14.7-2.

Table 14.7-2 The Costs for the Water Supply Development Project

Projects	Indicative Cost (PhP M)	Equivarent (JPY M)
Sub-Plan 1: Strengthening the Capacity of Water Service Management by Technical Cooperation and Grant/Loan of ODA Project	645	1,420
a. Rehabilitation of water supply facilities in health facilities and schools to keeping taps running		
b. Promoting hygienic practices	45	100
c. Method development for revenue reduction (e.g. Introduction of Pre-Paid Water Meter (PPWM))		
d. Water supply capacity expansion of Metro Cotabato Water District (MCWD)	600	1,320
Sub-Plan 2: Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities by Technical Cooperation	73	160
a. Improvement and additional development plan for water resources and water treatment plant		
b. Rehabilitation and development plan for water pipe networks		
c. PPP business possibility examination		
Sub-Plan 3: Reduction of Non-Revenue Water (NRW) for Cotabato City by Technical Cooperation	136	300
a. Monitor of the level of NRW of the service area		
b. Establish of Methods, operational procedures for effective NRW Reduction though pilot project at Pilot Metering Areas		
c. A Mid-Term Strategic Plan for NRW Reduction		
Sub-Plan 4: Water Supply Development for Cotabato City and Surrounding Municipalities by Grant and/or Loan of ODA Project	26,045	57,300
a. Water supply capacity expansion of Metro Cotabato Water District (MCWD)		
b. Water supply pipe extension project (3 Routes)		
c. Construction of Water Supply Facilities for Cotabato City and Surrounding Municipalities by Grant and/or Loan of ODA Project.		

Source: JICA Study Team

14.8 Initial Environmental and Social Assessment of Water Supply Sector Plan

The Environmental Impact Matrix of the water supply sector is shown in Table 14.8-1.

Table 14.8-1 Environmental Impact Matrix of the Water Supply Sector

		Pollution control								Natural				Social environment																Others			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Type of Permit	Remarks
Project/ Program	Phases	Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment, livelihood	Land use and utilization of local resources	Water usage	Existing social infrastructures and services	Social institutions such as social infrastructure and local decision-making institutions	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR	
1. Strengthening the Capacity of Water Service Management (Inclueding construction work of water supply capacity expansion)	Pre-construction																																
	Construction					B -	D										A+	A+											A+	C			
	Operation & Maintenance																	A+	A+	A+	A+					A+	A+		A+				
2. Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities	Pre-construction																																N/A: Capacity Building Project
	Construction																																
	Operation & Maintenance																																
3. Reduction of Non-Revenue Water (NRW) for Cotabato City	Pre-construction																																N/A: Capacity Building Project
	Construction																																
	Operation & Maintenance																																
4. Water Supply Development for Cotabato City and Surrounding Municipalities	Pre-construction																																
	Construction					B -	D										A+	A+											A+	C			
	Operation & Maintenance																	A+	A+	A+	A+					A+	A+		A+				

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.
D: No impact is expected.
N/A: Not applicable (for exaple, Capacity Building Project)

ECC: Environmental Compliance Certificate
CNC: Certificate of Non-Coverage

Source: JICA Study Team

CHAPTER 15
SEWERAGE DEVELOPMENT PLAN

15.1 Background

15.1.1 Overview

Currently, 70.8% of the population in Cotabato City have access to sanitary sanitation facilities but there is no sewerage or septage treatment system. Most households use onsite sanitation such as water sealed toilet with septic tank. Some households, however, use unsanitary toilet such as pit latrines and others, particularly those along river banks and high-density settlements lack access to sanitary toilets.

Entire Cotabato City

Areas along river banks

Source: JICA Study Team

Figure 15.1-1 Sanitary Condition in Cotabato City

In five municipalities surrounding Cotabato City (Datu Odin Sinsuat, Sultan Kudarat, Sultan Mastura, Parang, Pigcawayan), there are no sewerage or septage treatment systems. Many households are using unsanitary sanitation facilities. Among these municipalities, the municipality of Sultan Kudarat has the highest percentage (74%) of households using unsanitary sanitation facilities.

Table 15.1.1-1. Summary of Sanitation Situation in Surrounding Municipalities

Name of municipality	Total number of households	% of households using unsanitary facilities
Datu Odin Sinsuat	16,880	33.75
Sultan Kudarat	15331	74.00
Sultan Mastura	3,837	15.00
Parang	15,262	10.00
Pigcawayan	15,201	17.68

Source: MPDC, CLUP

15.1.2 Sanitation Sector Challenges

There are several challenges preventing Cotabato City and surrounding municipalities from significantly improving sanitation and water quality. These challenges fall into four categories: (a) Lack of septage management systems; (b) substandard design and construction of septic tanks; (c) inadequate drainage systems; (d) and unhygienic behaviors and practices.

15.1.3 Initiatives to Improve Sanitation and Water Quality

Over the last ten years, several policy initiatives have been implemented in the Philippines to address sanitation sector challenges. Notable initiatives include:

- The enactment of the Clean Water Act, 2004
- The development of The National Sustainable Sanitation Policy 2010-2016
- The development of the Philippine Sustainable Sanitation Roadmap (PSSR) 2010-2028. The PSSR serves as a guide for the country in achieving universal sanitation coverage and is the basis for formulation of sustainable sanitation programs. The PSSR presents the vision, goals, outcomes, outputs, activities, and inputs required to make sustainable sanitation a reality in the entire country.
- The development of the National Sewerage and Septage Management Program

In addition to these initiatives, the Department of Health in partnership with the Water and Sanitation Program (WSP) of the World Bank, the Swedish International Development Cooperation (SIDA) has published a range of guidelines/reports that support Local Government Units (LGU) and Water Districts to improve sanitation.

While a range of development initiatives have been implemented to improve sanitation in the Philippines, many households in Cotabato City and surrounding municipalities still lack access to sanitation. Currently, Cotabato City, in partnership with the United States Agency for International Development (USAID) has developed a septage management program to improve sanitation and water quality. The septage management program will be implemented by the City Government of Cotabato and the Metro Cotabato Water District (MCWD). The five municipalities surrounding Cotabato City have not developed septage management programs.

15.2 Issues on Sewerage Development

15.2.1 Environmental Degradation and Poor Health Conditions

Water bodies in the city and surrounding municipalities have levels of coliform bacteria that exceed the standards set by the Department of Environment and Natural Resources. The level of bacteria in water bodies present a significant health risk to the residents of the city and surrounding municipalities.

15.2.2 Sanitation Sector Challenges

There are four key challenges preventing Cotabato City and surrounding municipalities from significantly improving access sanitation and improving water quality: substandard design and construction of septic tanks; poor drainage system; lack of septage management program; and unhygienic behaviors and practices.

(1) Substandard Design and Construction of Septic Tanks

Majority of households use septic tanks. But septic tanks are often poorly designed and constructed. Many households use septic tanks that have open bottoms at leaking chambers, hence untreated effluent leaks into groundwater. In some cases, septic tanks are positioned underneath buildings, making it impossible for owners to desludge them. A key challenge is how to encourage households to repair their septic tanks since they will need money to do so.

(2) Inadequate Drainage Systems

The overflow wastewater (effluent) from septic tanks either flow freely to the groundwater in areas without drainage system or flow into accessible city drainage system and discharges into a river/creek without undergoing treatment or disinfection.

Domestic wastewater from central business district (CBD) in Cotabato city flows towards existing city drainage and exits to Rio Grande River without undergoing any type of treatment. The city drainage system within the central business district (CBD) is quite adequate to accommodate storm water under normal weather conditions. These undergo regular maintenance and cleaning works. The effluent wastewater from the septic tanks and nonfecal wastewater of residential houses and commercial establishments within the CBD also flow through to this city drainage system. However, the combined storm water and domestic wastewater from residential houses and commercial establishments flow into the Rio Grande River without undergoing any type of treatment, hence, polluting the river.

(3) Unhygienic Behaviors and Practices

Pollution of surface and groundwater is caused in part by lack of community awareness of the impact of inadequate sanitation on human health and limited ability by households to pay for sanitation products and services. As a result, many households discharge septage into rivers, creeks, and other water bodies. Many poor households in high-density urban areas and households living along riverbanks do not have access to sanitation, hence open defecation still exists. These issues are experienced in Cotabato City and the surrounding municipalities, but they are more serious in the surrounding municipalities.

(4) Lack of Septage Management Systems in Surrounding Municipalities

The enactment of the Clean Water Act, 2004 resulted in the preparation of the National Sewerage and Septage Management Program (NSSMP). The Clean water Act requires LGUs and Water Districts to create septage management programs in areas without sewerage systems. However, most LGUs lack the capacity, technical knowledge or funds to design and implement septage management programs. The priority of LGUs in the surrounding municipalities seem to be road construction. As a result, there is no sewerage or septage treatment plants; regulations to protect the environment are not enforced; septic tanks are not regularly desludged; the disposal of effluent from septic tanks does not comply with environmental regulations.

15.3 Goal and Objectives for Sewerage Development

15.3.1 Goal

The goal is to improve urban sanitation and the environment through the reduction of domestic wastewater pollution load (particularly the effluent from septic tanks to water bodies and to the groundwater, to protect people's health, thereby making Cotabato City and surrounding municipalities livable.

15.3.2 Objectives

To address the sector challenges outlined in section 15.2.2, a septage management program will be implemented in the five municipalities surrounding Cotabato City. The objectives of the septage management program will be to:

- Improve access to sanitary sanitation facilities;
- Increase adoption of behaviors and practices that protect the environment and health;
- Develop affordable and efficient septage services that will reduce water contamination and minimize pollution in the environment;
- Improve, protect and preserve quality of water bodies in the city; and
- Improve public health and minimize the occurrence of waterborne diseases.

15.4 Strategy on Sewerage Development Plan

The strategic approach to address the sanitation sector challenges and achieve the goals and objectives set out include: enhancing the capacity of LGU and Water Districts in surrounding municipalities to build and operate septage management systems; improving the drainage system to improve the creek environment; and reducing unhygienic behavior and practices.

15.4.1 Enhance the Ability of LGUs to Build and Operate Septage Management Systems

Enhancing the ability of LGUs to build and operate septage treatment systems will ensure an efficient septage management system and the protection of water quality and human health. The objectives of this strategy is to ensure the following:

- Availability of a septage treatment plant.
- An efficient and safe system for collecting septage from households.
- An efficient and safe system for transporting septage from households.

15.4.2 Improving Drainage Systems and Creek Environment

The objective of this strategy is to reduce the pollution of creeks/rivers caused by the overflow of untreated septage into drainage systems and then finally into creeks/rivers. Specific actions under this strategy include:

- Development of advanced treatment for wastewater from city drainage
- De-sludging of city drainage and creek
- Promotional activities to make people aware of the importance of preservation of the river environment

15.4.3 Reducing Unhygienic Behaviors and Practices

The objectives of this strategy are (1) to ensure that households adopt behaviors and practices that will protect the environment and their health, and (2) ensure that service providers (e.g. builders, desludging companies) provide adequate and hygienic services. Activities under this strategy will ensure that households:

- Gain knowledge about the link between inadequate sanitation and poor health;
- Understand behaviors that threaten the environment and human health
- Become aware of sanitation products (technologies) and services, including prices, finance options and recommended or certified service providers.
- Become aware of the regulations concerning the design and construction of septic tanks as well as desludging of septic tanks.

The strategy will also ensure the following among service providers:

- Service providers provide products and services that households want and at prices that households can afford.
- Service providers know relevant regulations regarding the design and constructing of septic tanks as well as the desludging and disposal of septage.

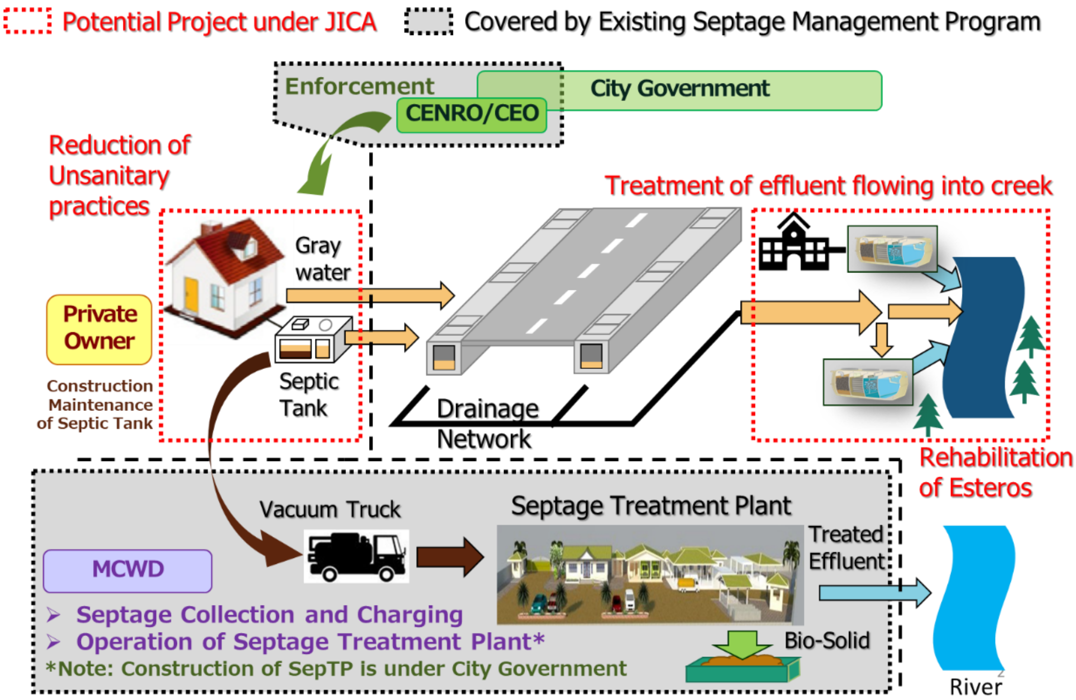
15.5 Sewerage Development Plan

15.5.1 Basic Premise for the Plan

The Plan was basically prepared with following the Septage Management Program (SMP), which is developed by the City Government of Cotabato and MCWD with technical assistance from Be Secure Program by USAID. In this development plan, following topics which are not covered by the SMP will be discussed too.

- Septage management for surrounding five municipalities
- Reduction of unsanitary practices
- Treatment of effluent in drainage which flows into creek in Cotabato City

Figure 15.5-1 shows the basic concept of the plan for Cotabato city. Since the city already has on-track plan for septage management, potential JICA project put focus on reduction of unsanitary practices and enhancement of creek environment by treatment of effluent from septic tanks and domestic wastewater. Centralized sewerage system will not be considered within the time range of this development plan, since the SMP which has target year of 2035 is on the track already. On the other hand, surrounding municipalities establishment of septage management is the first priority.



Source: JICA Study Team

Figure 15.5-1 Basic Concept of Sewerage Development Plan for Cotabato City

15.5.2 Septage Management in Cotabato City

(1) Basic Concept

According to the SMP, the concept of the projects to desludge septic tanks and transport the collected septage to the fully mechanized treatment facility for treatment before disposal of the bio-solids and effluents.

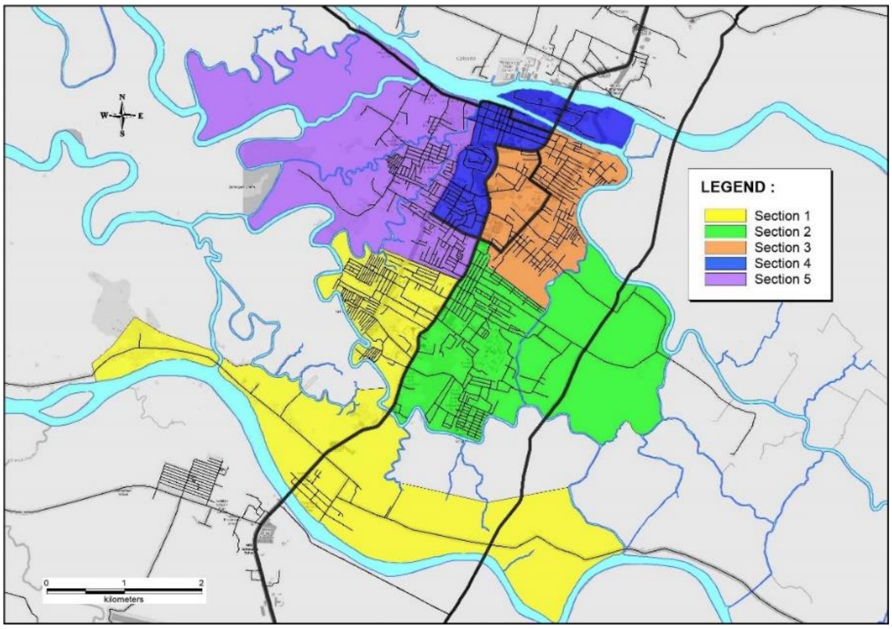
(2) Collection and Transportation

The city service area is divided into five sections. Each section corresponds to the year of servicing (years 1 to 5). The same schedule will be followed in the next five-year cycle to ensure that all septic tanks are regularly desludged every five years as required by the Department of Health.

Table 15.5-1 Projected Number of Household Clients in Cotabato City

Section	Covered Barangays	2015	2020	2025	2030	2035
Section 1	Kalanganan 2, Mother Brgy. Tamontaka, Tamontaka 1, Tamontaka 2, Tamontaka 3, Rosary Heights 10, Rosary Heights 11	3,994	4,630	5,368	6,223	7,214
Section 2	Rosary Heights 8, Rosary Heights 9, Rosary Heights 6, Rosary Heights 7, Poblacion 8, Poblacion 9	4,390	5,089	5,900	6,839	7,928
Section 3	Rosary Heights 4, Rosary Heights 5, Rosary Heights 2, Rosary Heights 3, Mother Barangay Poblacion, Poblacion 2, Poblacion 3, Poblacion 4	5,448	6,316	7,322	8,488	9,840
Section 4	Mother Barangay Rosary Heights, Rosary Heights 1, Rosary Heights 13, Poblacion 1, Poblacion 7, Poblacion 5, Poblacion 6	4,989	5,784	6,705	7,773	9,011
Section 5	Rosary Heights 12, Bagua 3, Mother Barangay Bagua, Bagua 2, Lugay-Lugay (Bagua 1), Mother Barangay Kalanganan	4,355	5,048	5,852	6,784	7,865
Total		**23,176**	**26,867**	**31,147**	**36,107**	**41,858**

Source: Feasibility Study, Cotabato City Septage Management Program, 2019



Source: Feasibility Study, Cotabato City Septage Management Program, 2019

Figure 15.5-2 Sectional Map of Coverage Area

(3) Septage Treatment and Disposal

The treatment process is fully mechanized with advantages of less labor force, odorless operation and shorter time for the treatment process. Basic requirements for treatment are screens to separate and collect non-bio-degradable materials from the septage, equalization/holding tank with stirrer to make the septage homogeneous, polymer dosing stage to promote coagulation of suspended bio-solids, dewatering machine to separate bio-solids and effluents, wastewater treatment facility to treat wastewater prior to discharge to the nearby river and a facility for the use of the bio-solids as soil conditioner and/or filling materials.

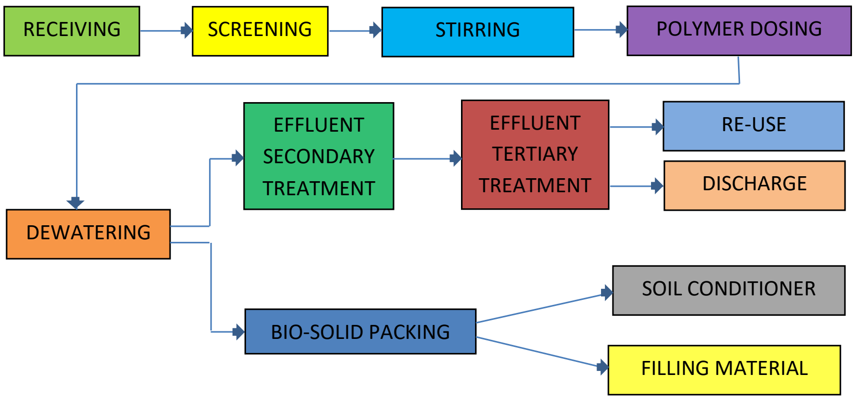
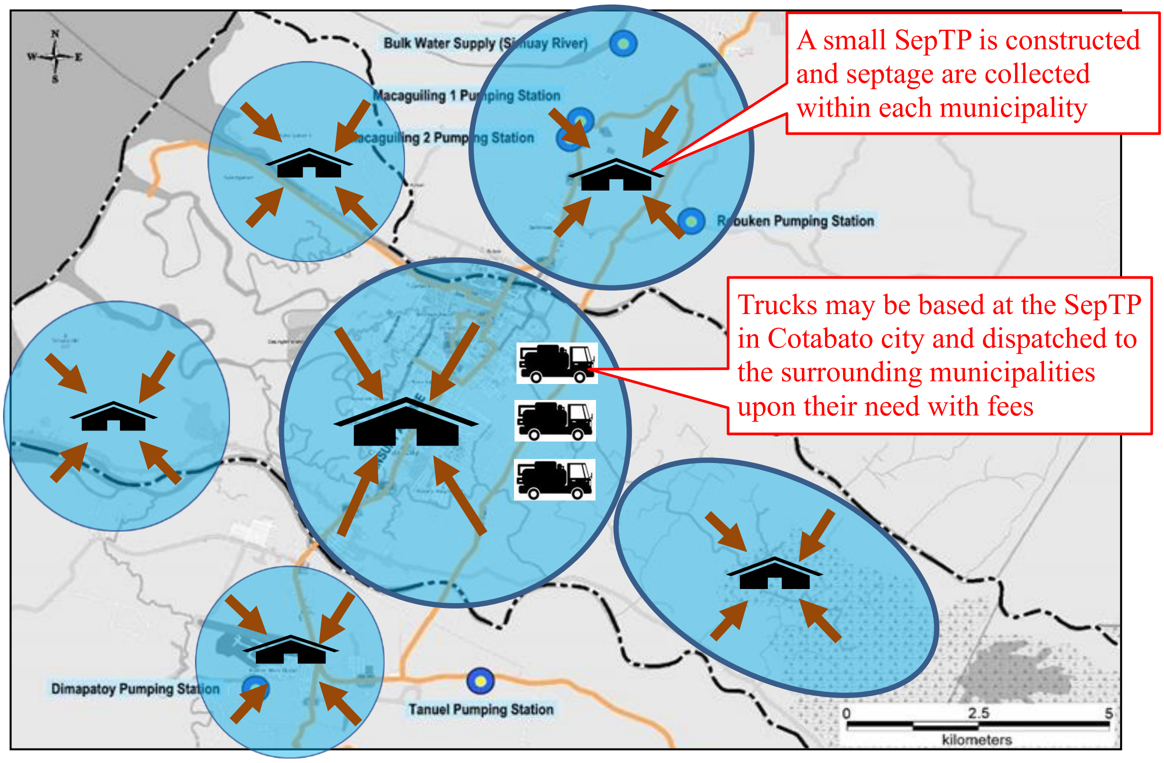


Figure 15.5-3 Process Diagram of the Proposed Septage Treatment Plant

15.5.3 Septage Management in Surrounding Municipalities

(1) Basic Concept

Although septage management program has not been established yet for the five surrounding municipalities, the program is supposed to be combination of desludging/collection and sludge treatment just same as the SMP for Cotabato city. However, since each municipality is distant from others sludge treatment shall be not centralized but done by each municipality, while desludging trucks may be based at the septage treatment plant in Cotabato city. Those vehicles owned and maintained by MCWD or Inter-LGUs organization for septage collection and dispatched to the surrounding municipalities upon their needs with fee. Further study shall be done in the future project and discussed by relevant stakeholders.



Source: JICA Study Team

Figure 15.5-4 Concept Image of Septage Management for Surrounding Municipalities

(2) Collection and Transportation

Same as the SMP for Cotabato city, service area is divided into five sections with each municipality. Each section corresponds to the year of servicing (years 1 to 5). The same schedule will be followed in the next five-year cycle to ensure that all septic tanks are regularly desludged every five years. To estimate household number in 2040, population growth of 1.86% is simply applied for growth rate of households. Sanitary rates (households with sanitary toilet / total households) are estimated as 90% in 2040, except Sultan Kudarat which rate is only 26% in the latest statistics.

Table 15.5-2 Projected Number of Household for Surrounding Municipalities

Section	Covered Municipalities	Latest Stat			Projection in 2040		
		Households		Rate	Households		Rate
		Sanitary	Total		Sanitary	Total	
Section 1	Dato Odin Sinsuat	11,182	16,880	66%	21,963	24,403	90%
Section 2	Sultan Kudarat	3,986	15,331	26%	11,082	22,164	50%
Section 3	Sultan Mastura	3,261	3,837	85%	4,992	5,547	90%
Section 4	Parang, Maguindanao	13,736	15,262	90%	19,858	22,064	90%
Section 5	Plgcawayan, North Cotabato	12,514	15,201	82%	19,778	21,976	90%
Total		**44,679**	**66,511**		**77,673**	**96,154**	

Source: JICA Study Team

(3) Septage Treatment and Disposal

Unlike Cotabato city, surrounding municipalities have sufficient space which is distant from inhabitants thus sludge drying bed can be an option for sludge treatment. Compared to the fully mechanized treatment, drying bed has following advantages: 1) low cost in construction, 2) Simple operation, and 3) Not dependent on power supply.

Source: JICA Study Team

Figure 15.5-5 Example of Sludge Drying Bed

15.5.4 Enhancement of Creek Environment

(1) Introduction

The effluent wastewater from the septic tanks and non-fecal wastewater of residential houses and commercial establishments within the CBD also flow through to this city drainage system (along the SK Pendatun St., Don Rufino Alonzo Ave., Jose Lim Sr. St., and Rajah Tabunaway Blvd.) and flow into the Manday creek or the “open creek” exiting to Rio Grande River, hence, polluting the river.

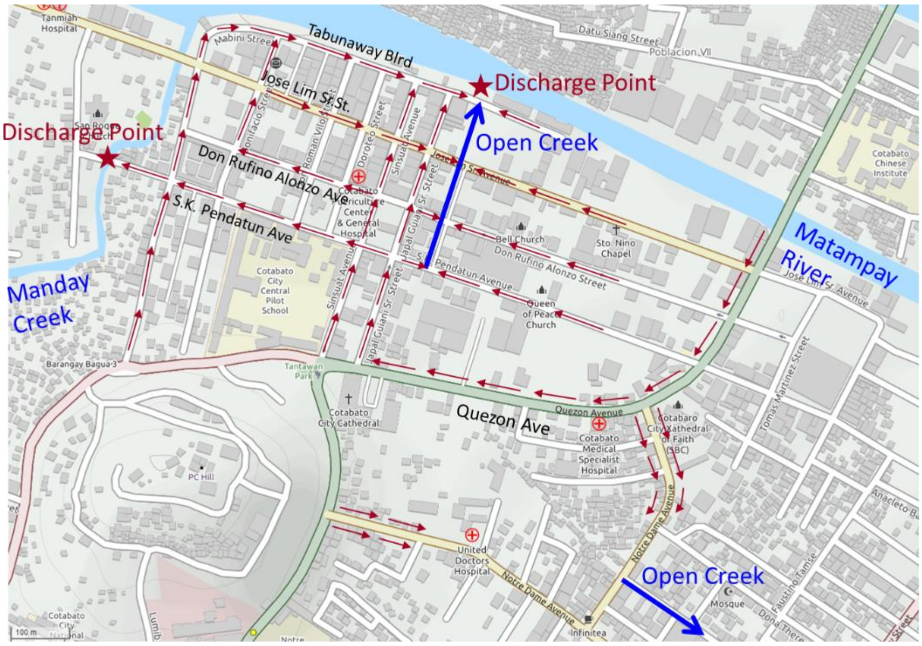


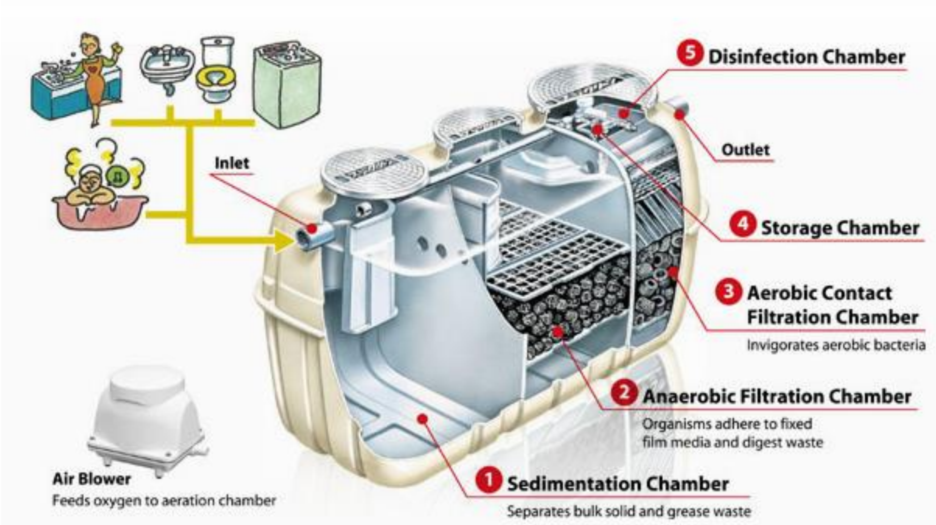
Figure 15.5-6 Current Condition of City Drainage in Cotabato CBD

Instead of centralized sewerage system which takes cost and time, de-centralized treatment plant will be installed at discharge point or major source of wastewater such as large-scale commercial facilities. Other measures to clean city drainage and creeks shall be considered, such as followings:

- A pocket/linear park can be attached at discharge point of the plant to attract more public attention to the quality of treated water and its contribution to the creek environment.
- A Vehicle-mounted Jet Cleaner for city drainage, as well as a Compact Dredger for narrow creeks will be provided for efficient cleaning and maintenance operation.

(2) Technologies

For de-centralized treatment method, Johkaso or other Japanese technologies can be utilized. Johkaso is a multifunctional treatment tank which has functions of sedimentation, anaerobic reaction, aeration, storage and disinfection in one tank.



Source: FujiClean CO.,LTD

Figure 15.5-7 Mechanism of Johkaso

Source: FujiClean CO.,LTD

Figure 15.5-8 Example of Installation of Johkaso in the Philippines

(3) Implementation Strategy of the Project

The project can be staged into short-term and long-term and the short-term project must consist of components which can be done without relocation.

Table 15.5-3 Staging of the Project for Creek Environment

	Short Term	Long Term
Treatment of Wastewater	Installation of treatment plant for public market (City Arcade)	Expansion of the treatment plant to capture wastewater from adjacent city drainage, which may be built under the parking lot of the market
Rehabilitation of the Creek	Provision of a small dredger for de-sludging of the creek	conversion of built up area along creek into linear park
Obligation of C/P	Allocation of OPEX budget for treatment plant and de-sludging	Relocation of informal settlement along Manday creek

15.5.5 Reduction of Unsanitary Practices

(1) Introduction

The health of the environment and residents of Cotabato City and surrounding municipalities is threatened by unhygienic behaviors and practices which pollute surface and groundwater. To protect the health of the environment and the residents in the city and surrounding municipalities, a sanitation and hygiene behavior change promotion program is required.

The sanitation and behavior change promotion program is based on the need to change mindset and behaviors. The objectives of the sanitation and behavior change promotion program at the household and community levels are the following:

1) Increasing access to sanitary sanitation facilities
2) Ending the practice of open defecation
3) Stopping improper use of sanitary facilities
4) Stopping improper desludging and disposal of septage

(2) Implementation Strategy of the Project

In developing the sanitation and hygiene promotion program, the following steps will be followed:

1. Survey to determine key sanitation issues and factors influencing unhygienic behaviors and practices in the city and surrounding municipalities.
2. Use the results of the survey to develop sanitation and hygiene behavior change promotion plan for Cotabato city and surrounding municipalities.
3. Determine the level/amount of resources required to implement the promotion plan.
4. Developing and testing information, education and communication (IEC) materials.

Table 15.5-4 Sanitation & Hygiene Promotion Program Activities

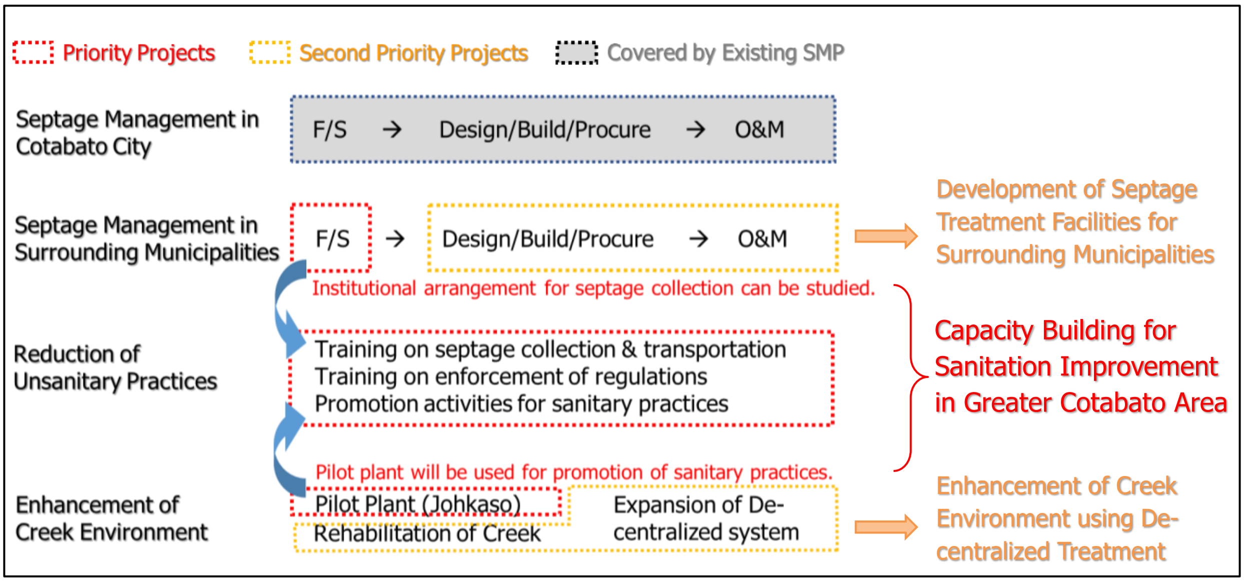
Short term	Medium term	Long term
Stop unhygienic behaviors and practices in Cotabato City - Develop and implement a sanitation and hygiene promotion plan - Train officials, volunteers to conduct behavior change communication. - Develop and distribute leaflets and other IEC materials - Post billboards/posters	Stop unhygienic behaviors and practices in Cotabato City and surrounding municipalities - Develop and implement a sanitation and hygiene promotion plan in all surrounding municipalities. - Continue to train officials and volunteers to conduct behavior change communication. - Develop and distribute leaflets and other IEC materials - Post billboards/posters	Declare universal access to sanitation in the city and surrounding municipalities

15.6 Selection of High Priority Projects for Sewerage Development Plan

Among 4 projects explained in previous sub-chapter "15.5 Sewerage Development Plan", 1 priority projects and 2 second priority projects are proposed as follows:

- Priority Projects
  1) Capacity Building for Sanitation Improvement in Greater Cotabato Area

     In addition to activities for reduction, F/S for septage management in surrounding municipalities and installation of pilot plant (Johkaso) will be combined.
- Second Priority Projects
  1) Development of Septage Treatment Facilities for Surrounding Municipalities
  2) Enhancement of Creek Environment using De-centralized Treatment Plant



Source: JICA Study Team

Figure 15.6-1 Basic Concept of Priority Projects

Summary of each priority/second priority project is as follows.

15.6.1 Capacity Building for Sanitation Improvement in Greater Cotabato Area

(1) Outline of the project

1) Purpose
   - To develop sustainable septage collection and transportation system for Cotabato city and surrounding municipalities including operation training
   - To promote sanitary practices in municipalities including training for enforcement of regulations in line with the National Sustainable Sanitation Roadmap

2) Implementation Agencies

   CENRO in Cotabato city and environmental sector in surrounding municipalities

3) Location

   Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

   From 2023 to 2025

(2) Project description

1) Training to city officers for Septage Management Practices

In Cotabato City a septage management program has developed to improve sanitation, however, capacity building of relevant officers to implement septage collection and transportation is still a challenge. As of now, desludging and collection of septage are rarely practiced in those municipalities thus training of city officers is needed to develop their capacity for implementation of septage management system.

2) Development of Sustainable Septage Collection and Transportation System

The septage management program for the five surrounding municipalities are supposed to be combination of desludging/collection and sludge treatment just same as the SMP for Cotabato city. However, since each municipality is distant from others sludge treatment shall be not centralized but done by each municipality, while desludging trucks may be owned and maintained by MCWD and dispatched to the surrounding municipalities upon their needs with fee. Further study shall be done in this project and discussed by relevant stakeholders. Development of financial management shall also be conducted to secure sustainability of SMP.

3) Promotion of Sanitary Practices

Majority of households use septic tanks. But many households use unsanitary septic tanks (have open bottoms) which do not conform relevant codes and allow discharge of wastewater to public water body. To tackle with this issue, capacity enhancement for reduction of unsanitary practices is needed. Components of this project are as follows.

a) Promotion activity to people for behavior change in hygienic and sanitation practices

b) Promotion of affordable options for replacement of sub-standard septic tanks including seminar to local builders

c) Installation of pilot plant for de-centralized treatment system

15.6.2 Development of Septage Treatment Facilities for Surrounding Municipalities

(1) Outline of the project

1) Purpose
   - To conduct surveys for feasibility and planning of the procurement of necessary equipment
   - To procure the equipment for the future operation of SWM system
2) Implementation Agencies
   Environmental sector in surrounding municipalities and MCWD
3) Location
   Greater Cotabato area (Cotabato city and surrounding municipalities)
4) Implementation Schedule
   From 2026 to 2029

(2) Project description

Based upon the SMP which is supposed to be established in "Development of Septage Management Program for Surrounding Municipalities", treatment facilities for each municipalities are constructed and additional vacuum trucks are provided to MCWD.

d) Outline Design of Septage Treatment facilities

Outline design of septage treatment facilities will be conducted, and necessary budget and financing scheme will be proposed.

e) Detailed Design and Construction of Septage Treatment Facilities

Detail design and construction of septage treatment facilities will be conducted.

f) Provision of vacuum trucks

Additional vacuum trucks will be provided to MCWD to dispatch them to the five surrounding municipalities.

g) Operation training

Operational training for environmental sector in surrounding municipalities.

15.6.3 Enhancement of Creek Environment using De-centralized Treatment Plant

(1) Outline of the project

1) Purpose
   - To improve water quality of creeks and enhance amenity in the central district of Cotabato city
   - To promote people's awareness for the importance of water environment
2) Implementation Agencies
   Cotabato city
3) Location
   CBD of Cotabato city, as shown in the map below
4) Implementation Schedule
   From 2025 to 2030

(2) Project description

1) Background

While the septage management program is on track by the City Government of Cotabato, water quality issues are remained. The effluent wastewater from the septic tanks and non-fecal wastewater of residential houses and commercial establishments within the central business district (CBD) of Cotabato City flow through to this city drainage system and exits to creeks without undergoing any type of treatment, hence, polluting the river.

2) Project Components

This project is to improve water quality of creek in CBD by de-centralized treatment plant, using Johkaso or other Japanese technologies, as well as other measures to clean city drainage and creeks. Project components are proposed as follows:

a) Feasibility Study for Environment Improvement using De-centralized Treatment Plant

To identify mechanism of water pollution in creeks and develop swift and efficient solution plan using de-centralized treatment plant, survey of septic tanks and drainage facilities, water quality analysis and comparison study on method and layout of treatment plants will be conducted. Also, site survey/outline design/cost estimation will be conducted to determine necessary budget of construction. This study may be combined with drainage master plan study in Disaster Risk Reduction Sector.

b) Design and Construction of De-centralized Treatment Plant for City Drainage

De-centralized treatment plants will be installed at drainage outfalls in the city center. It is optional though, a pocket/linear park can be attached at discharge point of the plant to attract more public attention to the quality of treated water and its contribution to the creek environment.

c) Provision of Equipment for Cleaning Operation of City Drainage and Creeks

A Vehicle-mounted Jet Cleaner for city drainage, as well as a Compact Dredger for narrow creeks will be provided for efficient cleaning and maintenance operation.

3) Expected Effects

Expected effects by implementing this project are considered as follows.

- Effluent from public market or other facilities in city center is treated before discharging to creek.
- City drainage and creeks will be maintained and cleaned efficiently by equipment.
- Hence, improvement in water quality of creek in the city center will be observed.

15.7 Implementation Schedule for Sewerage Development Plan

Implementation schedule of Sewerage Development Plan is as follows.

- ■ Schedule in Middle term
- \- Capacity Building for Sanitation Improvement in Greater Cotabato Area
- ■ Schedule in Long term
- \- Development of Septage Treatment Facilities for Surrounding Municipalities (Further Expansion)
- \- Creek Environment Improvement using De-centralized Treatment Plant (Further Expansion)

Table 15.7-1 Implementation Schedule for Each Project on Sewerage Development Plan

Project / Activities		Middle Term							Long Term											
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Priority Project																				
1. Capacity Building for Sanitation Improvement in Greater Cotabato Area																				
1-1	Training to city officers for septage management practices																			
1-2a	Detail data collection related to septage management in surrounding municipalities																			
1-2b	Development of Septage Management Program for Five Surrounding Municipalities																			
1-2c	Feasibility study of septage treatment facilities for surrounding municipalities																			
1-3a	Promotion activity to people for behavior change in hygienic and sanitation practices																			
1-3b	Seminar to local builders for proper septic tank and alternative technologies																			
1-3c	Design and construction of De-centralized treatment plant for city center			Pilot Plant for Public Market																
2nd Priority Project																				
2. Development of Septage Treatment Facilities for Surrounding Municipalities																				
2-1	Outline Design of Septage Treatment facilities																			
2-2	Detailed Design and Construction of Septage Treatment Facilities																			
2-3	Provision of vacuum trucks																			
2-4	Operation training																			
※	Expansion of Septage Treatment Facilities upon Demand Increase																			
3. Creek Environment Improvement using De-centralized Treatment Plant																				
3-1	Feasibility Study for Environment Improvement using De-centralized Treatment Plant																			
3-2	Provision of Equipment for Cleaning Operation of City Drainage and Creeks																			
3-3	Operation Training of De-centralized Treatment Plant and Drainage Cleaning																			
※	Development of Decentralized Treatment System to cover Overall City Drainage																			

15.8 Cost of Sewerage Development Plan

Cost of each project on Sewerage Development Plan is summarized as follows. This cost was estimated with supposing Japanese assistance and case example in Japan.

Table 15.8-1 Cost on Sewerage Development Plan

Project / Activities		Middle Term							Long Term												Total Cost
		2021	2022	2023	2024	2025	2026	2027	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Priority Project																					
1. Capacity Building for Sanitation Improvement in Greater Cotabato Area																					
1-1	Training to city officers for septage management practices		5	5	5																100
1-2a	Detail data collection related to septage management in surrounding municipalities		5																		
1-2b	Development of Septage Management Program for Five Surrounding Municipalities			10																	
1-2c	Feasibility study of septage treatment facilities for surrounding municipalities			10																	
1-3a	Promotion activity to people for behavior change in hygienic and sanitation practices		10		5																
1-3b	Seminar to local builders for proper septic tank and alternative technologies			10	5																
1-3c	Design and construction of De-centralized treatment plant for city center			20	10																
2nd Priority Project																					
2. Development of Septage Treatment Facilities for Surrounding Municipalities																					
2-1	Outline Design of Septage Treatment facilities					20															180
2-2	Detailed Design and Construction of Septage Treatment Facilities						50	50													
2-3	Provision of vacuum trucks							50													
2-4	Operation training								10												
3. Creek Environment Improvement using De-centralized Treatment Plant																					
3-1	Feasibility Study for Environment Improvement using De-centralized Treatment Plant					20															330
3-2	Provision of Equipment for Cleaning Operation of City Drainage and Creeks						100														
3-3	Operation Training of De-centralized Treatment Plant and Drainage Cleaning							10													
※	Development of Decentralized Treatment System to cover Overall City Drainage								50			50			50			50			

15.9 Environmental and Social Considerations of Sewerage Development Plan

Environmental and Social Consideration of each project on Sewerage Development Plan is summarized as follows. Environmental assessment is mainly required to following projects which has big construction works and operation.

- Capacity Building for Sanitation Improvement in Greater Cotabato Area
- Development of Septage Treatment Facilities for Surrounding Municipalities (Further Expansion)
- Creek Environment Improvement using De-centralized Treatment Plant (Further Expansion)

Table 15.9-1 Environmental and Social Considerations on the Sewerage Development Plan

		Pollution control								Natural				Social environment																Others		Type of Permit	Remarks
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
Project/ Program	Phases	Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment, livelihood	Land use and utilization of local resources	Water usage	Existing social infrastructures and services	Social institutions such as social infrastructure and local decision-making institutions	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR	
1. Capacity Building for Sanitation Improvement in Greater Cotabato Area	Pre-construction	-	-	-	-	-	-	-	-	-	-	-	-	C	C	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CNC	
	Construction	C	B-	B-	C	C	D	B-	D	C	C	C	C	C	C	C	B+	D	C	D	D	D	D	D	B-	D	D	D	B-	B-	D		
	Operation & Maintenance	B+	A+	B+	A+	B-	D	A+	D	C	B+	C	D	D	A+	D	B+	D	B+	B+	B+	D	D	D	B+	A+	B+	A+	B+	B+	B+		
2. Development of Septage Treatment Facilities for Surrounding Municipalities	Pre-construction	-	-	-	-	-	-	-	-	-	-	-	-	B-	C	C	-	B-	-	-	-	-	-	-	-	-	-	-	-	-	-	ECC	
	Construction	C	B-	B-	C	B-	D	C	D	D	B-	C	D	B-	C	C	B+	B-	C	D	D	C	C	D	B-	D	D	D	B-	B-	D		
	Operation & Maintenance	B-	A+	B+	A+	B-	D	C	D	D	B+	C	D	D	B+	D	B+	B+	B+	B+	B+	C	C	D	C	C	C	A+	C	C	B+		
3. Creek Environment Improvement using De-centralized Treatment Plant	Pre-construction	-	-	-	-	-	-	-	-	-	-	-	-	B-	C	C	-	B-	-	-	-	-	-	-	-	-	-	-	-	-	-	ECC	
	Construction	C	B-	B-	C	B-	C	C	C	C	B-	C	C	B-	C	C	B+	B-	B-	B-	D	C	C	C	B-	D	D	D	B-	B-	B-		
	Operation & Maintenance	B+	A+	B+	B+	B-	C	A+	B+	C	B+	A+	D	D	B+	D	B+	B+	B+	B+	B+	C	C	B+	A+	C	B+	B+	B+	C	B+		

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.
D: No impact is expected.
N/A: Not applicable (for exaple, Capacity Building Project)

ECC: Environmental Compliance Certificate
CNC: Certificate of Non-Coverage

CHAPTER 16
SOLID WASTE MANAGEMENT PLAN

16.1 Background of the Solid Waste Management (SWM) for Cotabato City

16.1.1 Background

With over 70% of the city's total land area below sea level, improper waste disposal could potentially escalate the recurring threat of flooding. Based on the results of the Waste Analysis and Characterization Study (WACS) in 2017, the city generates approximately 109 tons of wastes daily. By 2027, this figure is projected to increase at 167 tons per day. Currently, a one-hectare lot being used as a temporary Residual Containment Area (RCA) serves as the sole facility for waste disposal. The geographical constraints within the city poses a challenge in finding a suitable location for a Sanitary Landfill (SLF).

By virtue of City Ordinance No. 4417, the City Environment and Natural Resources Office (CENRO) was created in 2016 to address this upsurge in waste generation. The CENRO is tasked to spearhead the LGU's initiative on solid waste management (SWM) programs. The CENRO coordinates with other local government offices and stakeholders to properly implement the Ecological Solid Waste Management Plan (ESWMP) towards the realization of a "clean, healthy, environment-friendly, and economically stable Cotabato City by 2027."

16.1.2 City's Goals and Objective

In accordance with ESWMP, city's goals for SWM are as follows.

a) Institutionalize practical SWM measures among city residents for the preservation of the environment, and safeguard against pollution;
b) Enhance the technical capability of the City ENRO in delivering SWM services;
c) Entrench the commitment of the community on waste diversion and reduction by adopting and practicing waste segregation at source, recycling, re-use and composting of biological waste materials
d) Develop, expand and sustain LGU-managed enterprise for recyclable wastes in support to waste diversion efforts and ensure that diverted materials are returned to economic mainstream;
e) Improve SWM internal processes upholding good governance principles through gender-sensitive communication, capacity-building, linkages with various key SWM players and effective use of technology; and
f) Clustering with adjacent Municipalities for the establishment of SLF.

The objectives towards the goal on waste reduction, enforcement of rules and regulation and the establishments of facilities for SWM operations are shown as below.

Table 16.1-1 Specific Objectives

Programs/Projects/Activities	Performance rating	Time frame
Realization of 60% waste reduction at the 1st year of plan implementation based on the volume of waste currently generated, and 90% by the end 2027.	100%	2018-2027
Fully-operational Central MRF by 2020 with segregation and composting area.	100%	2018-2020
All barangays have functional MRFs by 2019 with material recovery efficiency of 100% by the end of 2020.	100%	2018-2020
Increase by 25% annually the participation of household, business and institutional sectors in waste diversion through reduction, reuse, and recycling	100%	2018-2021
Enforce and sustain of a 4-category waste segregation by all waste generators and 2-category for transport services.	100%	2018-2027
Improve segregated collection service efficiency by 85% by 2018.	100%	2018-2027
Expand coverage of waste collection and transport services to 37 barangays by the end of 2019.	100%	2018-2027
Enhance behavioral change communication activities on proper SWM, 100% by 2027.	100%	2018-2027
Increase participation of NGOs and private sectors by 25% in the ESWM Plan monitoring and implementation by 2018 onward;100% by 2027.	100%	2018-2027
Increase annual revenues by 10% on SWM fees to sustain SWM programs.	100%	2018-2025
Improved by 60% the enforcement of the “No Segregation, No Collection” policy; 100% by 2027.	100%	2018-2027
Enforcement of mandatory composting of biodegradable materials in all MRFs within the 37 barangays; 100% by 2027.	100%	2018-2027
Propose for adoption the City’s Ecological Solid Waste Management (ESWM) Plan by 2018.	100%	2018
Complete and operational SWM organizational structure, 100% by the end 2018.	100%	2018
Wrapping up of negotiations on SLF clustering with adjacent Municipalities before the end of 2019.	100%	2019
Construction of a category-2 Sanitary Landfill by 2020.	100%	2019-20
Full closure of the Biniruan Residual Containment Facility by 2020.	100%	2020

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

16.1.3 ity’s Strategy

In accordance with ESWMP, implementation strategies are classified Waste Reduction, Recycling, Management of Biodegradables and Disposal, and these programs focus on the functional elements of solid waste management. However, the concept of “Reduce, Reuse and Recycle” will be the overriding factor in the implementation strategy.

(1) Waste Reduction

To make the program sustainable while setting procedures for a win-win solution, the following activities are recommended for the waste reduction;

Table 16.1-2 Waste Reduction Program, By Year

Year	Activities
2018	o The environmental program "No Plastic, No Styrofoam Day" will be implemented per City Ordinance 4203, series of 2013 (Subject to the approval of the Implementing Rules and Regulations by the Sangguniang Panglungsod). Public markets, including all business establishments in the City will be prohibited to use disposable polythene bags or non-biodegradable materials as secondary wrappers for purchased commodities and the use of Styrofoam for food packing. Note: The Ordinance started on October 1, 2019 and is now on its second year of implementation.
	o Sponsoring annual events on cleanliness and SWM activities inducing waste reduction at source. The City Government will explore for funds or sponsors. Business establishments will be tapped to support such event in fulfillment of their social obligations.
2018	o A policy on "Bring your own '*bayong*' to market" will be implemented. Business establishments including the wet markets are encouraged to sell bayongs/eco-bags to customers for packing purposes of goods or merchandise.
	o Support the setting-up of junkyard enterprise by private entrepreneurs in the barangays. This will help widen the list of waste materials that can be traded. This will inspire the buying public to only buy commodities with recyclable containers. Thus, minimizing non-recyclable waste accumulation.
	o Intensify the implementation of City Ordinance No. 4203, series of 2013. Note: The Ordinance started on October 1, 2019 and is now on its second year of implementation.
2019	o Livelihood trainings on the conversion of waste materials into new products. This will help in the waste diversion process while at the same time creating livelihood opportunities.
2018-2027	o Intensive city-wide IEC campaign. o Monitoring and evaluation.

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

(2) Recycling

The recycling program needs to be strengthened by establishing a model for the community to get involved in the development process. Although recycling is becoming a by-word, the City LGU needs to promote alternatives that will encourage citizenry to do it properly. This will help the community earn money on their recyclable wastes while generating job opportunities.

In some areas, households usually wash and air-dry residual waste such as durable cellophane and polythene bags for re-use.

The liquor bottles, particularly longneck and flat bottles, will be re-used as container for home-made products such as coco vinegar, soy sauce, cooking oil and fermented fish and shellfish. Plastic bottles and gallon jars will be re-used for storing water and other liquids.

The gradual increase in the number of those that are recycling wastes at home connote realities that the City LGU will be able to attain the 62% waste reduction in the 1st year of plan implementation and more than 90% by 2027.

Table 16.1-3 Waste Recycling Program, By Year

Year	Activities
2018	o Setting-up of barangay MRFs. This will help start-up the barangay recycling program and as drop-off point for segregated recyclables for trading. MRF at schools will also be established.
	o Sustain the enforcement of "No Segregation, No Collection Policy".
2019	o Development of potential markets for recyclables to kindle the interest of the populace to produce materials for sale to include training on waste processing.
	o Development of community-based waste recycling industry for conversion of waste materials into new products. The conduct of livelihood trainings and orientation-seminars on values formation, especially on waste reduction, re-use, recycling and composting will help set-up said endeavor.
	o Setting-up of barangay model organic farms using locally produced soil enhancers. This may also entice rural folks to collect and compost biodegradable agricultural wastes instead of burning.
	o Setting-up of souvenir shop where products made out of recycled waste materials will be displayed and sold. This will serve as the initial market for cottage-based products from recycled waste materials.
2018-2027	o Intensified city-wide IEC campaign. o Monitoring and evaluation.

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

(3) Management of Biodegradables

The diversion of biodegradable wastes for processing into soil enhancers will reduce the volume entering the waste stream. Somehow, it will create job opportunities, induce economic development and reduce SWM costs. Related activities under this aspect is subsumed under source reduction and recycling.

Table 16.1-4 Programs for the Management of Biodegradables

Year	Program/Projects/Activities
2018	o Technical capability enhancement for all major contributors of biodegradable wastes including barangay officials, community leaders and other barangay personnel on vermicomposting.
	o Enforcement of the Policy on "No Segregation, No Collection". Composting of biodegradables at source for households with enough space for composting will be mandatory.
2018	o Encourage entrepreneurs to trade locally produced soil enhancers. o Establishment of composting facilities. Development of the MRFs in all barangays and schools as model for the composting of biodegradable wastes into tradable products.
2019	o Establishment of model organic farms along major routes using locally produced soil enhancers. This will help in marketing the product locally.
2018-2027	o Intensified city-wide IEC campaign. o Monitoring and maintenance.

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

(4) Disposal

Taking the result of the Waste Analysis and Characterization Study (WACS), the residential sector generates the largest volume of waste thrown in the waste stream. It is anticipated that the initial impact of plan implementation will be the significant reduction on the volume of wastes reaching the waste disposal facility. With the all-out support of the City-LGU, the diversion target of 90% in 2027 is highly attainable.

Table 16.1-5 Solid Waste Disposal Program.

Year	Program/Project/Activities
2018-2027	o Strict implementation of “No Segregation, No Collection “Policy.
2019	o Development of project proposal for a progressive SLF will be prepared and submitted to donors from local and foreign funding agencies for consideration.
2018-2020	o Closure and rehabilitation plan of the current RCA into an Eco-Park will be submitted to DENR-EMB XII for perusal and approval; o Establishment and operation of the Sanitary Landfill; o The reprocessing of plastics and polythene bags will be established where said materials are baled and sacked, and stored in the MRFs, especially in areas that are not easily accessed. A recycling program may be developed for this type of wastes; and o Only residuals will be collected and dumped in the current RCA. Biodegradable materials from the markets, households without space for composting, business establishments and institutions will be processed in the Central MRF.
2018-2027	o Intensified city-wide IEC campaign o Monitoring and evaluation.

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

(5) Waste Diversion Target

Table 16.1-6 shows the 10-year waste diversion target for Cotabato City based on the 2017 population census. SWM plan is prepared based on this target.

Table 16.1-6 Waste Diversion Target

Year	Waste Gen (kg/cap/day)	Projected Population	Daily Waste Gen (kg/day)	Diversion Target	Weight Diverted (kg/day)	Waste Diverted		
						Bio	Recyclables	Residual
2018	0.36	315,901	113,724.24	62.00%	70,509.03	56,577.84	13,931.19	5,100.90
2019	0.37	321,587	118,987.15	65.00%	77,341.65	56,947.68	14,789.74	5,604.23
2020	0.38	327,375	124,402.67	67.00%	83,349.79	61,876.03	15,468.42	6,005.34
2021	0.39	333,268	129,974.60	70.00%	90,982.22	67,816.83	16,376.73	6,788.66
2022	0.40	339,267	135,706.81	72.00%	97,708.91	73,382.40	17,090.01	7,236.50
2023	0.41	345,374	141,603.27	76.00%	107,618.49	81,780.59	18,059.55	7,778.35
2024	0.42	351,591	147,668.04	78.00%	115,181.07	88,218.23	18,827.64	8,135.20
2025	0.43	357,919	153,905.25	80.00%	123,124.20	94,630.88	19,842.97	8,650.35
2026	0.44	364,362	160,319.17	85.00%	136,271.29	97,985.75	27,659.21	10,626.33
2027	0.45	370,920	166,914.11	90.00%	150,222.70	103,804.86	30,020.00	16,691.41

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

16.2 Issues on Solid Waste Management

As a result of the comparison between city's current condition and the existing plan, some issues on SWM are categorized as follows.

16.2.1 Implementation Frameworks on SWM

(1) Lack of Effective Data on SWM

Effective data on SWM such as volume of waste generated, collected, segregated and disposed is important to manage and control the SWM system. Cotabato city had data provided by the Waste Analysis and Characterization Study (WACS) conducted in 2017 only until 2020, but "the Daily Waste Collection and Disposal Report" was started from April 2020. To analyze the past performance and expect the future trend, utilization of the report and more data such as waste composition and waste segregated amount are needed for adequate SWM system.

(2) Lack of Implementation Capacity for the Plan

Cotabato city has the ESWMP and effective and ideal policies and targets are set in the plan. However, most of the targets were not achieved as of 2020 and many challenges are still remained. Capacity enhancement on SWM including financial improvement are needed led by CENRO.

16.2.2 Waste Reduction

(1) Ineffective Public Awareness Campaigns and Lack of Discipline

The preliminary implementation of the "No Segregation, No Collection" policy was not well recognized by the residents. The collected waste remained haphazardly managed and mixed up during loading and transportation to the disposal facility. In most rural areas, traditional practices such as burning of wastes and throwing garbage into bodies of water were still widely adopted.

(2) Increasing Volume of Garbage due to Increasing Population and Commercial Activities

Increasing population levels and rapid urbanization effected by increasing economic activities with job opportunities have greatly accelerated the generation of solid wastes within the city. Similarly, increased volume of wastes means that it would be more difficult for the local government to provide adequate waste collection services and treatment facilities. Future projection of the volume of waste generated reflecting population increasing and economic development with jo opportunities and its measures are needed.

16.2.3 Waste Collection and Transport

(1) Collection Efficiency

Current waste collection efficiency was estimated 78.3% and this rate is not high level as an appropriate collection service. Enhancement of collection efficiency is to be needed in anticipation of the increasing volume of waste due to increasing population and commercial activities.

(2) Limited Collection Area

The eight barangays outside the collection area were limited to set schedules in 2017 and were often left to dispose their household wastes based on their own traditional understanding. As of 2020, 36 out of 37 barangays were covered by the city's regular waste collection service. All area should be covered by the collection service for the proper waste collection.

(3) Deposited Solid Wastes Along the Beach During High Tide

Solid wastes improperly thrown from upstream barangays end up at the coasts of Barangays Kalanganan Mother, 1 and 2 during high tide. The responsibility of handling these wastes were then transferred to these coastline barangays.

16.2.4 Intermediate Treatment and 3R Facility

(1) Limited Material Recovery

Current material recovery efficiency was estimated 49.4% and this rate is low level as an appropriate waste recovery. Enhancement of material recovery efficiency is to be needed for the sustainable SWM system.

(2) Lack of Material Recovery Facility (MRF)

Area of the MRF installation is 36 out of 37 barangays, which is good enough but must be fully operational, and means the city fails to comply with Section 32 of the RA 9003, which mandates the establishment of an MRF in every barangay. Proposed Central MRF by the city are needed to be installed in the near future to promote composting of biodegradables and enhance utilization of recyclables.

(3) Investigation of Possibility of Waste to Energy (WTE) and/or Other Facilities

Construction and operation of the Waste to Energy (WTE) facility are planned in Kidapawan city and Cotabato city now negotiates to use the facility in the future with Kidapawan city. Investigation of use of the facility needed in detail to verify its feasibility with city's plan. In addition, other possibilities of the intermediate treatment facilities such as large composting facility, bio-gas plant and incineration should be considered for the high level waste diversion.

16.2.5 Final Disposal

(1) Lack of Sanitary Landfill

The need for a sanitary landfill (SLF) has been highlighted, with the current dumping site including RCA overfilled and nearing its design lifespan. Initial investigations have shown that there is no environmentally suitable space to construct a new landfill.

(2) Proper Closing and Rehabilitation of the Existing Disposal Facility

Existing dumping site including RCA is already overfilled but construction of new landfill is still not determined so that existing dumping site is needed to extend the operation life. Embarkment by the waste and environmental measures such as leachate control to reduce the environmental impact are needed for life expansion.

16.3 Goal and Objective on Solid Waste Management Plan

Goals on SWM system is to establish an efficient and sustainable SWM system with the development direction of Greater Cotabato City, which are concentration, connectivity and vulnerability reduction based on the vision of Cotabato city "A clean, healthy, environment-friendly and economically-stable Cotabato City".

Considering the current condition and issues, the objectives on SWM Plan are set to achieve the above goal as follows.

a) To strengthen the comprehensive SWM system of collection, transportation, intermediate treatment (composting and recycling) and disposal, and secure the proper institutional / organizational framework, technical capability and relative budget on SWM,
b) To develop awareness and capacity for waste handling and source separation as essential components of sustainable waste management, and to restructure and extend efficient collection service with the view of projection of increasing volume of waste;
c) To introduce effective intermediate treatment and to expand 3R to 3Rs plus composting to maximize waste diversion;
d) To upgrade and rehabilitate the existing disposal site, and construct safe sanitary landfill; and
e) To integrate and multi-connect the SWM system in Greater Cotabato city for the efficient use of resource

16.4 Strategy on Solid Waste Management Plan

To solve the issues and achieve the goals and objectives, the strategic approach to formulate the SWM Plan are proposed with each phase which are waste collection and transportation, intermediate treatment and 3Rs plus composting, final disposal and implementation framework strengthening.

16.4.1 Waste Collection and Transportation

The objective of the Waste Collection and Transportation is to improve the existing collection service activities and expand the coverage area in order to maintain public sanitation and cleanliness of the city. Strategies for the waste collection and transportation are as follows.

- ✓ Coverage of waste collection and transportation services aims to all barangays
- ✓ Segregated collection service aims to improve service efficiency with considering the appropriate collection route and efficiency.

- ✓ Implementation of waste collection and transportation is carried out with a sufficient number of waste collection vehicles. The procurement plan for waste collection vehicles shall be determined as the most optimum system of collection and transportation.

16.4.2 Intermediate Treatment and 3R Promotion

The objective of the Intermediate Treatment and 3R Promotion is for reduction of domestic waste generation, recovery of resources, reuse, recycling, intermediate treatment and resource circulation. Strategies for the intermediate treatment and 3R promotion are as follows.

- ✓ Installation of MRFs aims to all barangays with the functional composting and recycling system.
- ✓ The waste diversion system shall be developed with the proposed central MRF, the Waste to Energy facility and/or other intermediate facilities to improve the material recovery efficiency in consideration of financial capacity of the project proponent.
- ✓ The awareness raising and IEC campaign on the intermediate treatment and 3R promotion activities shall be exercised upon public, schools and stakeholders by continuous lead of CENRO.

16.4.3 Final Disposal

The objective of Final Disposal is to be provided as the last process of SWM to dispose waste for storing eternally and for stabilizing the waste of no value for resource materials and protection of the surrounding environment from secondary pollution. Strategies for the final disposal are as follows.

- ✓ The development work of new sanitary landfill shall be carried out by appropriate site selection and stage wise construction work in consideration of the environmental impact and financial capacity of the project proponent.
- ✓ The improvement and the safe post-closure of the existing dumping site shall be carried out to attain the satisfactory level for mitigating the current negative impacts.
- ✓ Operation of final disposal is carried out with a sufficient number of heavy equipment. The procurement plan for heavy equipment shall be determined as the most optimum system of final disposal.
- ✓ Cluster operation of an SLF by the city and surrounding municipalities should be conducted for the sustainable operation.

16.4.4 Implementation Framework Strengthening

The objective of implementation framework strengthening is to comprehensively strengthen the functions, human resources, financial system, responsibilities and services on SWM of CENRO. Strategies for the implementation framework strengthening are as follows.

- ✓ Data collection of the volume of waste generated, collected, recovered and disposed shall be carried by CENRO for appropriate SWM.
- ✓ The development of the master plan for the integrative and comprehensive SWM system shall be carried out in the Cotabato city and surrounding municipalities
- ✓ Responsibilities, obligations, human resources and finance development for providing appropriate SWM services shall be comprehensively designed and implemented based on the results of the capacity assessment.

16.5 Solid Waste Management Plan

16.5.1 Basic Premise for the SWM Plan

(1) Base of the Plan

The Plan was basically prepared with following the Ecological Solid Waste Management Plan (2010 – 2019) (ESWMP). As a result of the comparison between ESWMP and actual current status of the city's SWM, the plan is updated.

(2) Target of Waste

Target of waste of the plan is general waste generated from household, commercial, industries and institutions such as schools, offices, public market and hospitals. Waste from production of mining, petroleum extraction, agriculture and hazardous waste are basically not included.

(3) Target Area

Proposed target area of the plan is not only Cotabato city but also surrounding municipalities. Basic information and data for the planning and projection of the plan are based on the data in Cotabato city.

(4) Target Period

Target period of the plan is set in 2027 as a middle term and in 2040 as a long term.

16.5.2 Volume of the Waste in the Future

(1) Waste Generation on the Base Year (2017)

According to the ESWMP, volume of the waste generation is computed at 0.35 kg/day per capita, and the waste generation and handling flow is shown as below.

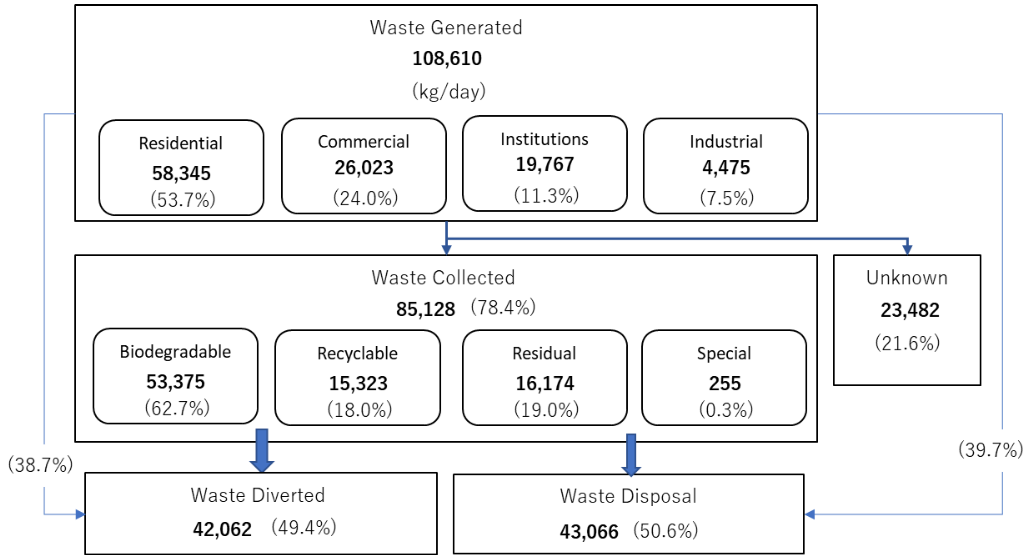


Figure 16.5-1 Waste Generation and Handling Flow in Cotabato City in 2017

(2) Estimation of Future Waste Generation Volume

In order to estimate the waste generation in the future, approach to set each item is as follows.

a) **Projected population:** According to the projection mentioned in Chapter 8.

b) **Waste generation in Middle term:** Following the ESWMP which is 0.01 kg increasing each year (0.35 kg/capita/day in 2017 to 0.45 kg/capita/day in 2027)

c) **Waste generation in Long term:** Waste generation rate is set as 1% increasing (0.455 kg/capita/day in 2028 to 0.512 kg/capita/day in 2040). This range of rate is valid with considering following situation;

- the rate tends to increase depending on the economic development and increase of disposable individual income
- the rate decreases depending on the implementing 3R programs proposed in the plan
- the current waste generation in other cities (in 2010): 0.61 kg/c/d in Metro Manila and 0.50 kg/c/d in provincial capitals

As a result of above approach, estimated waste generation volume in Cotabato city is shown below. Waste volume is 168 t/day in 2027 and 243 t/day in 2040.

Table 16.5-1 Estimated Waste Generation Volume in Cotabato city

Year	Waste Generation Unit (kg/day/capita)	Projected Population	Waste Generation (kg/day)	Waste Generation (t/year)
2017 (Base)	**0.350**	**310,700**	**108,745**	**39,692**
2018	0.360	316,500	113,940	41,588
2019	0.370	322,400	119,288	43,540
2020	0.380	328,400	124,792	45,549
2021	0.390	334,500	130,455	47,616
2022	0.400	340,700	136,280	49,742
2023	0.410	347,000	142,270	51,929
2024	0.420	353,500	148,470	54,192
2025	0.430	360,100	154,843	56,518
2026	0.440	366,800	161,392	58,908
2027	**0.450**	**373,600**	**168,120**	**61,364**
2028	0.455	380,500	172,937	63,122
2029	0.459	387,600	177,926	64,943
2030	0.464	394,800	183,043	66,811
2031	0.468	402,100	188,292	68,727
2032	0.473	409,600	193,722	70,709
2033	0.478	417,200	199,290	72,741
2034	0.482	425,000	205,046	74,842
2035	0.487	432,900	210,946	76,995
2036	0.492	441,000	217,042	79,220
2037	0.497	449,200	223,288	81,500
2038	0.502	457,600	229,738	83,855
2039	0.507	466,100	236,346	86,266
2040	**0.512**	**474,700**	**243,114**	**88,737**

There is not enough information of waste generation volume in surrounding municipalities so that waste generation unit (kg/capita/day) in surrounding municipalities is calculated based on the waste generation volume in Pigcawayan and set 0.31 kg/capita/day as follows.

- Waste generation volume in Pigcawayan: 20,844.9 kg/day
- Population in Pigcawayan: 66,796 (in 2015)
- Waste generation unit: 0.312 (kg/capita/day)

Projected volume of waste generation is estimated in the same approach as shown below. Waste volume is 234 t/day in 2027 and 379 t/day in 2040.

Therefore, waste generation in the Greater Cotabato city area is estimated 402 t/day in 2027 and 622 t/day in 2040.

Table 16.5-2 Estimated Waste Generation Volume in Greater Cotabato city

Year	Waste Generation Unit	Projected Population	Waste Generation in Surrounding Manicipalities	Waste Generation in Greater Cotabato city
	(kg/day/capita)		(kg/day)	(kg/day)
2017 (Base)	**0.310**	**403,197**	**124,991**	**233,736**
2018	0.320	418,465	133,909	247,849
2019	0.330	433,732	143,132	262,420
2020	0.340	449,000	152,660	277,452
2021	0.350	466,380	163,233	293,688
2022	0.360	483,760	174,154	310,434
2023	0.370	501,140	185,422	327,692
2024	0.380	518,520	197,038	345,508
2025	0.390	535,900	209,001	363,844
2026	0.400	553,600	221,440	382,832
2027	**0.410**	**571,300**	**234,233**	**402,353**
2028	0.414	589,000	243,905	416,842
2029	0.418	608,000	254,291	432,216
2030	0.422	627,000	264,859	447,903
2031	0.427	645,520	275,410	463,702
2032	0.431	664,040	286,144	479,866
2033	0.435	682,560	297,066	496,356
2034	0.440	701,080	308,178	513,223
2035	0.444	719,600	319,482	530,428
2036	0.448	738,160	330,999	548,041
2037	0.453	756,720	342,715	566,003
2038	0.457	775,280	354,632	584,370
2039	0.462	793,840	366,753	603,099
2040	**0.467**	**812,400**	**379,081**	**622,194**

16.5.3 Implementation Framework Strengthening Plan

(1) Introduction

Present effective data on SWM such as volume of waste generated, collected, segregated and disposed is shortage in both Cotabato city and surrounding municipalities so that regular data collecting is needed to analyze the past performance and make the future SWM plan.

In addition, capacity enhancement on SWM including organizational and financial improvement are needed to implement the ESWMP and this SWM plan.

(2) Effective Data Collection

Waste measure and record system by each city and/or each barangay should be introduced at MRF, disposal area and/or each collection point.

Table 16.5-3 Example of Data Collecting Method

Point	Data type	Method
Generation point	Generated volume	・To report by generators
Collection point	Generated volume	・To measure the weight by scale etc. ・To measure the volume of containers by sight observation
Collection vehicles	Collected volume	・To record the number of daily trip and vehicle's capacity
MRFs	Collected volume Recovery volume	・To measure the weight by scale etc. ・To measure the volume of containers by sight observation ・To record the number of vehicles to carry the recyclables
Disposal site	Disposal volume	・To measure the weight and/or volume by truck scale etc. ・To measure the volume of waste filing by sight observation / drone survey etc.

(3) Investigation of Establishment Inter-Municipality Unit for SWM

In order to efficiently implement the integrated SWM system in the Greater Cotabato city, establishment of inter-municipality unit composed by Cotabato city and surrounding municipalities is one of the approaches. Advantage for the establishment of inter-municipality unit is as follows.

- To establish the stable and efficient SWM system with sharing the SWM equipment such as collection vehicles
- To reduce the cost for construction of facilities, treatment and maintenance for each LGU
- To secure the human resources and share the technology with combination between multi municipalities
- To share the suitable land for the SWM facilities

(4) Project Components on Implementation Framework Strengthening

1) Middle Term Until 2027

Considering the current condition of SWM in Cotabato city, following projects and activities are proposed in middle term until 2027.

- Preparation of master plan the integrated SWM system and inter-municipality connection
- Introduction of the waste recording system to stock the effective data
- Procurement of necessary equipment for measuring the waste weight or volume

2) Long Term from 2028 to 2040

Projects in middle term are developed and following projects and activities are proposed in long term from 2028 to 2040.

- Introduction of integrated SWM system by inter-municipality management in Greater Cotabato city area and capacity development for its system.

16.5.4 Waste Collection and Transportation Plan

(1) Introduction

Current area of the waste collection service included 36 out of the 37 barangays in Cotabato city according to the interview to CENRO. Waste collection was conducted twice a day with a morning shift from 4 AM to 10 AM and an evening shift from 9 PM to 3 AM. All wastes collected from these areas were transported directly to the RCA in Biniruan.

In addition, current status of the waste collection in surrounding municipalities is as follows.

Table 16.5-4 Current Status of Waste Collection in Surrounding Municipalities

LGUs	Regular collection area	Frequency	Collection Vehicle
Datu Odin Sinsuat	2 barangay out of 39 (5%)	3 times / week	2 dump trucks
Sultan Kudarat	market, municipal hall and households along the highways	Twice / week	1 dump trucks
Sultan Mastura	market, municipal hall, and households along the national highway		
Parang	Market, municipal hall, line agencies, and households along the roadsides		1 dump trucks
Pigcawayan	10 barangays out of 40 (25%)	Daily	2 Garbage Collector Trucks

(2) Planned volume of the waste collection

Based on the projected volume of the waste generation and collection efficiency, volume of planned waste collection is decided. Current collection efficiency is 78.38%, which is not high level and it should be improved not to leave residual solid waste. Target collection efficiency is set 90% by 2027 and 100% by 2040 for the cleaning of the city environment in anticipation of the increasing volume of waste due to increasing population and commercial activities.

< Target >
Collection efficiency: 78.38% (2017) ⇒ 90% (2027) ⇒ 100% (2040)

As a result of calculation of above target, collected waste generation is 151 t/day in 2027 and 243 t/day in 2040 in Cotabato city.

Table 16.5-5 Estimated Waste Collected Volume in Cotabato city

Year	Waste Generation in Cotabato city (kg/day)	Waste Collected in Cotabato city: Collection Efficiency	Total (kg/day)	Bio (kg/day)	Recyclable (kg/day)	Residual (kg/day)	Special (kg/day)
2017 (Base)	**108,745**	**78.28%**	**85,128**	**53,375**	**15,323**	**16,174**	**255**
2018	113,940	79.45%	90,530	56,762	16,295	17,201	272
2019	119,288	80.63%	96,177	60,303	17,312	18,274	289
2020	124,792	81.80%	102,077	64,002	18,374	19,395	306
2021	130,455	82.97%	108,238	67,865	19,483	20,565	325
2022	136,280	84.14%	114,668	71,897	20,640	21,787	344
2023	142,270	85.31%	121,375	76,102	21,847	23,061	364
2024	148,470	86.48%	128,404	80,509	23,113	24,397	385
2025	154,843	87.66%	135,730	85,103	24,431	25,789	407
2026	161,392	88.83%	143,362	89,888	25,805	27,239	430
2027	**168,120**	**90.00%**	**151,308**	**94,870**	**27,235**	**28,749**	**454**
2028	172,937	90.77%	156,974	98,423	28,255	29,825	471
2029	177,926	91.54%	162,871	102,120	29,317	30,945	489
2030	183,043	92.31%	168,963	105,940	30,413	32,103	507
2031	188,292	93.08%	175,256	109,886	31,546	33,299	526
2032	193,722	93.85%	181,801	113,989	32,724	34,542	545
2033	199,290	94.62%	188,559	118,226	33,941	35,826	566
2034	205,046	95.38%	195,582	122,630	35,205	37,161	587
2035	210,946	96.15%	202,833	127,176	36,510	38,538	609
2036	217,042	96.92%	210,364	131,898	37,865	39,969	631
2037	223,288	97.69%	218,136	136,771	39,264	41,446	654
2038	229,738	98.46%	226,204	141,830	40,717	42,979	679
2039	236,346	99.23%	234,528	147,049	42,215	44,560	704
2040	**243,114**	**100.00%**	**243,114**	**152,432**	**43,760**	**46,192**	**729**

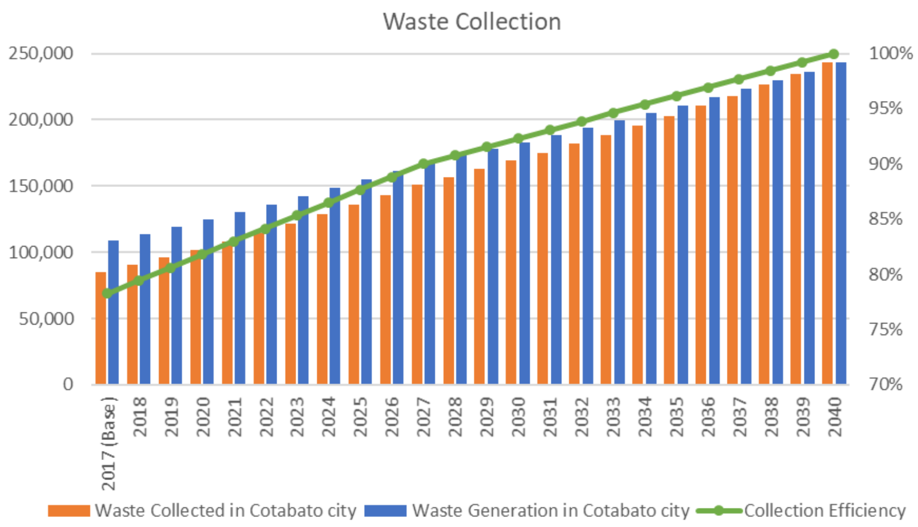


Figure 16.5-2 Projection of Waste Collected Volume in Cotabato City

In the same approach, waste collected volume in surrounding municipalities is also estimated as shown below. Collection volume is 211 t/day in 2027 and 379 t/day in 2040.

Therefore, waste collection volume in the Greater Cotabato city area is estimated 362 t/day in 2027 and 622 t/day in 2040.

Table 16.5-6 Estimated Waste Collected Volume in Greater Cotabato City

Year	Waste Generation in Surrounding Manicipalities (kg/day)	Waste Collected in Surrounding Manicipalities: Collection Efficiency	Waste Collected in Surrounding Manicipalities: Total (kg/day)	Waste Generation in Greater Cotabato city (kg/day)	Waste Collected: Total (kg/day)
2017 (Base)	**124,991**	**68.11%**	**85,128**	**233,736**	**170,256**
2018	133,909	70.30%	94,133	247,849	184,663
2019	143,132	72.49%	103,750	262,420	199,927
2020	152,660	74.68%	113,999	277,452	216,076
2021	163,233	76.86%	125,468	293,688	233,706
2022	174,154	79.05%	137,675	310,434	252,342
2023	185,422	81.24%	150,642	327,692	272,017
2024	197,038	83.43%	164,393	345,508	292,797
2025	209,001	85.62%	178,950	363,844	314,680
2026	221,440	87.81%	194,448	382,832	337,810
2027	**234,233**	**90.00%**	**210,810**	**402,353**	**362,118**
2028	243,905	90.77%	221,391	416,842	378,364
2029	254,291	91.54%	232,774	432,216	395,644
2030	264,859	92.31%	244,486	447,903	413,449
2031	275,410	93.08%	256,343	463,702	431,599
2032	286,144	93.85%	268,535	479,866	450,336
2033	297,066	94.62%	281,070	496,356	469,629
2034	308,178	95.38%	293,954	513,223	489,536
2035	319,482	96.15%	307,194	530,428	510,027
2036	330,999	96.92%	320,814	548,041	531,178
2037	342,715	97.69%	334,806	566,003	552,941
2038	354,632	98.46%	349,176	584,370	575,380
2039	366,753	99.23%	363,932	603,099	598,459
2040	**379,081**	**100.00%**	**379,081**	**622,194**	**622,194**

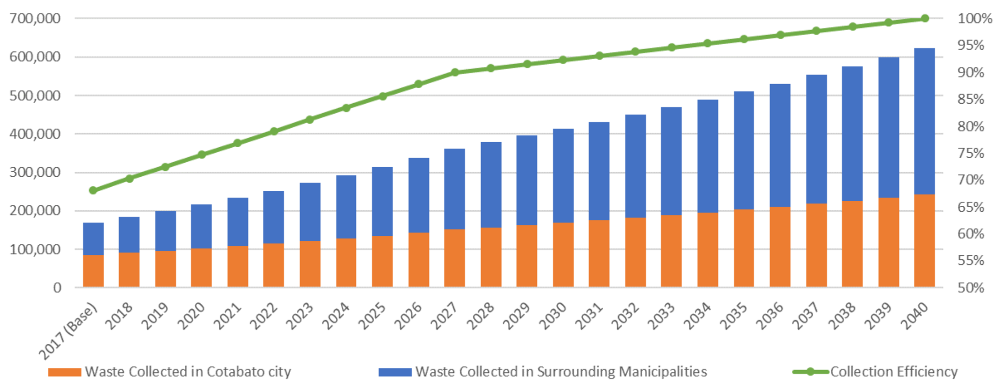


Figure 16.5-3 Projection of Waste Collected Volume in Greater Cotabato City

(3) Required Number of Planned Waste Collection Vehicles

1) Planned Waste Collection Vehicles in Cotabato city

CENRO has 7 dump trucks and 7 compactor trucks for the waste collection and transportation, and procurement of 2 more compactor trucks in proposed in ESWMP. Table 16.5-7 shows the type of vehicles in use. The waste collection in each collection route is conducted twice a day (2 trips a day) so that capacity of the waste collection is 144t/day with use of all equipment.

Table 16.5-7 Capacity of waste collection vehicles in Cotabato city

Heavy equipment	Quantity	Specification	Capacity	Trip /day	Capacity / day
Dump trucks	2	7 m^3	7 t	2	14 t
	1	15 m^3	7.5 t	2	15 t
	3	7 m^3	10.5 t	2	21 t
	1	15 m^3	7.5 t	2	15 t
Sub-total	7	65 m^3	32.5 t		65 t
Compactor trucks	2	10 m^3	10 t	2	20 t
	1	7 m^3	3.5 t	2	7 t
	4	8 m^3	16 t	2	32 t
Proposed trucks (new)	2	10 m^3	10 t	2	20 t
Sub-total	7	79 m^3	39.5 t^3	2	79 t
Total	**14**	**144 m^3**	**72 t**		**144 t**

This capacity may cover the collected waste volume in the middle term which volume 143 t/day in 2026 but it is difficult to cover the collected waste volume in long term after 2027.

To collect all waste estimated 243 t/day in 2040, more equipment or number of trips are needed. In case suitable trucks which capacity is 10m3 (5t) are procured, 10 trucks with 2 trips/day will be needed in 2040

Covering more 100 t/day (243 t/day in 2040 – 144 t/day of existing capacity) 100 t/day ÷ (10m3 (5t) × 2 trips) = 10 trucks

Actually, condition of existing vehicles is needed to be considered to estimate the required number of planned vehicles.

2) Planned Waste Collection Vehicles in Surrounding Municipalities

Required collection vehicles in surrounding municipalities are estimated based on the increase volume of waste generation from base year of 2017. Increase volume in 2027 from 2017 is 126 t/day and required number of vehicles is 13 trucks, and increase volume in 2040 from 2017 is 294 t/day and required number of vehicles is approx. 30 trucks, which is a 10 m3 (5t) trucks.

Table 16.5-8 Planned Waste Collection Vehicles in Surrounding Municipalities

Year	Volume of waste collection (kg/day)	Increase volume from base year (kg/day)	Required vehicles (5 t x 2 trips)
2017 (Base)	85,128		
2027	210,810	125,682	13
2040	379,081	293,953	30

(4) Strength of Coverage of waste collection and Collection efficiency

Collection system by each barangay government should be strengthened through the increasing of waste collection coverage and improvement of collection efficiency. To improve the collection system, 2 approaches are suggested.

- Hard approach: Procurement of the collection equipment and strengthening organizational framework such as development of human resources.
- Soft approach: Investigation of collection frequency, re-training of the waste collection team and reviewing of the current collection route and design a routing scheme to maximize segregated collection effort.

(5) Project Components on Waste Collection and Transportation

1) Middle Term Until 2027

Considering the current condition of SWM in Cotabato city, following projects and activities are proposed in middle term until 2027.

- Expansion of the waste collection service area to all barangays
- Review & Reconsideration of collection route & frequency
- Procurement of proposed collection vehicles
- Capacity Enhancement of the collection management and collection team.
- Preparation of master plan to strengthen the waste collection and transportation system including above actions

2) Long Term from 2028 to 2040

Projects in middle term are developed and following projects and activities are proposed in long term from 2028 to 2040 to achieve the 100% waste collection efficiency.

- Procurement of more collection vehicles in anticipation of the increasing volume of waste, expansion of service area and lifetime of the existing collection vehicles.
- Integrated collection and transportation system by inter-municipality management in Greater Cotabato city area.

16.5.5 Intermediate Treatment and 3R Promotion Plan

(1) Introduction

Current material recovery efficiency in Cotabato city was estimated 49.4% and this rate is needed to be increased for the sustainable material cycle and decreasing the burden of disposal process. Area of the MRF installation is 36 out of 37 barangays in Cotabato city and the city has to establish MRFs in all barangays according to Section 32 of the RA 9003, which mandates the establishment of an MRF in every barangay. Investigation of construction of proposed Central MRF and use and negotiation of WTE Facility is also needed.

In addition, current status of the material recovery in surrounding municipalities is as follows.

Table 16.5-9 Current Status of Material Recovery in Surrounding Municipalities

LGUs	Treatment condition	MRF / Other
Datu Odin Sinsuat	・Collected waste is not given proper treatment/ disposal ・Segregation of waste materials is not given much importance	・Central composting facility (CCF) which can process about 23,925 kg of biodegradable waste monthly.
Sultan Kudarat	-	・A municipal MRF is in front of the municipal's designated dumpsite
Sultan Mastura	-	・MRFs in the 11 barangays except 2 barangays
Parang	・All non-recyclables are burned while biodegradables are dumped in a composting area. ・Recyclables are usually taken by local trash men who collects and sell to junk traders.	・MRF in each barangay ・Obligation of MRFs is to manage the garbage collection and dumping
Pigcawayan	-	・Only 3 barangays have MRF

(2) Material Recovery Efficiency

Current material recovery efficiency is 49.4% and it should be improved. Target material recovery efficiency is set 90% by 2027 according to ESWMP in Cotabato city and 100% by 2040.

Material recovery efficiency: 49.4% (2017) ⇒ 90% (2027) ⇒ 100% (2040)

Additional installation of MRF in barangays which doesn't have own MRF is needed to achieve the above target.

As a result of calculation of above target, recovered waste volume is 136 t/day in 2027 and 243 t/day in 2040 in Cotabato city.

Table 16.5-10 Estimated Waste Recovered Volume in Cotabato city

Year	Waste Generation in Cotabato city	Material Recovery in Cotabato city					
		Recovery Efficiency	Total	Bio	Recyclable	Residual	Special
	(kg/day)		(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)
2017 (Base)	**108,745**	**49.41%**	**42,062**	**26,373**	**7,571**	**7,992**	**126**
2018	113,940	53.47%	48,405	30,350	8,713	9,197	145
2019	119,288	57.53%	55,329	34,691	9,959	10,512	166
2020	124,792	61.59%	62,866	39,417	11,316	11,945	189
2021	130,455	65.65%	71,054	44,551	12,790	13,500	213
2022	136,280	69.71%	79,929	50,115	14,387	15,187	240
2023	142,270	73.76%	89,531	56,136	16,116	17,011	269
2024	148,470	77.82%	99,928	62,655	17,987	18,986	300
2025	154,843	81.88%	111,138	69,684	20,005	21,116	333
2026	161,392	85.94%	123,206	77,250	22,177	23,409	370
2027	**168,120**	**90.00%**	**136,177**	**85,383**	**24,512**	**25,874**	**409**
2028	172,937	90.77%	142,484	89,337	25,647	27,072	427
2029	177,926	91.54%	149,089	93,479	26,836	28,327	447
2030	183,043	92.31%	155,966	97,791	28,074	29,634	468
2031	188,292	93.08%	163,123	102,278	29,362	30,993	489
2032	193,722	93.85%	170,613	106,974	30,710	32,416	512
2033	199,290	94.62%	178,406	111,860	32,113	33,897	535
2034	205,046	95.38%	186,555	116,970	33,580	35,446	560
2035	210,946	96.15%	195,031	122,285	35,106	37,056	585
2036	217,042	96.92%	203,891	127,840	36,700	38,739	612
2037	223,288	97.69%	213,102	133,615	38,358	40,489	639
2038	229,738	98.46%	222,724	139,648	40,090	42,318	668
2039	236,346	99.23%	232,724	145,918	41,890	44,218	698
2040	**243,114**	**100.00%**	**243,114**	**152,432**	**43,760**	**46,192**	**729**

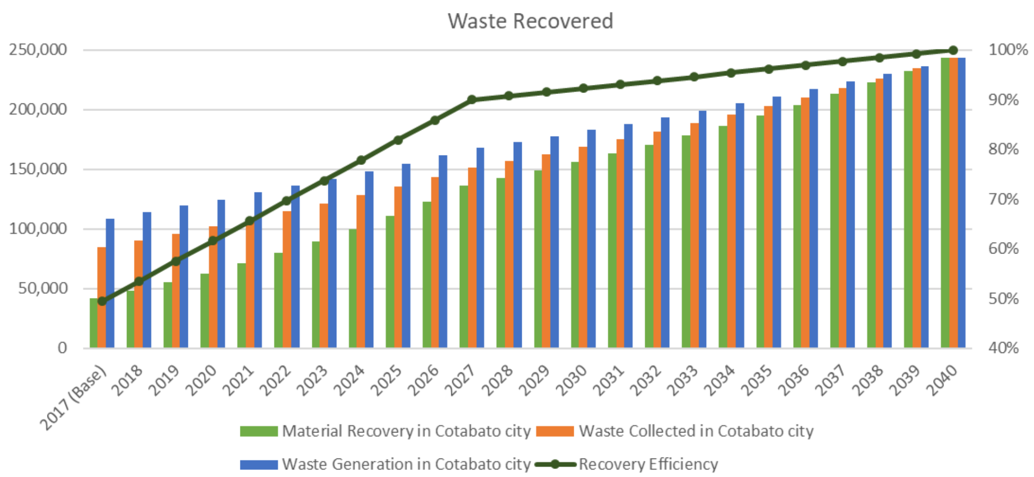


Figure 16.5-4 Estimated Waste Recovered Volume in Cotabato City

In the same approach, waste recovered volume in surrounding municipalities is also estimated as shown below. Collection volume is 190 t/day in 2027 and 379 t/day in 2040.

Therefore, waste recovered volume in the Greater Cotabato city area is estimated 326 t/day in 2027 and 622 t/day in 2040.

Table 16.5-11 Estimated Waste Recovered Volume in Greater Cotabato city

Year	Waste Collected in Surrounding	Material Recovery in Surrounding Manicipalities		Material Recovery in Greater Cotabato
	Total	Rate	Total	Total
	(kg/day)		(kg/day)	(kg/day)
2017 (Base)	**85,128**	**49.41%**	**42,062**	**84,123**
2018	94,133	53.47%	50,332	98,737
2019	103,750	57.53%	59,685	115,014
2020	113,999	61.59%	70,209	133,075
2021	125,468	65.65%	82,365	153,418
2022	137,675	69.71%	95,966	175,895
2023	150,642	73.76%	111,120	200,650
2024	164,393	77.82%	127,935	227,863
2025	178,950	81.88%	146,528	257,666
2026	194,448	85.94%	167,111	290,317
2027	**210,810**	**90.00%**	**189,729**	**325,906**
2028	221,391	90.77%	200,955	343,438
2029	232,774	91.54%	213,077	362,167
2030	244,486	92.31%	225,679	381,645
2031	256,343	93.08%	238,596	401,719
2032	268,535	93.85%	252,010	422,623
2033	281,070	94.62%	265,936	444,341
2034	293,954	95.38%	280,387	466,942
2035	307,194	96.15%	295,379	490,410
2036	320,814	96.92%	310,943	514,834
2037	334,806	97.69%	327,080	540,181
2038	349,176	98.46%	343,804	566,528
2039	363,932	99.23%	361,132	593,856
2040	**379,081**	**100.00%**	**379,081**	**622,194**

(3) Investigation of proposed Facilities in Cotabato city

1) Central Materials Recovery Facility

The City Government of Cotabato is currently proposing to build a Central MRF to address the lack of segregation at the barangay level with budget 174 Million PhP. The proposed Central MRF will be situated in a city government-owned four-hectare lot along the East Diversion Road (about 2 km. from the national highway). In the process of consideration of the technology for waste diversion, composting and hospital waste treatment plant considering the problem on hospital waste treatment with the current COVID-19 pandemic are proposed.

This facility is useful to develop the city's segregation system so that other facilities should be considered with a focus on this facility.

2) Waste-to-Energy Facility

The city government is negotiating for its inclusion in the Waste-to-Energy (WTE) project, which is currently being developed in Kidapawan City. The facility will have the capability of treating 200 tons of wastes per day, with Cotabato City aiming to provide 30 tons daily.

Investigation for the using this facility with its effectiveness and financial aspect is needed and capacity of the facility for Cotabato city of 30 t/day may not be enough in the future according to the projection of waste recovered volume referred in Table 16.5-10.

(4) Possibility for Other Intermediate Treatment Facility

To achieve the target material recovery efficiency in the future, more functional and large-scale facilities for intermediate treatment is needed.

1) Initial Evaluation of Intermediate Treatment Option

Intermediate treatment facilities such as incineration (with/without power generation function), methanisation facility including methane (bio) gas plant and composting facility. Initial evaluation of options for intermediate treatment which could be applicable for the intermediate treatment facilities of Cotabato city and/or surrounding municipalities is summarized as below.

Table 16.5-12 Initial Evaluation of Intermediate Treatment Options

Items	Option 1: Incineration	Option 2: Incineration with Power Generation	Option 3: Methanisation with Power Generation	Option 4: Composting
Objective Waste	Combustible Waste	Combustible Waste	Biodegradable Waste	Biodegradable Waste
Technical Reliability	Reliable	Reliable but complex in operation	Biological reaction is not stable	Biological reaction is not stable
Cost	Expensive	Very Expensive	Expensive	Cheaper
Environmental Aspect	Need removal of pollutants from combustion gas emission	Need removal of pollutants from combustion gas emission	Odour and risk of flammable gas	Odour in miss operation
Applicability	Middle to large cities	Middle to large cities	Small to large cities	Any towns / cities
Note	Waste containing high moisture is not suitable such as food waste	Refer to inspection progress of proposed WTE facility	Inspection is needed for the balance of demand & supply of generated gas	Central (large-scale) composting system should be investigated

As a whole, waste characteristics are the key to choose the best alternative. Current study for waste component is not enough so that detail survey of waste characteristics should be needed for the investigation of above facilities such as WACS to update the data. The development of intermediate treatment is obliged to take consideration of the financial situation of LGUs.

2) Proceeding/Sorting Equipment

To apply the above facilities and their efficient operation, proceeding and sorting process of the residual waste is important. Cotabato city has limited proceeding equipment such as two shredders at city MRF. Additional following equipment is proposed for the appropriate proceeding and sorting/separation of the waste to proceed the high level waste segregation.

- Shredder/ Cutter / Crusher: To crush and make the (large-size) waste smaller to sort easily for using as a material base
- Sorting with Conveyor: Sorting by machinery and by hand is considered after carrying waste by conveyors. In Japan, hand sorting contributes to the employment for people with disability so that this system will contributes to the employment for the waste pickers in Philippines.

(5) 3R Program

Basically, the 3R scheme is composed of many kinds of soft approaches for waste reduction, recovery, reuse and recycling to promote 3R activities. The programs should be implemented comprehensively with effective activities which are divided into the four categories as below. The 3R programs in the four categories are inter-related, and should be implemented to achieve the goals of 3R.

a) Waste Generation Source Control for Waste Reduction

Waste generation source control aims to minimize the generation of waste through the production of durable goods and the avoidance of over packaging in distribution and sale, and by motivating and changing the awareness of waste generators toward a lifestyle of resource and environmental conservation.

b) Waste Discharge Control for Recovery and Waste Diversion

Waste discharge control aims at reducing the amount of waste discharged by individual waste generation sources through self-disposal at the backyard, converting organic waste into compost, repair and reuse of broken instruments and appliances, and exchange or sale of reusable goods within the community.

c) Recovery of Recyclables at Sources and Reuse

Recovery of recyclables intends to enhance the recovery of recyclable materials through segregation at waste generation sources, recovery of recyclable materials before the waste is discharged to the waste collection service, securing the routes for recovery and trading of recyclable materials, etc.

d) Recycling of Recyclable Materials

Recycling industries or the recyclers should take the primary role in this activity by performing regular and constant recovery of recyclable materials and utilizing the recovered materials for the production of goods.

In the process of recovery of recyclable materials, the following four technical options are considered depending on the waste segregation condition as below.

Table 16.5-13 Technical Option for Recovery of Recyclable Waste

Option	Segregation Condition	Function of MRF
1	Segregation at Waste Generation Source	Secondary segregation of recyclable materials, storage and distribution
2	Mixed Waste	Primary and secondary segregation of mixed waste and recovery of recyclable materials, storage and distribution
3	Mixed Waste and Recovery by Collection Workers	Secondary segregation of recyclable materials, storage and distribution
4	Mixed Waste and Recovery by Waste Pickers at Disposal Site	MRF may not be required

To implement above activities, following strategy for the strength of segregation shown in ESWMP and its implementation are needed.

Strategies for promoting segregation in the barangays

- Intensified behavior change communication and education campaign, focusing on the best practices on waste segregation, recycling and composting;
- Setting up of the Barangay Hall as Learning Center and at the same time serve as model area for demonstrating proper SWM practices;
- Periodic "Pulong-Pulong" and Focus Group Discussion (FGD) in every Purok. This will be an avenue to extend the learning on solid waste management;
- House to house visitation will be a strategy of showing how the LGU is addressing the problem. With the said scheme, they may reconsider their options to adopt the SWM alternatives being introduced;
- As a long-term solution, school children will be educated on the proper waste segregation and other SWM practices which will enable them to practice what they learn; and
- Issuance of citation ticket after 3 official warnings to households that will dispose unsegregated wastes.
- A School-Based SWM Program being implemented parallel to the efforts being done at the barangay level. This is to instill in the young minds of the students the value of proper SWM.

Strategies for startup, implementation, monitoring and enforcement

- Strengthen the IEC campaign in the barangays;
- Strengthen the enforcement of the "No Segregation, No Collection" Policy;
- Aptitude development of sanitary officers in the barangays to augment the CENRO in SWM policy enforcement and monitoring of compliance at the barangay level;
- Sustain partnerships with the Philippine National Police (PNP), Professionals, Civil and Religious Organizations.

Strategies for implementing Barangay MRFs

- The CENRO will be requested to attend the Annual Barangay Planning Workshops to recommend and justify the inclusion of budget for the construction and operation of the MRF;
- The Barangay Government to solicit for funding support from the National Government;

- Request the DENR-Region XII to donate some of the confiscated illegal lumber stocked at their office; and
- Technical capability enhancement for Barangay Officials, community leaders and barangay personnel on MRF management, operation and waste handling.

Strategies for start-up, implementation, monitoring and enforcement

- Conduct information and education drive in all barangays;
- Encourage the community to segregate and store recyclable materials for sale to established buying stations or junkshops;
- Provide technical capability enhancement for Barangay Officials, community leaders and barangay personnel on MRF operations, proper waste handling and management of recyclable materials;
- Provide livelihood training on waste recycling;
- Sustain MRF operation in barangays and schools;
- Establish in the barangay a model organic farm using locally produced soil enhancers to persuade every household to compost biodegradable wastes at source by means of vermicomposting, pit or static pile composting;
- Development of recycling facilities;
  bottles into grits for CHB
  cellophane for plastic blocks
- Recycling of used rubber tires into flower pots, chairs and other useful products; and
- Technical capability enhancement for barangay leaders on the generation of SWM-related livelihoods;
  tetra pack for "bayong" production.
  plastic bottles for general decors.

Source: 10-year Ecological Solid Waste Management Plan (2010-2019) of Cotabato City

(6) Project Components on Intermediate Treatment and 3R Promotion

1) Middle Term until 2027

Considering the current condition of SWM in Cotabato city, following projects and activities are proposed in middle term until 2027.

- Establishment of MRF at barangay which doesn't have own MRF
- Investigation proposed intermediate facilities such as central MRF and WTE facility
- Improvement of function of existing facilities such as composting.
- Procurement of necessary proceeding and/or sorting facilities
- Preparation of master plan to strengthen the material recovery system including above components

2) Long Term from 2028 to 2040

Projects in middle term are developed and following projects and activities are proposed in long term from 2028 to 2040 to achieve the 100% material recovery efficiency.

- Capacity Enhancement of the material recovery at each MRFs.
- Feasibility survey and introduction of large-size intermediate facilities such as incineration and methanisation facility.
- Integrated intermediate treatment system by inter-municipality management in Greater Cotabato City area.

16.5.6 Final Disposal Plan

(1) Introduction

Securing a sanitary landfill (SLF) and proper closing and rehabilitation of the existing dumping site is priority challenges in Cotabato city.

In addition, current status of the waste disposal in surrounding municipalities is as follows.

Table 16.5-14 Current Status of waste disposal in Surrounding Municipalities

LGUs	Disposal Condition	Landfill/Dumping site
Datu Odin Sinsuat	・Many households employ traditional disposal such as burning, burying and composting	・No site for disposal due to strong opposition from residents while the LGU is allocating an annual budget for garbage collection and continually looking for at least 5.5 hectares suitable to establish the municipal sanitary landfill.
Sultan Kudarat	・Traditional disposal of garbage such as the burning and burying method	・9 hectare landfill at Ladia which is not yet fully utilize
Sultan Mastura	・Some households disposed their solid wastes through dumping in pits, burying, and burning, and others practice waste segregation	・Dumpsite currently located in Barangay Macabiso
Parang	-	・A one-hectare municipal dumpsite at Brgy. Guiday T. Biruar. ・the LGU had acquired a four- hectare land which will serve as the permanent sanitary landfill which is ready for onwards operation.
Pigcawayan	・Residual waste materials are placed at RCA located inside the sanitary landfill	・A sanitary landfill

(2) Waste Disposal volume

Current disposal volume rate is 50.6% and it should be improved for the reducing burden of disposal site and realizing the sustainable SWM. Target disposal rate is set 10% by 2027 according to ESWMP in Cotabato city and 0% by 2040.

Disposal target: 50.6% (2017) ⇒ 10% (2027) ⇒ 0% (2040)

As a result of calculation of above target, recovered waste volume is 15 t/day in 2027 and 0 t/day in 2040 in Cotabato city.

Table 16.5-15 Estimated Waste Disposal Volume in Cotabato city

Year	Waste Generation in Cotabato city	Material Recovery in Cotabato city	Disposal in Cotabato city					
		Total	Bio	Recyclable	Residual	Special	Total Disposal	Rate
	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	(kg/day)	
2017 (Base)	**108,745**	**42,062**	**27,003**	**7,752**	**8,183**	**129**	**43,066**	**50.59%**
2018	113,940	48,405	26,412	7,582	8,004	126	42,124	46.53%
2019	119,288	55,329	25,612	7,353	7,761	123	40,848	42.47%
2020	124,792	62,866	24,585	7,058	7,450	118	39,211	38.41%
2021	130,455	71,054	23,314	6,693	7,065	112	37,184	34.35%
2022	136,280	79,929	21,781	6,253	6,600	104	34,739	30.30%
2023	142,270	89,531	19,966	5,732	6,050	96	31,844	26.24%
2024	148,470	99,928	17,855	5,126	5,410	85	28,476	22.18%
2025	154,843	111,138	15,419	4,426	4,672	74	24,592	18.12%
2026	161,392	123,206	12,637	3,628	3,829	60	20,155	14.06%
2027	**168,120**	**136,177**	**9,487**	**2,724**	**2,875**	**45**	**15,131**	**10.00%**
2028	172,937	142,484	9,085	2,608	2,753	43	14,490	9.23%
2029	177,926	149,089	8,641	2,481	2,618	41	13,781	8.46%
2030	183,043	155,966	8,149	2,339	2,469	39	12,997	7.69%
2031	188,292	163,123	7,607	2,184	2,305	36	12,133	6.92%
2032	193,722	170,613	7,015	2,014	2,126	34	11,188	6.15%
2033	199,290	178,406	6,366	1,828	1,929	30	10,153	5.38%
2034	205,046	186,555	5,660	1,625	1,715	27	9,027	4.62%
2035	210,946	195,031	4,891	1,404	1,482	23	7,801	3.85%
2036	217,042	203,891	4,058	1,165	1,230	19	6,473	3.08%
2037	223,288	213,102	3,156	906	956	15	5,034	2.31%
2038	229,738	222,724	2,182	626	661	10	3,480	1.54%
2039	236,346	232,724	1,131	325	343	5	1,804	0.77%
2040	**243,114**	**243,114**	**0**	**0**	**0**	**0**	**0**	**0.00%**

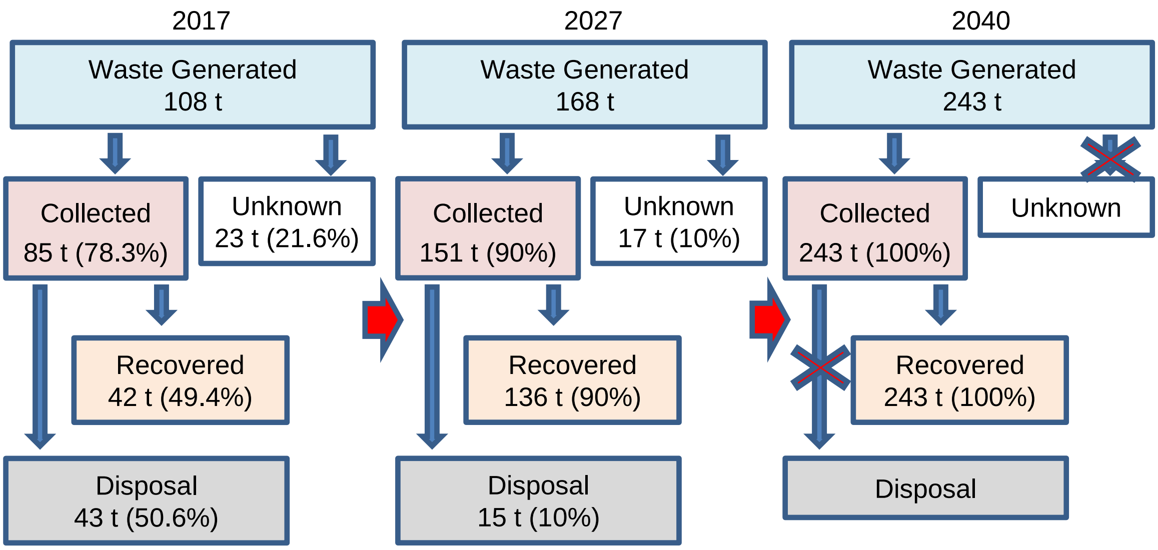


Figure 16.5-5 Concept of Projected Waste Volume in Cotabato City

In the same approach, waste disposal volume in surrounding municipalities is also estimated as shown below. Disposal volume is 21 t/day in 2027 and 0 t/day in 2040.

Therefore, waste recovered volume in the Greater Cotabato city area is estimated 36 t/day in 2027 and o t/day in 2040.

Table 16.5-16 Estimated Waste Recovered Volume in Greater Cotabato city

Year	Waste Collected in Surrounding	Material Recovery in Surrounding	Disposal in Surrounding Municipalities	
	Total	Total	Total Disposal	Rate
	(kg/day)	(kg/day)	(kg/day)	
2017 (Base)	**85,128**	**42,062**	**43,066**	**50.59%**
2018	94,133	50,332	43,801	46.53%
2019	103,750	59,685	44,065	42.47%
2020	113,999	70,209	43,790	38.41%
2021	125,468	82,365	43,103	34.35%
2022	137,675	95,966	41,709	30.30%
2023	150,642	111,120	39,522	26.24%
2024	164,393	127,935	36,457	22.18%
2025	178,950	146,528	32,422	18.12%
2026	194,448	167,111	27,337	14.06%
2027	**210,810**	**189,729**	**21,081**	**10.00%**
2028	221,391	200,955	20,436	9.23%
2029	232,774	213,077	19,696	8.46%
2030	244,486	225,679	18,807	7.69%
2031	256,343	238,596	17,747	6.92%
2032	268,535	252,010	16,525	6.15%
2033	281,070	265,936	15,135	5.38%
2034	293,954	280,387	13,567	4.62%
2035	307,194	295,379	11,815	3.85%
2036	320,814	310,943	9,871	3.08%
2037	334,806	327,080	7,726	2.31%
2038	349,176	343,804	5,372	1.54%
2039	363,932	361,132	2,799	0.77%
2040	**379,081**	**379,081**	**0**	**0.00%**

Disposal in Greater Cotabato	
Total Disposal	Rate
(kg/day)	
86,133	**50.59%**
85,926	46.53%
84,913	42.47%
83,001	38.41%
80,287	34.35%
76,447	30.30%
71,366	26.24%
64,933	22.18%
57,014	18.12%
47,493	14.06%
36,212	**10.00%**
34,926	9.23%
33,478	8.46%
31,804	7.69%
29,880	6.92%
27,713	6.15%
25,288	5.38%
22,594	4.62%
19,616	3.85%
16,344	3.08%
12,760	2.31%
8,852	1.54%
4,604	0.77%
0	**0.00%**

(3) Plan of Sanitary Landfill

1) Proposed SLF

A two-hectare sanitary landfill was proposed to be built in Barangay Bagua I in Cotabato city which is under Category II and could accommodate 15 to 75 tons of residual wastes per day, in accordance with DENR Administrative Order 2006-10, however, negotiation for construction of new SLF is not proceeded.

In addition, location of proposed site is not recommended due to Tsunami area. Table 16.5-18 shows the general requirement for the SLF location. Site selection of the SLF should be considered such condition to avoid risks of environmental and social impact.

Table 16.5-17 Category of SLF in Philippines

	Category 1	Category 2	Category 3	Category 4
Waste generated		≦75 t/day	≦200 t/day	>200 t/day
Daily and intermediate Soil cover	2713	✓	✓	✓
Embarkment/Cell separation	✓	✓	✓	✓
Drainage facility	✓	✓	✓	✓
Gas venting	✓	✓	✓	✓
Leachate collection	✓	✓	✓	✓
Leachate treatment	Pond system	Pond system	Pond system	Combination of physical, biological and chemical
Leachate recirculation	At a later stage of operation	At a later stage of operation	At a later stage of operation	Treatment
Clay liner	✓	✓		
Clay liner and/or synthetic liner			✓	✓

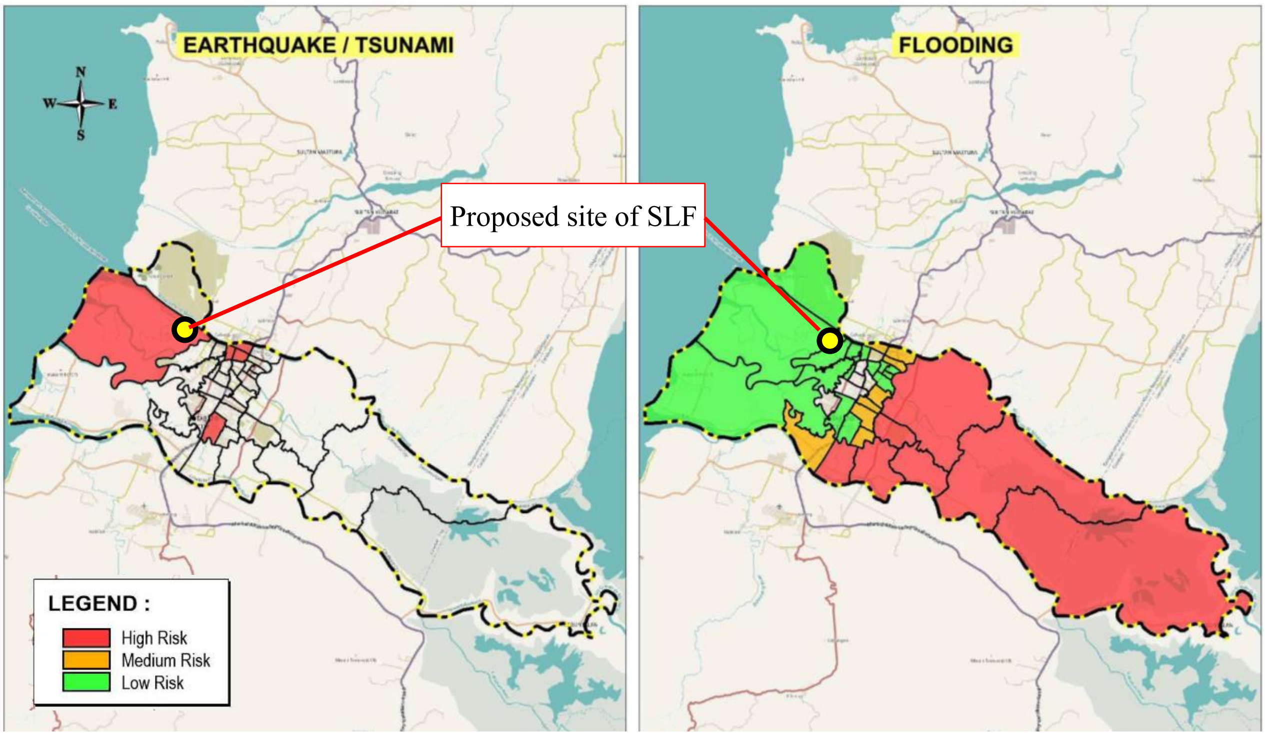


Figure 16.5-6 Location Proposed SLF in Cotabato City

Table 16.5-18 Requirement for SLF Location

Location to be avoided	Risk
Residential area	Objection by the residents & offensive odor
Flood / Tsunami area	Waste run off by water
Wet land	Run off the leachate & Impact to the natural environment
Along the sea /river	Run off the leachate
Environmental Protection area	Impact to the environment
Cultural protection area	Objection by the residents
Land Slide area	Waste collapse by the land slide
High topographic gradient area	Waste collapse by topographic feature

2) Necessary of the site selection of SLF

Necessary of construction of SLF is very high in not only Cotabato city but also surrounding municipalities. In order to introduce a SLF, it is necessary to select a site that is suitable for final landfill construction as a site selection survey and feasibility survey at selected site in the near future.

Selection flow of the candidate site of a SLF construction should be implemented as follows.

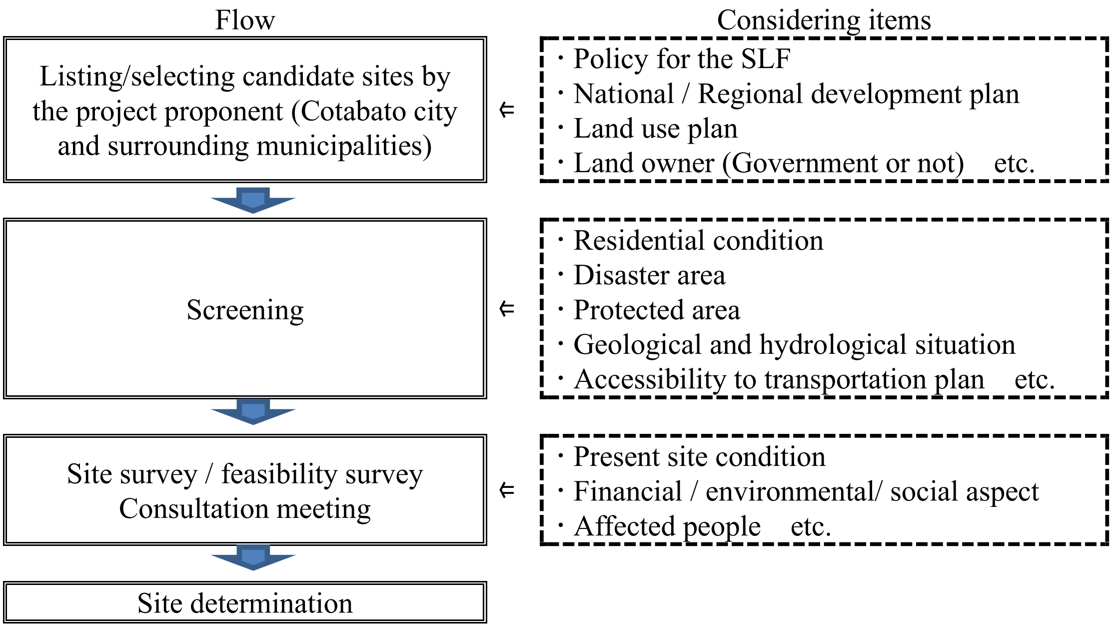


Figure 16.5-7 Investigation flow for site selection of a new SLF

Cotabato city is located under sea level area and there are Tsunami and flooding risk at large are of the city so that candidate site should be included in surrounding municipalities, and investigation of the SLF plan should be prepared by the combination of Greater Cotabato City.

Period for the site selection, planning designing and construction of a new SLF is expected to be taken approximately 7 years, which is in 1 year for site selecting, 2 years for the feasibility survey, 2 years for planning and designing and 2 years for the construction.

3) Necessary component of the SLF

Necessary functions of a new SLF are proposed as the semi aerobic landfill method composed with following facilities. Typical structure of a SLF is shown below.

1) Structure for Solid Waste Retention
   - Enclosure dike
   - Divider dike
   - Embarkment
2) Leachate Treatment Facilities
   - Leachate collection pipe (main & branch)
   - Leachate Treatment Pond
3) Gas Exhaust Equipment (pipe)
4) Rainwater Drainage facilities
   - Rainwater collection pipe
   - Rainwater Pond
5) Access Road and Onsite Road
6) Administrative Facility

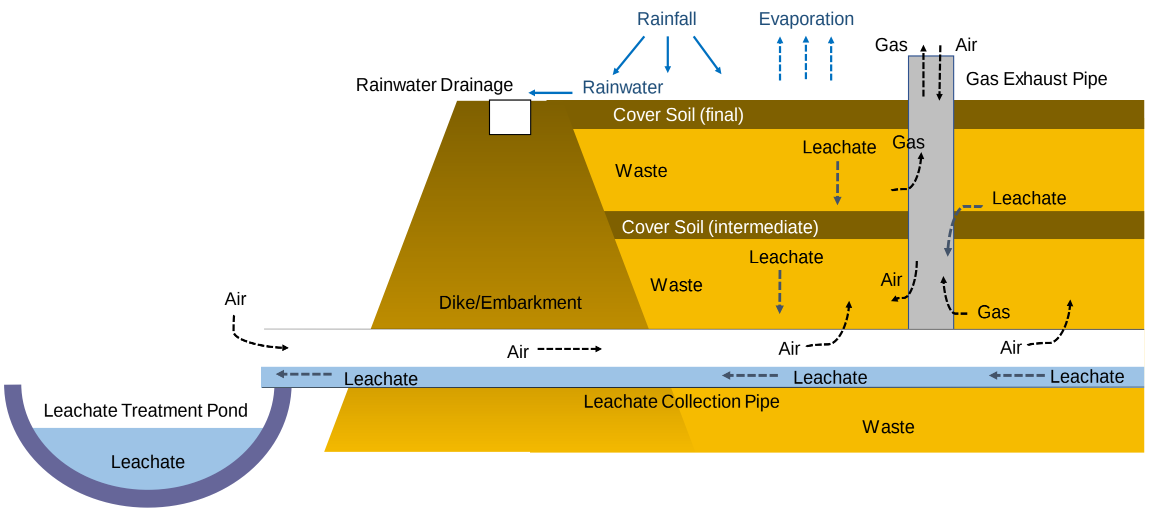


Figure 16.5-8 Typical Structure of a Sanitary Landfill

(4) Closure Plan of Existing Dumping site in Cotabato city

Existing dumping site is already overfilled but construction of new landfill is still not determined so that existing dumping site is needed to extend the operation life. In addition, the Biniruan RCF is needed to close appropriately after construction of a new SLF.

It is expected to be taken 7 years until the operation of a new SLF so that existing dumping site should be used in this period. For the appropriate operation of the existing dumping site, life expansion works and improvement of the dumping site considering the environmental impact are needed. Assumed additional work for the existing dumping site is as follows according to above.

Table 16.5-19 Assumed Additional Work for the Existing Dumping Site

Item	Purpose
Levelling and compaction of incoming waste	・To level the base for the future waste embarkment
Implementation of soil covering	・To mitigate the environmental impact such as scattering waste and offensive odor ・To stabilize the slope
Onsite road construction	・To increase efficiency for above works by heavy equipment
Retaining wall construction	・To block the waste spread outside of the site
Rainwater drainage and leachate treatment facility (if needed)	・To control leachate and outflow of the waste
Gas exhaust pipe	・To control the gas generated from the waste

(5) Volume of Final Disposal

Volume of the waste for final disposal is estimated as follows. In this estimation, existing dumping site is used until 2027 and its accumulation of the volume is 453 thousand m3 including volume of the cover soil, and new SLF is operated from 2028 and its accumulation of the volume is 235 thousand m3 including volume of the cover soil.

Table 16.5-20 Accumulation Volume of the Waste Disposal

Year	Disposal in Greater Cotabato		Required Capacity		
	Total Disposal	Accumulation	Waste	Cover soil	Total
	(kg/day)	(t)	(m3)	(m3)	(m3)
2017 (Base)	**86,133**				
2018	85,926				
2019	84,913				
2020	83,001	30,295	60,591	12,118	72,709
2021	80,287	59,600	119,201	23,840	143,041
2022	76,447	87,503	175,007	35,001	210,008
2023	71,366	113,552	227,104	45,421	272,525
2024	64,933	137,253	274,506	54,901	329,407
2025	57,014	158,063	316,126	63,225	379,351
2026	47,493	175,398	350,795	70,159	420,954
2027	**36,212**	**188,615**	**377,230**	**75,446**	**452,676**
2028	34,926	12,748	25,496	5,099	30,595
2029	33,478	24,967	49,935	9,987	59,922
2030	31,804	36,576	73,151	14,630	87,782
2031	29,880	47,482	94,964	18,993	113,956
2032	27,713	57,597	115,194	23,039	138,233
2033	25,288	66,827	133,654	26,731	160,385
2034	22,594	75,074	150,148	30,030	180,177
2035	19,616	82,234	164,468	32,894	197,361
2036	16,344	88,199	176,399	35,280	211,679
2037	12,760	92,857	185,714	37,143	222,857
2038	8,852	96,088	192,176	38,435	230,611
2039	4,604	97,768	195,536	39,107	234,644
2040	**0**	**97,768**	**195,536**	**39,107**	**234,644**

(6) Required Number of Planned Equipment for the Operation of SLF

CENRO has 2 bulldozer, 2 backhoe and 1 wheel loader for the operation of existing dumping site, and new 1 wheel loader will be procured by city. In case the equipment will be used for the closure and site re-development after closure, new equipment for the operation of new SLF is needed. Assumed necessary equipment is proposed as follows.

Table 16.5-21 Proposed Necessary Equipment for the SLF

Condition	Heavy equipment	Quantity	Using site	Note
Existing	FUSO water truck	1	Existing dumping site	6,000 liters
	Backhoe loader	2	Existing dumping site	1.5 m3 bucket
	Bulldozer	1	Existing dumping site	D6
Proposed in ESWMP	Bulldozer	1	New SLF	D7
	Wheel loader	1	Existing dumping site	3 m3 bucket
New	Backhoe	2	New SLF	1.5 m3 bucket
	Wheel loader	1	New SLF	3 m3 bucket

(7) Project Components on Final Disposal

1) Middle Term until 2027

Considering the current condition of SWM in Cotabato city, following projects and activities are proposed in middle term until 2027.

- Site selection and feasibility survey for a new SLF
- Construction of a new SLF
- Investigation and implementation of the life expansion and improvement work of existing dumping site
- Preparation of master plan to make policy for a new SLF and existing dumping site use

2) Long Term from 2028 to 2040

Projects in middle term are developed and following projects and activities are proposed in long term from 2028 to 2040 to achieve the sanitary disposal system.

- Capacity Enhancement of the operation of the SLF
- Procurement of necessary equipment for the operation of a new SLF.
- Integrated disposal system by inter-municipality management in Greater Cotabato city area.

16.6 Selection of High Priority Projects for Solid Waste Management Plan

Two priority projects and five second priority projects are proposed as follows based on components of SWM plan. Criteria for the selection of the two priority projects is shown in Table 16.6-1.

- **Priority Projects**
  1) Integrated Solid Waste Management Master Plan in Greater Cotabato City
  2) Construction of New Sanitary Landfill
- **Second Priority Projects**
  3) Improvement of Existing Solid Waste Management Facilities
  4) Capacity Enhancement of Solid Waste Management
  5) Procurement of Solid Waste Management Equipment
  6) Construction of Intermediate treatment facilities

Table 16.6-1 Criteria for the Selection of the Two Priority Projects

Evaluation Criteria	Integrated Solid Waste Management Master Plan	Construction of New Sanitary Landfill
Importance and Urgency	○ (Urgent) The urgency of the planning is not so high, but it is important for preparing guidelines and policies for comprehensive solid waste management and laying the foundation for the future management. It is also very important for building the inter-municipality cooperation system needed for the construction of landfill.	◎ (High urgent) Construction of the landfill site is the most important in the SWM of the target area due to the situation where the landfill capacity of the existing disposal site is tense and expectation that the amount of waste generated is increasing in the future. In addition, this is also really urgent as the DENR due to the requirement by RA 9003, which all LGU must have a SLF.
Project Impact	○ Effectiveness for the future sustainability in comprehensive planning is larger, rather than the immediate effectiveness.	○ A landfill site that can be used for more than 10 years will be constructed. In addition, securing disposal site promotes the collection and transportation of the waste and intermediate treatment, which has a high ripple effect on the overall proper SWM.
Possibility of Implementation (Needs)	○ Active project implementation is expected since there are strong needs to make planning for the comprehensive SWM and to build an inter-municipality cooperation system.	◎ Needs of the construction of landfill site is the highest in the local SWM, and there are also high needs and expectations for inter-municipality cooperation, so that active project implementation is expected.
Compatibility with Cotabato City Plan	◎ It is highly consistent since the project is a more specific and complementary planning to the key items of the Ecological Solid Waste Management Plan (ESWMP) of the Cotabato city.	◎ The project has a high consistency since it matches the important items of the Ecological Solid Waste Management Plan (ESWMP) of Cotabato City.
Environmental Aspect	○ Environmental load, economic efficiency, etc. are evaluated in the project, which is leading to the future projects that appropriately considers the environment and society in the future.	◎ Proposed landfill site has a significant improvement in hygiene and environmental load comparing with the existing disposal site, which is open dumping of the waste.
Needs of Japanese Technology	◎ Planning mainly for inter-municipality cooperation requires coordination of various stakeholders so that it is difficult to implement it by only local resources. In addition, it is possible to use Japanese case of SWM such as Japan's wide-area unions.	◎ In addition to Japanese strengths such as the achievement of inter-municipality cooperation, it is useful to utilize the knowledge and technology (semi-aerobic landfill, etc.) for proper management of disposal sites with less environmental load.
Contribution to Peace Building	○ Cooperation with Cotabato City and surrounding municipalities is one theme, in the project and the project contributes to peacebuilding by strengthening cooperation through the comprehensive SWM.	○ Cooperation with Cotabato City and surrounding municipalities is one theme, in the project and the project contributes to peacebuilding by strengthening cooperation through the comprehensive SWM.
Overall Evaluation	○ The project will lead to future comprehensive SWM projects, and it has a high priority in terms of building their foundation.	◎ Construction of the landfill site is the most important in the SWM of the target area, and all evaluation items are high so that the priority of the project implementation is high.

Criteria value ◎: Very Highly, ○: Highly

Summary of each project is as follows.

16.6.1 Integrated Solid Waste Management Master Plan in Greater Cotabato City

(1) Outline of the Project

1) Purpose

- To formulate the master plan of the integrated solid waste management plan in greater Cotabato area for the appropriate and sustainable SWM system including waste collection and transportation, waste treatment, waste disposal and organizational and institutional frameworks.
- To make opportunity and promote the inter-municipality operation of SWM

2) Implementation Agencies

CENRO in Cotabato city and environmental sector in surrounding municipalities

3) Location

Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

From 2021 to 2022

(2) Project Description

1) Background

While problems related to SWM such as equipment shortage, land problems, financial shortages, environmental impact, and residential awareness are recognized in each city of Greater Cotabato area, it is becoming difficult for each city to deal with these problems alone. In order to investigate the possibility of dealing with these problems through wide-area cooperation, formulating a SWM plan in collaboration with the Greater Cotabato area is needed

2) Project Components

Main project components are proposed as follows to prepare a master plan for SWM system targeted to Cotabato City and 5 Surrounding Municipalities.

a) Detail data collection related to SWM in Greater Cotabato city

Data for SWM is shortage especially in surrounding municipalities so that data collection is needed to make future plan

b) Preparation of plans for the waste collection, intermediate treatment and final disposal

The system and necessary facility/equipment of the waste collection, intermediate treatment and final disposal should be investigated and their operation method by the inter-municipality is planned.

c) Establishment of Inter-municipality organization for SWM

In order to implement the integrated SWM plan and secure the human resources, budget and technologies etc. for SWM, establishment of inter-municipality organization composed by Cotabato city and 5 surrounding municipalities is investigated.

d) Site selection survey for Sanitary Landfill

Construction of SLF is the one of the most important challenges for each LGUs in Greater Cotabato city. Since environmental, social and financial issues and factors to be considered are involved in the construction of the SLF, it is investigated over a wide area.

3) Expected Effects

Expected effects by implementing this project are considered as follows.

- Integrated SWM system in Greater Cotabato area is investigated
- Policy decision and budget securing for SWM is promoted
- Human resources, budget, land use, facilities/equipment and technology related to SWM can be shared within the area

16.6.2 Construction of New Sanitary Landfill

(1) Outline of the Project

1) Purpose

- To conduct surveys for feasibility, planning, and designing of the construction of a new SLF with suitable functions
- To construct a new SLF for the sustainable waste final disposal system in Greater Cotabato city

2) Implementation Agencies

CENRO in Cotabato city and environmental sector in surrounding municipalities

3) Location

Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

From 2022 to 2027

(2) Project Description

1) Background

While the construction of an appropriate SLF is required urgently in Cotabato city and surrounding municipalities for the appropriate solid waste disposal system due to the shortage of disposal site and overfilling of existing dumping site, candidate site for SLF is not secured in Cotabato city and some surrounding municipalities. Prompt commencement of the planning, design and construction of a new SLF are needed after selecting the candidate site.

2) Project Components

Main project components are proposed as follows to construct a new SLF in Greater Cotabato City. The commencement of this project is based on the premise that the selection of suitable candidate sites of a SLF has been completed.

a) Feasibility Survey for the Construction of New Sanitary Landfill

Feasibility survey for the new SLF is conducted at the candidate site proposed by the former survey (MP survey in this plan). In the survey, financial and economical analysis and initial environmental assessment are also conducted.

b) Detail Design for the Construction of New Sanitary Landfill

Planning and basic design for the construction of the new SLF are conducted at a proposed site after the feasibility survey to decide the basic concept of the SLF. After that, detail design (D/D) and estimation of the construction cost are conducted.

c) Construction of New Sanitary Landfill

After a tender stage based on the D/D of the SLF, construction of new SLF is started by contractors. Supervision (S/V) by a consultant is also implemented during the construction stage. After the construction, operation training for the new SLF is implemented in short period as a soft component.

3) Expected Effects

Expected effects by implementing this project are considered as follows.

- Feasibility of a new SLF is investigated with environmental, financial and social aspects
- Necessary function and effects of the new SLF are planned and designed
- A new SLF with necessary function is constructed, and proper disposal of waste at the SLF will improve the sanitary environment in Greater Cotabato City

16.6.3 Improvement of Existing Solid Waste Management Facilities

(1) Outline of the Project

1) Purpose

- To improve the existing dumping site in Cotabato city for its life expansion and appropriate closure
- To procure the necessary equipment for the intermediate treatment of the biodegradable waste, recyclables and residual waste

2) Implementation Agencies

CENRO in Cotabato city

3) Location

Cotabato city (and surrounding municipalities if needed)

4) Implementation Schedule

From 2022 to 2027

(2) Project Description

To achieve the 2 main purposes, feasibility survey and planning/designing of improvement and rehabilitation work of existing dumping site and procurement of necessary equipment for the waste intermediate treatment are needed to implement. Project components of this project are as follows.

a) Feasibility Survey and Detail Design for the Improvement of the Existing SWM Facilities

Planning, F/S and design are implemented for the rehabilitation of existing dumping site and for the procurement of sorting/proceeding equipment for the intermediate treatment.

b) Improvement and Rehabilitation Work of Existing Dumping site

Improvement work for the rehabilitation of existing dumping site is implemented at first, and operation training for life expansion work of dumping site is implemented after construction.

c) Closure Work of Existing Dumping site

After construction of a new sanitary landfill, closure work of existing dumping site is implemented for the re-development of the former site.

d) Procurement of Additional SWM Facilities

Procurement of sorting/proceeding equipment is implemented and operation training for the equipment is also implemented after procurement.

16.6.4 Capacity Enhancement of Solid Waste Management

(1) Outline of the Project

1) Purpose

- To strengthen the SWM capacity such as technical, organizational financial and institutional capacities for the implementation agencies.
- To strengthen the capacity of inter municipality organization for integrated SWM

2) Implementation Agencies

CENRO in Cotabato city and environmental sector in surrounding municipalities

3) Location

Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

From 2023 to 2026 as a 1st phase

From 2028 to 2030 as a 2nd phase with new facilities/equipment

(2) Project Description

To establish the sustainable SWM system in Greater Cotabato city, capacity enhancement for the implementation agencies of SWM is needed. Project components of this project are as follows.

a) Development of waste collection a& transportation system

To cover the collection service in whole area of greater Cotabato city, collection and transportation service should be developed by the investigation of trip route, collection frequency and preparation of collection vehicles and its human resources. In case collection system by municipalities is limited, collaboration with private sector is conducted to investigate.

b) Development of Intermediate Treatment and 3R programs

Composting and recycle system is improved with technical approach, and 3R programs such as developing public awareness, waste separation and educational program are implemented as a soft approach.

c) Development of Final Disposal system

Training for life expansion and environmental pollution management in existing dumping site is implemented. In the 2nd phase after construction of a new SLF, appropriate operation training such as waste compaction, embarkment and leachate control is implemented.

d) Development of financial management

To continue the sustainable SWM system, financial improvement is conducted, and system of waste collection charge should be improved with the communication with residents.

e) SWM operation by Inter-municipality organization

In case inter-municipality organization is established in former project, operation training of SWM by the organization is implemented

16.6.5 Procurement of Solid Waste Management Equipment

(1) Outline of the Project

1) Purpose

- To conduct surveys for feasibility and planning of the procurement of necessary equipment
- To procure the equipment for the future operation of SWM system

2) Implementation Agencies

CENRO in Cotabato city and environmental sector in surrounding municipalities

3) Location

Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

From 2025 to 2027

(2) Project Description

While existing equipment such as waste collection vehicles and heavy equipment for the dumping site operation are allocated in Cotabato city, these equipment is being not enough in the future due to the increasing of the waste generation. In addition, present number of equipment in surrounding municipalities is also shortage so that procurement of the necessary equipment is needed for the appropriate SWM system. Project components of this project are as follows.

a) Planning and Design Survey for the Procurement of Solid Waste Management Equipment

Planning and design for the procurement of necessary equipment are implemented considering waste characteristic, condition of existing vehicles, its specification and maintenance system of waste collection vehicles and heavy equipment for landfill operation.

b) Procurement of Solid Waste Management Equipment

Equipment is donated /procured with procurement supervision by a consultant.

16.6.6 Construction of Intermediate treatment facilities

(1) Outline of the Project

1) Purpose

- To conduct surveys for feasibility, planning, and designing of the construction of a new intermediate treatment facility such as incineration and bio-gas plant
- To construct a new intermediate treatment facility for the sustainable material recovery system in Greater Cotabato city

2) Implementation Agencies

CENRO in Cotabato city and environmental sector in surrounding municipalities

3) Location

Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

From 2028 to 2032

(2) Project Description

While use of WTE facility is now proposed in Cotabato city, detail planning of this facility is not decided. In order to achieve the high-level material recovery system as a future SWM system, large size intermediate treatment facility such as incineration and bio-gas plant with power generation is needed. Project components of this project are as follows.

a) Feasibility Survey for the Construction of New Intermediate Treatment Facility

Feasibility survey for the new intermediate treatment facility is conducted at the candidate site proposed by the former survey or implementation agencies. In the survey, financial and economical analysis and initial environmental assessment are also conducted.

b) Detail Design for the Construction of New Intermediate Treatment Facility

Planning and basic design for the construction of the new intermediate treatment facility are conducted at a proposed site after the feasibility survey to decide the basic concept of the intermediate treatment facility. After that, detail design (D/D) and estimation of the construction cost are conducted.

c) Construction of New Sanitary Intermediate Treatment Facility

After a tender stage based on the D/D of the intermediate treatment facility, construction of new facility is started by contractors. Supervision (S/V) by a consultant is also implemented during the construction stage. After the construction, operation training for the new facility is implemented in short period as a soft component.

16.7 Implementation Schedule for Solid Waste Management Plan

Implementation schedule of SWM Plan is as follows.

- Schedule in Short term (from 2021 to 2022)
  - Integrated Solid Waste Management Master Plan in Greater Cotabato City
- Schedule in Middle term (from 2023 to 2028)
  - Construction of New Sanitary Landfill
  - Improvement of Existing Solid Waste Management Facilities
  - Capacity Enhancement of Solid Waste Management (Phase 1)
  - Procurement of Solid Waste Management Equipment
- Schedule in Long term (from 2029 to 2040)
  - Capacity Enhancement of Solid Waste Management (Phase 2)
  - Construction of Intermediate treatment facilities

Table 16.7-1 Implementation Schedule for Each Project on SWM Plan

Project / Activities		Short Term		Middle Term						Long Term											
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Priority Project																					
1. Integrated Solid Waste Management Master Plan in Cotabato City & Surrounding Municipalities																					
1-1	Detail data collection related to SWM in Greater Cotabato city	■																			
1-2	Preparation of waste collection, intermediate treatment and final disposal plan	■																			
1-3	Establishment of Inter-municipality organization for SWM	■	■																		
1-4	Site selection survey for Sanitary Landfill	■	■																		
2. Construction of New Sanitary Landfill																					
2-1	Feasibility Survey for the Construction of New Sanitary Landfill		■	■																	
2-2	Detail Design for the Construction of New Sanitary Landfill				■	■															
2-3	Construction of New Sanitary Landfill						■	■													
※	Operation of New Sanitary Landfill								▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
2nd Priority Project																					
3. Improvement of Existing Solid Waste Management Facilities																					
3-1	Feasibility Survey and Detail Design for the Improvement of the Existing SWM Facilities		■																		
3-2	Improvement and Rehabilitation Work of Existing Dumping site		■	■▨	▨	▨	▨	▨													
3-3	Closure Work of Existing Dumping site							■													
3-4	Procurement of Additional SWM Facilities		■	■																	
4. Capacity Enhancement of Solid Waste Management				1st Phase for existing system					2nd Phase for new system												
4-1	Development of waste collection a& transportation system			■	■	■	■		■	■	■										
4-2	Development of Intermediate Treatment and 3R programs			■	■	■	■		■	■	■										
4-3	Development of Final Disposal system			■	■	■	■		■	■	■										
4-4	Development of financial management			■	■	■	■		■	■	■										
4-5	SWM operation by Inter-municipality organization			■	■	■	■		■	■	■										
5. Procurement of Solid Waste Management Equipment																					
5-1	Planning and Design Survey for the Procurement of Solid Waste Management Equipment					■	■														
5-2	Procurement of Solid Waste Management Equipment						■	■													
6. Construction of Intermediate treatment facilities																					
6-1	Feasibility Survey for the Construction of New Intermediate Treatment Facility Management								■												
6-2	Detail Design for the Construction of New Intermediate Treatment Facility									■	■										
6-3	Construction of New Sanitary Intermediate Treatment Facility											■	■								
※	Operation of New Intermediate treatment facility													▨	▨	▨	▨	▨	▨	▨	▨

16.8 Cost of Solid Waste Management Plan

Cost of each project on SWM Plan is summarized as follows. This cost was estimated with supposing Japanese assistance and case example in Japan.

Table 16.8-1 Cost on SWM Plan

Project / Activities		Short Term		Middle Term						Long Term												Total Cost
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
1. Integrated Solid Waste Management Master Plan in Cotabato City & Surrounding Municipalities																						
1-1	Detail data collection related to SWM in Greater Cotabato city	10.0	10.0																			80
1-2	Preparation of waste collection, intermediate treatment and final disposal plan	10.0	10.0																			
1-3	Establishment of Inter-municipality organization for SWM	10.0	10.0																			
1-4	Site selection survey for Sanitary Landfill	10.0	10.0																			
2. Construction of New Sanitary Landfill																						
2-1	Feasibility Survey for the Construction of New Sanitary Landfill		13.6	27.3																		650
2-2	Detail Design for the Construction of New Sanitary Landfill				40.9	40.9																
2-3	Construction of New Sanitary Landfill						263.6	263.6														
3. Improvement of Existing Solid Waste Management Facilities																						
3-1	Feasibility Survey and Detail Design for the Improvement of the Existing SWM Facilities		27.3																			186
3-2	Improvement and Rehabilitation Work of Existing Dumping site		26.5	26.5																		
3-3	Closure Work of Existing Dumping site		26.5	26.5																		
3-4	Procurement of Additional SWM Facilities		26.5	26.5																		
4. Capacity Enhancement of Solid Waste Management																						
4-1	Development of waste collection a& transportation system			7.7	7.7	7.7	7.7		10.3	10.3	10.3											309
4-2	Development of Intermediate Treatment and 3R programs			7.7	7.7	7.7	7.7		10.3	10.3	10.3											
4-3	Development of Final Disposal system			7.7	7.7	7.7	7.7		10.3	10.3	10.3											
4-4	Development of financial management			7.7	7.7	7.7	7.7		10.3	10.3	10.3											
4-5	SWM operation by Inter-municipality organization			7.7	7.7	7.7	7.7		10.3	10.3	10.3											
5. Procurement of Solid Waste Management Equipment																						
5-1	Planning and Design Survey for the Procurement of Solid Waste Management Equipment					31.8	31.8															327
5-2	Procurement of Solid Waste Management Equipment						131.8	131.8														
6. Construction of Intermediate treatment facilities																						
6-1	Feasibility Survey for the Construction of New Intermediate Treatment Facility Management								36.4													1,073
6-2	Detail Design for the Construction of New Intermediate Treatment Facility									29.5	29.5											
6-3	Construction of New Sanitary Intermediate Treatment Facility											488.6	488.6									
Total Cost		40	160	145	80	111	466	395	88	81	81	489	489									

16.9 Environmental and Social Considerations of Solid Waste Management Plan

Environmental and social considerations for each project on SWM Plan is summarized as follows. Environmental assessment is mainly required to following projects which has big construction works and operation with the waste handling.

- Construction of New Sanitary Landfill
- Construction of Intermediate treatment facilities

Table 16.9-1 Environmental and Social Considerations on the SWM Plan

Project/ Program	Phases	Pollution control								Natural				Social environment																Others		Type of Permit
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
		Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment, livelihood	Land use and utilization of local resources	Water usage	Existing social infrastructures and services	Social institutions such as social infrastructure and local decision-making institutions	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR
1. Integrated Solid Waste Management Master Plan in Cotabato City & Surrounding		N/A																														CNC
2. Construction of New Sanitary Landfill	Pre-construction	-	-	-	-	-	-	-	-	-	-	-	-	C	C	C	-	B-	-	-	-	-	-	-	-	-	-	-	-	-	-	ECC
	Construction	B-	B-	B-	B-	B-	C	D	C	C	B-	D	C	C	C	C	B+-	B-	C	C	C	C	C	C	B-	C	C	C	B-	B-	B-	
	Operation & Maintenance	B-	B-	B+	C	B-	C	B-	C	C	C	D	D	D	D	D	B+	B+	C	B+	B+	C	C	C	B-	C	C	C	D	B-	B+	
3. Improvement of Existing Solid Waste Management Facilities	Pre-construction	-	-	-	-	-	-	-	-	-	-	-	-	D	C	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	CNC
	Construction	B-	B-	B-	B-	B-	C	D	C	C	C	D	C	D	C	D	B+-	D	D	D	D	D	D	D	D	C	C	C	B-	B-	B-	
	Operation & Maintenance	B-	B+-	B+	C	B-	C	B+-	C	C	C	D	D	D	C	D	B+-	B+	D	B+	B+	D	D	D	B+	C	C	C	D	D	B+	
4. Capacity Enhancement of Solid Waste Management		N/A																														CNC
5. Procurement of Solid Waste Management Equipment	Pre-procurement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CNC
	Procurement	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	C	C	D	D	D	D	
	Operation & Maintenance	B-	D	D	D	B-	D	D	D	D	D	D	D	D	D	D	B+	D	D	B+	B+	D	D	D	D	C	C	D	D	B-	B-	
6. Construction of Intermediate treatment facilities	Pre-construction	-	-	-	-	-	-	-	-	-	-	-	-	C	C	C	-	B-	-	-	-	-	-	-	-	-	-	-	-	-	-	ECC
	Construction	B-	C	B-	B-	B-	C	B-	C	C	B-	D	C	C	C	C	B+-	B-	C	C	C	C	C	C	B-	C	C	C	B-	B-	B-	
	Operation & Maintenance	B-	D	B-	C	B-	C	B-	C	C	C	D	D	D	C	C	B+	D	C	B+	B+	C	C	C	B-	C	C	C	D	D	B+	

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.
D: No impact is expected.
N/A: Not applicable (for exaple, Capacity Building Project)

ECC: Environmental Compliance Certificate
CNC: Certificate of Non-Coverage

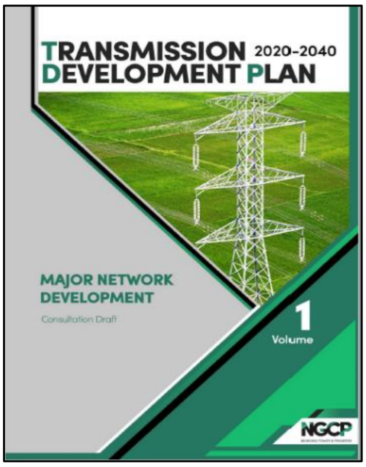
CHAPTER 17
POWER SUPPLY DEVELOPMENT PLAN

17.1 Background on Power Supply

17.1.1 The future policy of DOE in the Philippines

(1) Power Supply

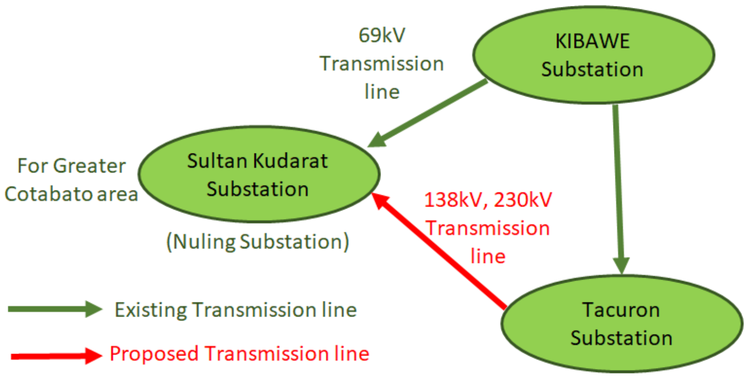
According to Transmission Development Plan 2020-2040, the Department of Energy (DOE) plans to reduce grid power outages by installing 230kV transmission lines and renovating the Sultan Kudarat substation (Nuling substation) starting 2025 to 2035.



Source: NGCP

Figure 17.1-1 Transmission Development Plan 2020-2040

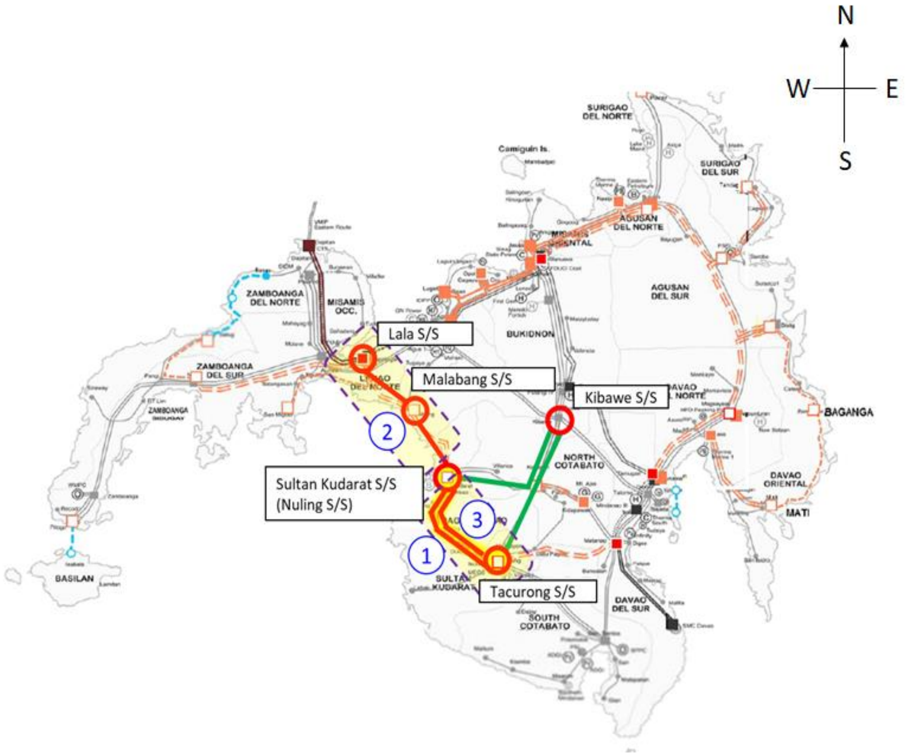
Currently, the only power supply for the Greater Cotabato City is through the 69kV transmission line from the Kibawe substation. It is a concern if this transmission line meets an accident then the Commercial Power Supply in the Greater Cotabato City will be cut. Future plans involve the extension of the 230kV transmission line from the Tacurong substation to the Sultan Kudarat substation. This will provide back-up supply if one of them has an accident. It will be possible to continue supplying Electricity to the Greater Cotabato City. Also included is the renovation of the Sultan Kudarat substation that is underway.



Source: JICA Study Team

Figure 17.1-2 Future Plan for Transmission Line to Greater Cotabato City

In addition, Figure 17.1-3 shows the on-going projects on the map and Table 17.1-1 provide the details of each project.



Source: JICA Study Team (arranged from document provided by the Transmission Development Plan 2020-2040)

Figure 17.1-3 Ongoing Transmission Plan for Greater Cotabato City

Table 17.1-1 Ongoing Transmission Plan for Greater Cotabato City

<table>
<tr><td rowspan="2">1) Sultan Kudarat – Tacurong 230kV Transmission Line</td><td>Maguindanao, Sultan Kudarat</td><td>Jan 2025</td></tr>
<tr><td colspan="2"><u>Substation Components:</u>
■ Tacurong 138kV Substation, 2-138kV PCBs and associated equipment;
■ Sultan Kudarat 138kV Substation Expansion, 2-138kV PCBs and associated equipment.
<u>Transmission Components:</u>
■ Sultan Kudarat – Tacurong 138kV Transmission Line, ST-DC1, 2-795 MCM ACSR/AS, 101 km.
Bulk Cost Estimate: 1,872 Milion Pesos</td></tr>
<tr><td rowspan="2">2) Lala – Malabang – Sultan Kudarat 230kV Transmission Line</td><td>Lanao Del Norte, Lanao del Sur, Maguindanao</td><td>Dec 2030</td></tr>
<tr><td colspan="2"><u>Substation Components:</u>
■ Lala 230kV Substation: 4-230kV PCBs and associated equipment;
■ Malabang 230kV Substation (New): 1×50MVA 138/69-13.8kV Power Transformer and accessories, 8-230kV PCBs, 3-69kV PCBs and associated equipment;
■ Sultan Kudarat 230kV Substation: 3-230kV PCBs and associated equipment.
<u>Transmission Components:</u>
■ Lala-Malabang-Sultan Kudarat 230kV Transmission Line: ST-DC, 2-795 MCM ACSR/AS, 115 km.</td></tr>
<tr><td rowspan="2">3) Sultan Kudarat – Tacurong 230kV Transmission Line 2</td><td>Maguindanao, Sultan Kudarat</td><td>Dec 2035</td></tr>
<tr><td colspan="2"><u>Transmission Components:</u>
■ Sultan Kudarat-Tacurong: 230kV Transmission Line, ST-DC, 2-795 MCM ACSR, 110 km
<u>Substation Components:</u>
■ Sultan Kudarat 230kV Substation Expansion, 1-230kV PCBs and associated equipment;
■ Tacurong 230kV Substation Expansion, 2-230kV PCBs and associated equipment.</td></tr>
</table>

Source: JICA Study Team (arranged from document provided by Transmission Development Plan 2020-2040)

The Tacurong and Sultan Kudarat substations in the south of the map will be connected by a 138kV transmission line, and the two substations will be renovated at the same time. The construction is scheduled to be completed by January 2025. After that, there are plans to connect the Lala substation, Malabang substation and Sultan Kudarat substation in the northwest with a 230kV transmission line. This is scheduled to be completed by December 2030. In addition, by December 2035, the Tacurong and Sultan Kudarat substations will be connected by a 230kV transmission line parallel to the 138kV transmission line. With these projects, Mindanao aims for a circular transmission route to avoid power outages as much as possible.

(2) Promoting Smart Grids

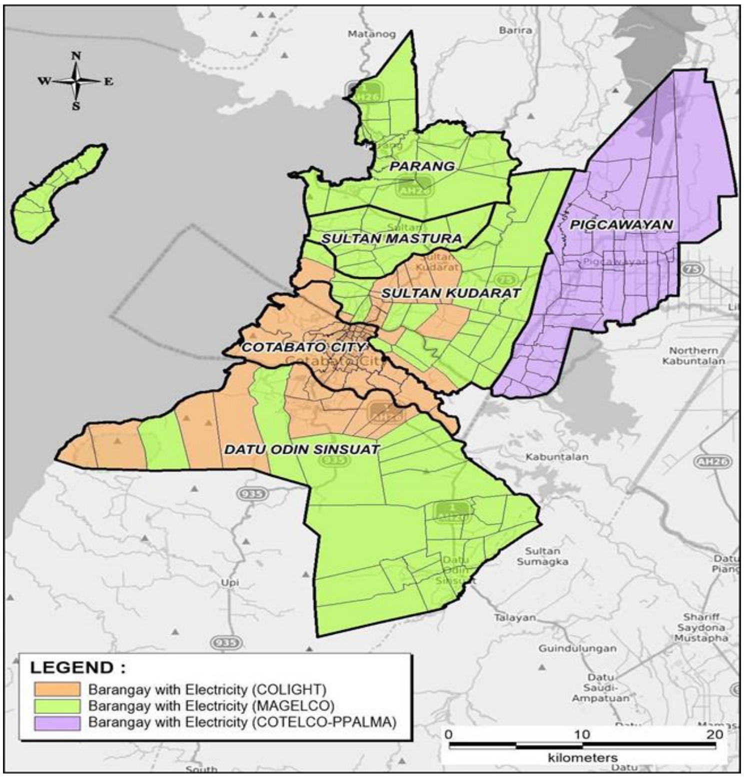
According to the Transmission Development Plan 2020-2040, DOE has been promoting smart grids since 2019. The following is an excerpt of the document.

- There have been continuing research and development over the years toward commercial realization of the Smart Grid. Nowadays, the adoption of Smart Grid technologies and the development of Smart Grid roadmaps and pilot projects have become global trend for power utilities.
- In 2019, DOE drafted a circular entitled “Providing a National Smart Grid Policy Framework for the Philippine Electric Power Industry and Roadmap for Distribution Utilities”.

17.1.2 The Status of Power Supply in Greater Cotabato City

(1) Power Distribution Company

In Greater Cotabato City, electricity is provided by 3 power distribution companies namely CLPC, MAGELCO and COTELCO-PPALMA. The franchise coverage of the 3 power distribution companies is shown in Figure 17.1-4.



Source: JICA Study Team (arranged from document provided by 3 power distribution companies)

Figure 17.1-4 Franchise Area of the Three Power Distribution Companies

According to their franchise area map, we can see that CLPC (Colight) and MAGELCO are intricate. Orange represents the CLPC area, green represents the MAGELCO area, and purple represents the COTELCO -PPALMA area. The number of barangays supplied by each company is shown in Table 17.1-2. CLPC has 63 barangays, MAGELCO has 87 barangays, and COTELCO -PPALMA has 39 barangays.

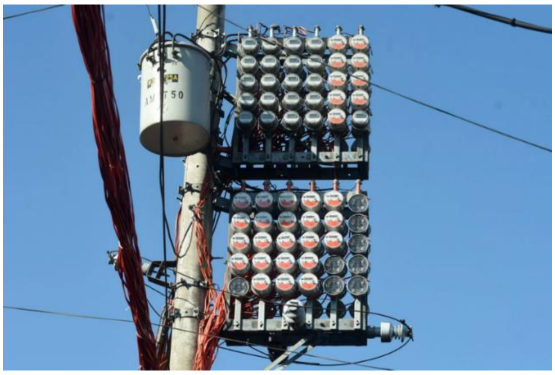
Table 17.1-2 Number of Barangays Supplied by Each Company

Distribution Company	Municipality	No of Energized
Cotabato light and power (CLPC) (Private)	Cotabato City	37
	Sultan Kudarat	14
	Datu Odin Sinsuat	12
	TOTAL	63
MAGELCO (EC)	Sultan Kudarat	26
	Sultan Mastura	13
	Parang	25
	Datu Odin Sinsuat	23
	TOTAL	87
COTELCO-PPALMA (EC)	Pigcawayan	39
	TOTAL	39

Source: JICA Study Team (arranged from document provided by CLPC, MAGELCO and COTELCO-PPALMA)

(2) Cotabato Light and Power Company (CLPC)

Cotabato Light and Power Company (CLPC), a subsidiary of Aboitiz Power Company, is the power distributor for Cotabato City and portion of the adjoining towns of Sultan Kudarat and Datu Odin Sinsuat. Existing programs and future plans are shown in Table 17.1-3. The table shows CLPC's plans and programs. To increase the power capacity, they proposed to build a 25MVA substation in Tamontaka 2 that is estimated to be completed by 2022. And then, the Elevated Metering Center is being set up to reduce distribution loss. By installing the Watt-hour meter at a high position, it is expected to have the effect of preventing power theft without going through the Watt-hour meter.



Source: JICA Study Team

Figure 17.1-5 Sample Picture of Elevated Metering Center

Also installed are Load Break Switch and Reclosers for automation of distribution network. This will shorten the power outage period and improve the power supply service. CLPC also has programs to strengthen online payments and advertising activities.

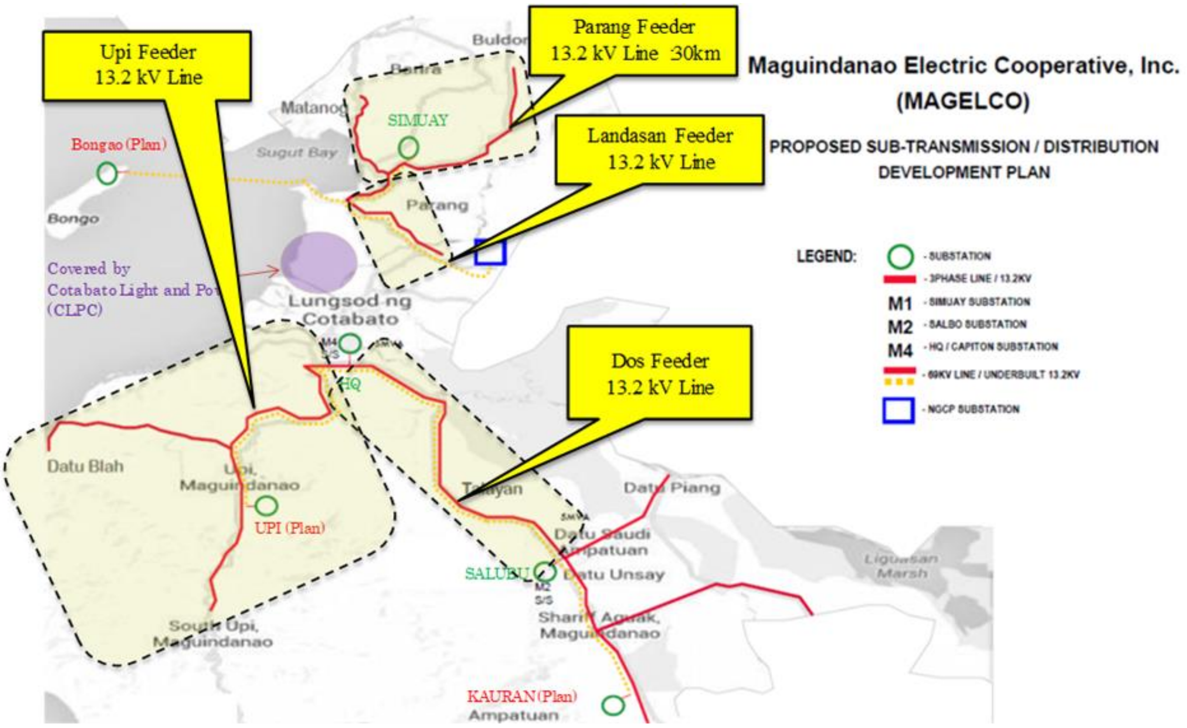
Table 17.1-3 Existing Programs and Future Plans of CLPC

No.	Program/Plan	Existing programs and future plans to further improve the Company's services, etc.
1	Increase Capacity	Proposed 25MVA Substation in Tamontaka 2. estimated to complete in 2022
2	Ongoing Loss Reduction Programs	Elevated Metering Center
3	Automation of distribution network to lessen interruption period.	Load Break Switches, Reclosers
4	Digital channels	Payment options thru online banking and e-wallets Web-based customer transactions
5	Continuous outreach for customer awareness	• Barangay pulong-pulong • Weekly radio program • Posting of advisory in social media

Source: JICA Study Team (arranged from document provided by CLPC)

(3) Maguindanao Electric Cooperative, INC (MAGELCO)

Maguindanao Electric Cooperative, INC (MAGELCO) is a recipient of grant aid from JICA, and has recently received equipment to strengthen the 4 Feeders as shown in Figure 17.1-6.



Source: JICA Study Team, (Preparatory survey report on 'The project for Improvement of Equipment for Power distribution in Bangsamoro area in the Republic of the Philippines Final report')

Figure 17.1-6 Ongoing Feeder Improvement Project of MAGELCO

It covers Greater Cotabato City, which is the scope of this project. Equipment includes Pole Transformers, Electrical Wire of Insulated Aluminum Conductor Steel Reinforced, and other accessories. They have already received the equipment and are currently working on the installation. In addition to this, 2 Boom Trucks with Bucket and 2 Boom Trucks with Digger shown in Figure 17.1-7 have been provided, and work is proceeding with the help of the equipment.

(a) Boom Trucks with Bucket

(b) Boom Trucks with Digger

Source: MAGELCO

Figure 17.1-7 Boom Trucks Provided by Japan

Table 17.1-4 Future Approved Projects of MAGELCO

No.	Name of Project	Brief Description	Time table	Cost and Source of fund
1	Reconstruction of Datu Saudi Ampatuan to Datu Abdullah Sangki Line	Reconstruction of 25km 13.2kV power line connecting Datu Saudi Ampatuan and Datu Abdullah Sangki for power reliability	Dec-2020	PhP 29,016,528.60 DITO Telecommunity Corp
2	Reconstruction of RSK S/S to Shariff Aguak Line	Reconstruction of 5km 13.2kV power line connecting Ampatuan and Shariff Aguak for power reliability	Dec-2020	PhP 4,004,973.39 DITO Telecommunity Corp
3	Reconstruction of Shariff Aguak to Manasapano Line	Reconstruction of 5km 13.2kV power line connecting Shariff Aguak and Mamasapano for power reliability	Dec-2020	PhP 13,182,245.49 DITO Telecommunity Corp
4	Reconstruction of Sultan sa Barongis (SSB) Line	Reconstruction of 5km 13.2kV Sultan sa Barongis power line for power reliability	Dec-2020	PhP 22,768,145.46 DITO Telecommunity Corp
5	10MVA Sarmiento Power Substation	Additional 10MVA Power Substation in West Maguindanao for power reliability	Dec-2020	PhP 20,976,000.00 DITO Telecommunity Corp
6	69kV Simuay-Sarmineto Line	Extension of 69kV line from Simuay to Sarmiento, Parang	Dec-2020	PhP 32,393,243,85 DITO Telecommunity Corp

Source: MAGELCO

In addition, in the MAGELCO franchise area, there are projects such as the reconstruction of the 13.2kV Distribution Network, the reconstruction of Substations, and the construction of Substations, as shown in Table 17.1-4. Among them, the project in Greater Cotabato City is the extension work for the 69kV distribution line from Simuay to Parang. MAGELCO has additional proposed projects shown in Table 17.1-5, which are the construction of a distribution substation in the Upi area and the extension of 69kV distribution lines.

Table 17.1-5 Proposed Projects of MAGELCO

No.	Name of Project	Brief Description	Time table	Cost and Source of fund
1	5MVA Timanan Power Substation South Upi	Additional 10MVA Power Substation in Central Maguindanao for power reliability	Dec-2021	PhP 41,424,000.00 No identified source of fund yet
2	69kV Lebak-South Upi Line	Extension of 69kV line from Lebak to Timanan, South Upi	Dec-2021	PhP 100,000,000.00 No identified source of fund yet

Source: MAGELCO

As described, MAGELCO is focusing on increasing power capacity by strengthening distribution lines and distribution substations. Other, power supply problems have occurred due to the aging of electrical equipment.

(4) Cotabato Electric Cooperative, INC.-PPALMA (COTELCO-PPALMA)

As for the Municipality of Pigcawayan, it is being served by COTELCO-PPALMA and households also experienced frequent brownouts due to erratic power supply from the main source. Currently COTELCO-PPALMA (see Table 17.1-6) is constructing a 10MVA distribution substation in Pigcawayan to increase capacity. Included in the plan is the replacement of Watt hour meters and Transformers that have become obsolete and unusable. They are also planning to enable real-time monitoring of distribution substations by SCADA.

Table 17.1-6 Ongoing Plan of COTELCO-PPALMA

No.	Name of Project	Brief Description	Time table	Cost and Source of fund
1	Construction of 10MVA Substation at Pigcawayan with 69kV line with substation lot	Cater additional customer in the Municipality of Pigcawayan and Libungan Area	Dec-2020	44,179,697
2	Replacement of Defective Meters	It will be used for the Replacement of Old and defective Meters. Reduce our system loss.	Dec-2021	20,999,800
3	Replacement of Overloaded Transformer	It will cater additional customers specially NIHE customer	Dec-2021	23,911,000
4	SCADA	On time Monitoring of Our Substations	Dec-2020	34,151,425
5	Sub office lot Pigcawayan and building	Efficiency of Services	Dec-2020	6,500,000

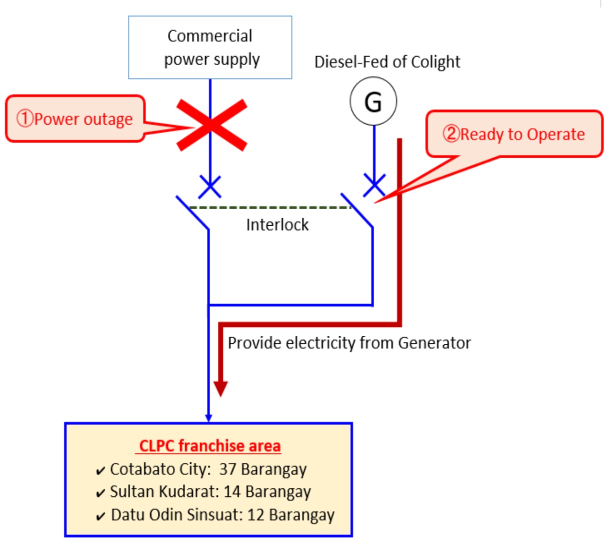
Source: COTELCO-PPALMA

In total, there are 40 (forty) projects to increase power capacity and improve quality of service.

(5) The situation during a commercial system power outage

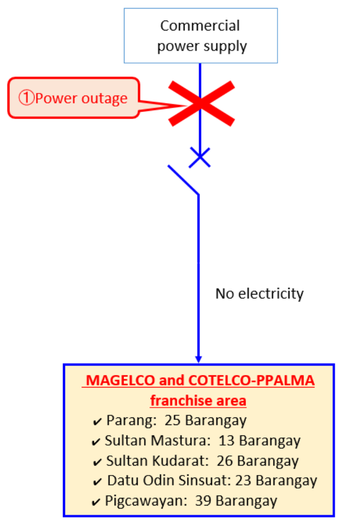
Cotabato City is the only city in Mindanao that can supply electricity to the CLPC franchise area by diesel –fed generation during power outage. First, as shown in the Figure 17.1-8, when a power failure occurs in the commercial system, the circuit is switched and the power supply by CLPC's diesel generator is started. The electricity will supply the 37 barangays in Cotabato City, 14 barangays in Sultan Kudarat and 12 barangays in Datu Odin Sinsuat. This is not the case for the franchise area of MAGELCO and COTELCO-PPALMA, there is no power generation system that starts when there is a commercial system power outage like CLPC, so there will be a power outage.

Sample diagram during power area shown in Figure 17.1-8 and Figure 17.1-9.



Source: JICA Study Team

Figure 17.1-8 Sample Diagram for CLPC Franchise Area



Source: JICA Study Team

Figure 17.1-9 Sample Diagram for MAGELCO and COTELCO-PPALMA

17.2 Issues on Power Supply Development

(1) The Existing Power Supply Statuses

According to interviews with 3 power distribution operators, small animals, trees, and car accidents as shown in the table were mentioned. Power outages occur due to contact with trees or small animals or due to short circuits and ground faults that occur in electric power facilities. In Japan, electrical wire of insulated aluminum conductor steel reinforced are used to prevent ground faults due to contact with trees. The same material was provided to MAGELCO by JICA.

Table 17.2-1 Causes of Power Outages

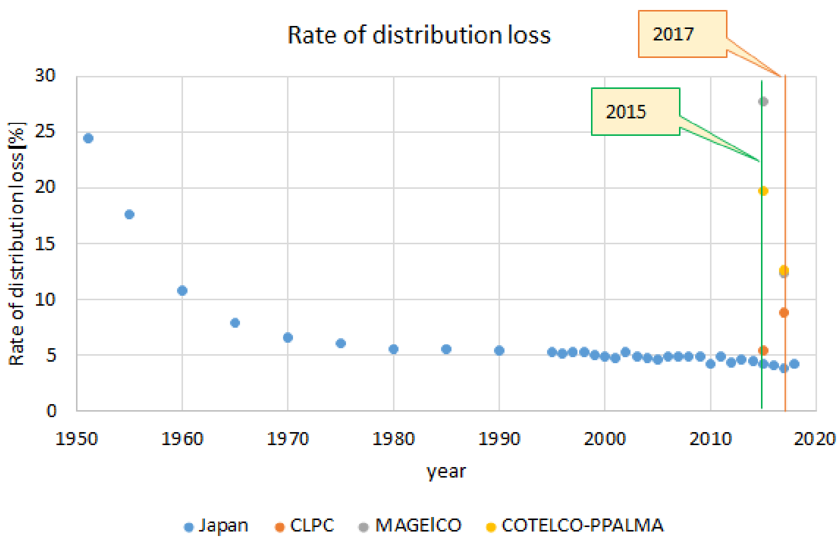
Cause of the power outage	Caused by
Short Circuit	Small animals: Rat, Snake, Bird, Wild cat, etc.
Ground Fault	Touching trees: Acacia tree, Banana tree, etc.
Other	Car hit, Transmission line problem, etc.

Source: CLPC, MAGELCO and COTELCO-PPALMA

(2) Distribution Loss

Distribution loss is expressed as the ratio of power consumption to power generation, and the smaller the ratio, the more energy efficient and equipment operation is possible. Power distribution loss is high due to aging equipment and theft of electricity from meters.

The distribution loss in Japan and the distribution loss in Greater Cotabato City are shown in Figure 17.2-1. As shown in the figure, distribution loss in Japan is about 5% as of 2017. On the other hand, CLPC is 8.74%, MAGELCO is 12.3%, and COTELCO-PPALMA is 12.55%. This indicates that the distribution loss is higher than in Japan. However, considering that MAGELCO was 27.69% and COTELCO-PPALMA was 19.69% in 2015, it can be confirmed that the distribution loss has decreased in the last few years.

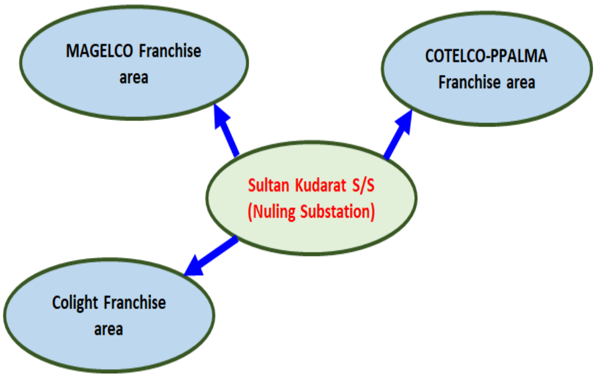


Source: JICA Study Team

Figure 17.2-1 Rate of Distribution Loss

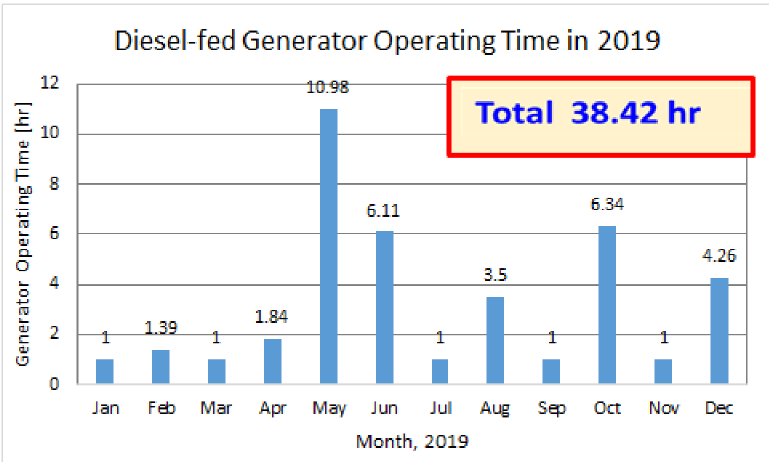
(3) Commercial Power Outages.

In Greater Cotabato City other than within the CLPC area, there is no power supply by diesel-fed generation during a commercial power system outage. MAGELCO and COTELCO-PPALMA are powered by the same Substation (Sultan Kudarat substation) as CLPC. Therefore, it is considered that the power outage time caused by the commercial power system is almost the same as the operating time of the CLPC generator. According to an interview with CLPC, the generator will run for about 38.42 hours in 2019. From this, it can be said that in 2019, the 38.42 hours commercial power system outage had an impact on the MAGELCO franchise area and the COTELCO-PPALMA franchise area. Diesel-fed generator operating time in 2019 shows in Figure 17.2-3.



Source: JICA Study Team

Figure 17.2-2 Distribution Area of Sultan Kudarat Substation



Source: JICA Study Team (arranged from document provided by CLPC)

Figure 17.2-3 Diesel-fed Generator Operating Time in 2019

(4) Other Issues

- According to an interview with CLPC, if an electricity accident occurs within the service area of one of the distribution companies, CLPC or MAGELCO, it will spread to the other distribution system through the common line.
- There is no power plant for public power distribution in Greater Cotabato City.
- In the Greater Cotabato City outside the CLPC service area, there are many unpaid electricity charges by customer.
- There are still some areas without electricity in Greater Cotabato City.

17.3 Objectives for Power Supply Development

To establish power supply that contributes to the realization of the development vision of Greater Cotabato City, the following must be achieved:

- Provision of uninterrupted electricity to critical economic nodes so as to contribute to economic development of the City (commercial areas, industrial areas, ports, airports etc.);
- Reduce the frequency of power outages and shorten the length of power outages, and improve the voltage drop, so as to contribute to improving the quality of life; and,
- Improving public policy particularly on requiring the renewal of existing power distribution equipment.

17.4 Strategies for Power Supply Development

The objectives of the Power Supply Development Plan are the following:

- To renew existing electrical distribution equipment in poor condition to strengthen the power supply in Greater Cotabato City.
- Ensuring power supply capacity in the event of a power system outage.
- To expand electrical distribution lines or to increase power capacity in areas where industrial and commercial growth is expected as the population grows.

17.5 Power Supply Sector Plan

(1) Strategy to Renovate the Distribution Network

In Greater Cotabato City, the CLPC franchise area has high demand from the numerous households residing in the area. There are also many old utility poles and electric wires. These old and aging equipment has higher power consumption which contributes to the power distribution loss and accidents. Therefore, it is necessary to repair the aging distribution line in Cotabato City.

Table 17.5-1 Renovation of the Distribution Network

Power Distribution Company	Explanation	Priority
MAGELCO	MAGELCO is currently developing a feeder supported by JICA.	2
COTELCO-PPALMA	There are already plans for extension, etc. to increase the reliability of distribution lines.	2
CLPC	The CLPC area is the area with many households and high demand in franchise area. Therefore, there are many old utility poles and electric wires.	1

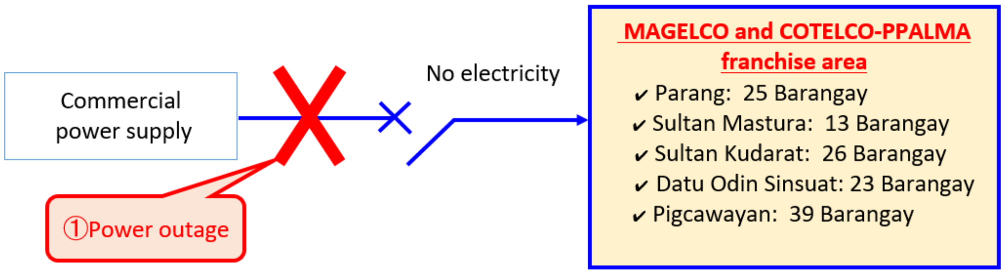
Source: JICA Study Team

(2) Strategy for Rehabilitation for Distribution Substations

According to the manufacturer of electrical equipment, the recommended replacement period for the main equipment of the substation equipment is approximately 26 years. In Greater Cotabato City, it will be necessary to renew facilities due to various factors such as an increase in electricity demand due to population growth. Therefore, each distribution company has plans to construct a new distribution substation.

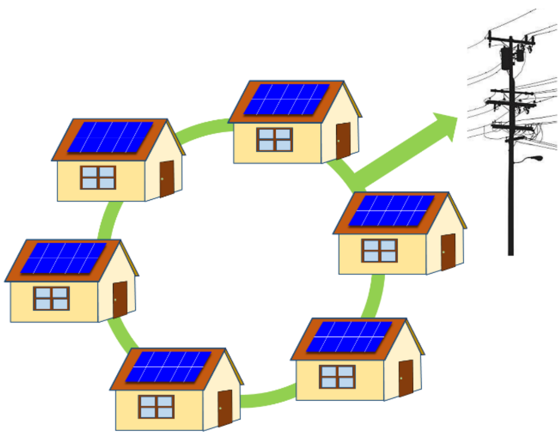
(3) Strategy for Power Supply in the Event of a Grid Power Outage

Cotabato City has an emergency generator. However, the surrounding 5 Municipalities of MAGELCO and COTELCO-PPALMA franchise area do not have emergency generators. This have already been considered by the 5 LGUs in their CLUP due to the numerous power outages. Special consideration therefore must be done in the future. At present, in the event of a power outage on the grid, electricity will be completely cut off in the 5 surrounding municipalities other than the CLUP franchise area. To prevent this condition from happening, one measures is the use of solar power generation. Sample diagram during power outages in MAGELCO and COTELCO-PPALMA franchise area is shown in Figure 17.5-1, and sample image of solar power generated by microgrid is shown in Figure 17.5-2.



Source: JICA Study Team

Figure 17.5-1 Sample Diagram During Power Outages in MAGELCO and COTELCO-PPALMA Franchise Area



Source: JICA Study Team

Figure 17.5-2 Sample Image of Solar Power Generated by Microgrid

(4) Strategy to Collect Electricity Charges from Customer

Failure to collect electricity charges will hinder the operation of distribution companies, which will affect the renewal of facilities and the stable supply of electricity. According to the interview from MAGELCO, financial problems are actually occurring shown in Table 17.5-2.

Table 17.5-2 MAGELCO's Financial Challenges

	MAGELCO's financial challenges	Explanation/ Details
1	Outstanding debt to PSALM amounting to 2.3 Billion Pesos	The debt accumulated over the years because member-consumers refused to pay their power bills. Payments made by MAGELCO are credited not to the principal but to the interest.
2	Low collection efficiency	The refusal of member-consumers to pay their power bills persist up to the present. MAGELCO is compelled to implement drastic measures such as massive disconnection of delinquent member-consumers to improve collections and reduce power consumption.

Source: MAGELCO

17.6 Cost of Power Sector Plan

The tentative costs of these power supply sector plan shown in Table 17.6-1.

Table 17.6-1 Cost of Power Sector Plan

	Project / Program	Location	Grant	Indicative Cost [PhP]
1	Distribution Network Renovation	CLPC franchise area	✔	410
2	Distribution Substation Rehabilitation and Development	Greater Cotabato City	✔	273* *Depend on Number of Substation
3	Power Capacity enhancement in the event of power outage	MAGELCO and COTELCO-PPALMA franchise area	✔	491
4	Installation Smart meters for collecting electricity charge	Greater Cotabato City	✔	466

Source: JICA Study Team

17.7 Proposed Priority Projects

17.7.1 Project Prioritization Criteria

(1) Priority Criteria for New Development

1) The content does not overlap with the project currently in progress or the project being planned.
2) Electrical Power cannot be supplied during a system power outage.
3) Electricity theft measures are not sufficient.
4) The electricity bill is not fully collected.
5) At present, it is not possible to comply with the Philippine smart grid policy.
6) There is a problem with the power distribution equipment.
7) Insufficient consideration is given to the life and aging of power distribution equipment.
8) The project has already been decided, but the contract for implementation has not progressed.

(2) Proposed Priority Project for Distribution Network Renovation

As shown in Table 17.7-1, the target area is the CLPC franchise area.

Table 17.7-1 Evaluation of Priority Criteria for Distribution Network Renovation

Project Prioritization Criteria	Franchise area of Distribution Company		
	CLPC	MAGELCO	COTELCO-PPALMA
1. The content does not overlap with the project currently in progress or the project being planned.	✔	✔	✔
6. There is a problem with the power distribution equipment.	✔	✔	✔
7. Insufficient consideration is given to the life and aging of power distribution	✔	✔	✔
8. The project has already been decided, but the contract for implementation has not progressed	✔	–	–
Priority	1	2	2

Note: ✔ = yes - = no
Source: JICA Study Team

(3) Proposed Priority Project for Distribution Substation Rehabilitation and Development

The target distribution substation is more than 20 years old within Greater Cotabato City. Evaluation of priority Criteria for Distribution Substation Rehabilitation and Development is shown in Table 17.7-2. The renovation of the Salbu distribution substation and the Simuay distribution substation in the MAGELCO franchise area can be listed as candidates.

Table 17.7-2 Evaluation of Priority Criteria for Distribution Substation Rehabilitation and Development

Project Prioritization Criteria	Franchise area of Distribution Company		
	CLPC	MAGELCO	COTELCO-PPALMA
Target Distribution Substation	**Sinsuat**	**Salbu, Simuay**	**Vilanica**
1. The content does not overlap with the project currently in progress or the project being planned.	✔	✔	✔
6. There is a problem with the power distribution equipment.	✔	✔	✔
7. Insufficient consideration is given to the life and aging of power distribution	✔	✔	✔
8. The project has already been decided, but the contract for implementation has not progressed	–	✔	–
Priority	2	1	2

Note: ✔ = yes - = no
Source: JICA Study Team

(4) Proposed Priority Project for Power Capacity Enhancement in the Event of power Outage

As shown in Table 17.7-3, MAGELCO and COTEOCO-PPALMA franchise areas in Greater Cotabato City are urgent. In addition, this project is match with the policy of power supply from renewable energy of the Surrounding Municipalities of Cotabato City.

Table 17.7-3 Evaluation of Priority Criteria for Power Capacity Enhancement in the Event of Power Outage

Project Prioritization Criteria	Franchise area of Distribution Company		
	CLPC	MAGELCO	COTELCO-PPALMA
1. The content does not overlap with the project currently in progress or the project being planned.	✔	✔	✔
2. Electrical Power cannot be supplied during a system power outage.	—	✔	✔
Priority	2	1	1

Note: ✔ = yes - = no
Source: JICA Study Team

(5) Proposed Priority Project for Installation Smart Meters for Collecting Electricity Charge

Evaluation of priority Criteria for Installation Smart meters for collecting electricity charge is shown in Table 17.7-4. However, the Philippines is promoting smart grids.

Therefore, the target areas are Cotabato City, Sultan Kudarat, Sultan Masturas, Parang, Pigcawayan, and Datu Odin Sinsuat, or known as Greater Cotabato City.

Table 17.7-4 Evaluation of Priority Criteria for Installation of Smart Meters for Collecting Electricity Charge

Project Prioritization Criteria	Franchise area of Distribution Company		
	CLPC	MAGELCO	COTELCO-PPALMA
1. The content does not overlap with the project currently in progress or the project being planned.	✔	✔	✔
3. Electricity theft measures are not sufficient.	✔	✔	✔
4. The electricity bill is not fully collected.	—	✔	✔
5. At present, it is not possible to comply with the Philippine smart grid policy.	✔	✔	✔
Priority	1	1	1

Note: ✔ = yes - = no
Source: JICA Study Team

17.7.2 Project Profile of High Priority Projects

Sub-plan 1: Distribution network renovation for CLPC franchise area

According to the interview with CLPC, as shown in Table 17.7-5 and Table 17.7-6, the total number of wires that need to be replaced is more than 500 km. In addition, there are more than 1000 wooden poles in total. The summary is as follows.

a. After conducting feasibility study, make a renewal plan.
   This includes the future increase in power demand and increase in the wire size.
b. Replace wooden poles with concrete poles.
   This is because wooden poles are more prone to deterioration than concrete poles.
c. Replacement of aging distribution lines.

Table 17.7-5 Distribution Wires for Replacement

No.	Wire Size	Length of Mar 2020 [m]
1	#4 AAC	239,489
2	#4 ACSR	25,160
3	#6 AAC	200,797
4	#6 ACSR	56,386
	TOTAL	**521.9 [km]**

Source: CLPC

Table 17.7-6 Distribution Poles for Replacement

No.	Pole Type	Qty as of Mar 2020 [Unit]	No.	Pole Type	Qty as of Mar 2020 [Unit]
1	Creosoted 25 ft.	48	**7**	Tanalized 35 ft.	63
2	Creosoted 30 ft.	91	**8**	Tanalized 45 ft.	8
3	Creosoted 35 ft.	20	**9**	Tanalized 50 ft.	1
4	Creosoted 45 ft.	1	**10**	Tanalized 55 ft.	3
5	Tanalized 25 ft.	936	**11**	Tanalized 60 ft.	2
6	Tanalized 30 ft.	152	**12**	Tanalized 65 ft.	5
				TOTAL	**1330 [Unit]**

Source: CLPC

Sub-plan 2: Distribution substation rehabilitation and development for MAGELCO franchise area

As shown in Table 17.7-7, the recommended replacement period for substation equipment is about 26 years. Therefore, the substation, which has been around for more than 26 years, is about to be renovated.

Table 17.7-7 Electrical Equipment Life

Name of Equipment	Normal inspection cycle (years)	Detailed inspection cycle (year)	Recommended update time (year)	Average renewal time of users (year)
Gas Insulated Switchgear	1-3	6	25	28.0
Disconnect Switch	1-3	6	20	27.1
Vacuum Circuit Breaker	1-3	6	20	25.5
Gas Circuit Breaker	1-3	6	20	25.7
Transformer	1-3	6	25	27.6
Lightning arrester	1-3	6	20	25.8

Source: The Japan Electrical Manufacturers' Association (JEMA)

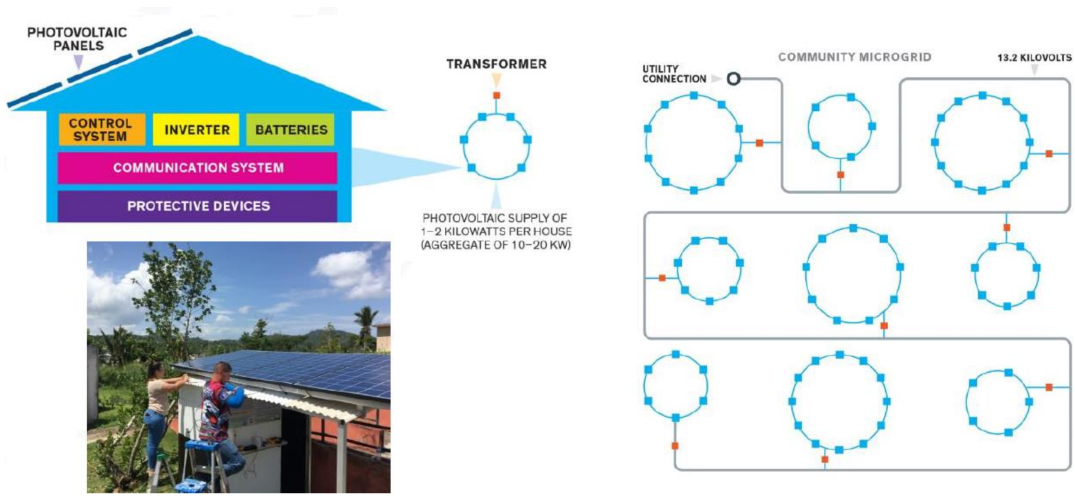
Aging of the main equipment of substation equipment is one of the causes of distribution loss. The summary is as follows.

a. After conducting feasibility study, make a facility renewal plan for an aging distribution substation.
b. Plan the procurement of equipment and carry out repair work.
c. In this case, it is desirable to plan for substations over 20 years old.
d. Conduct maintenance education

Sub-plan 3: Power capacity enhancement in the event of a power outage for MAGELCO and COTELCO-PPALMA franchise area

Some overseas are developing the following microgrids.

a. PV panel of about 1kW, storage battery, communication control device, inverter, etc. are installed in each house.
b. Form a regional microgrids with a small capacity of 10 to 20 kW of about 10 units.
c. Interconnection to the distribution system of the electric power company.

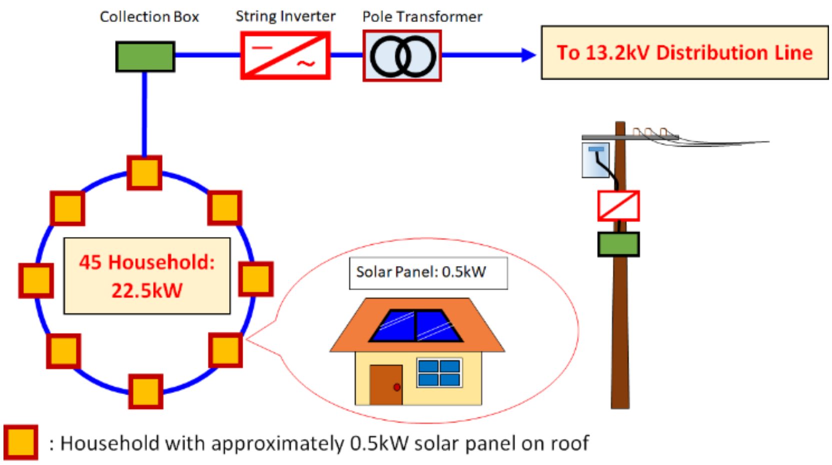


Source: Institute Electrical and Electronics Engineers (IEEE) Spectrum

Figure 17.7-1 Residential/Regional Microgrid

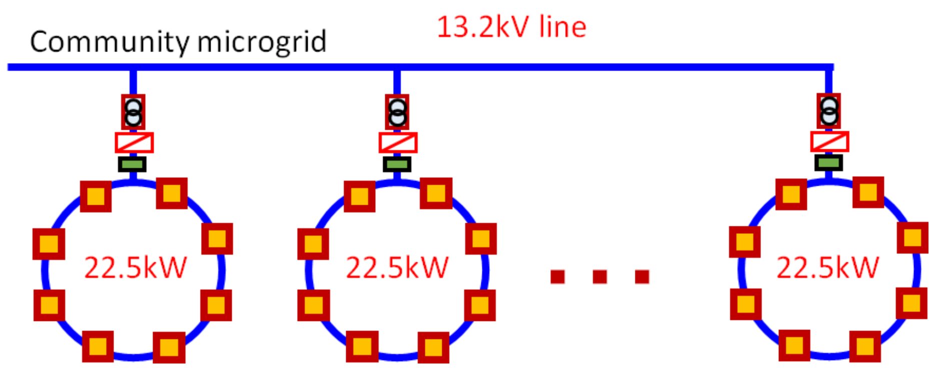
By doing this, it is possible to secure electricity as if there are a power plant without constructing a solar power plant on a vast land. However, this method requires a lot of equipment for each house, which is expensive. The following is proposed to solve the problem.

a. Securing power in an emergency in the event of a system power outage in the surrounding municipalities except the CLPC franchise area.
b. A solar panel of about 0.5 kW is placed on the roof of each household, and the current is collected by the string inverter installed on the utility pole and connected to the power grid.
c. Conduct maintenance education



Source: JICA Study Team

Figure 17.7-2 Residential/Regional Microgrid for Surrounding Municipalities of Cotabato City



Source: JICA Study Team

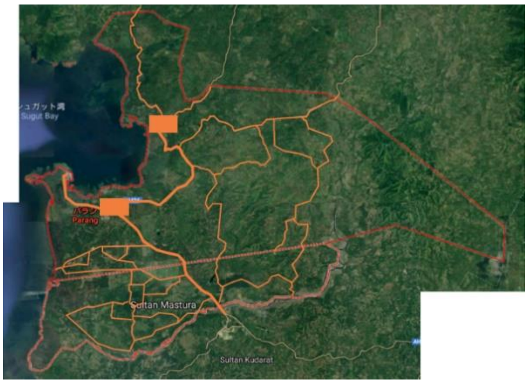
Figure 17.7-3 Community Microgrid for Surrounding Municipalities of Cotabato City

In this way, it is necessary to ask each household to cooperate in installing only solar panels, collect electricity with the collection box installed on the utility pole, change DC voltage to AC voltage with a string inverter, and transform it to 13.2 kV with a pole transformer. Finally, connect to the distribution network. By not loading the battery, power is supplied only in the daytime, it will be sufficient for the operation of commerce and industry that is mainly in the daytime.

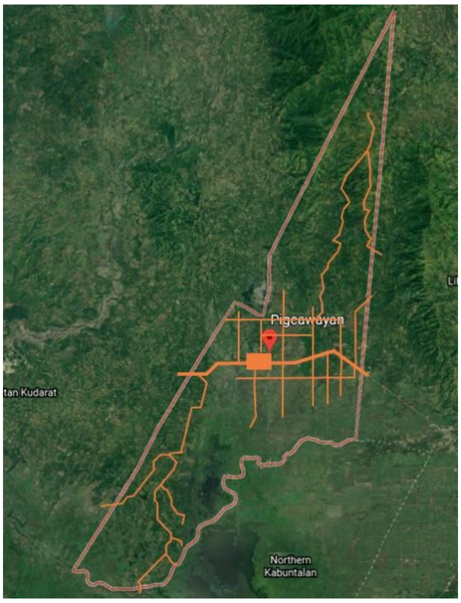
If 0.5 kW is installed in each household, it is expected that a maximum capacity of 12 MW can be secured. However, the following should be considered:

- Solar power generation depends on the weather
- Solar power generation is effective only in the daytime
- How many households can cooperate?

The orange lines on the map are dotted with households on the roads in each municipality area. The orange square fill is the urban area. For Sultan Kudarat and Datu Odin Sinsuat, focusing on the MAGELCO franchise area. By constructing a photovoltaic power generation system like the one mentioned earlier, it is possible to continue supplying power during the day even if the commercial power system outage.



a. Parang and Sultan Mastura



b. Pigcawayan

c. Sultan Kudarat

d. Datu Odin Sinsuat

Source: JICA Study Team

Figure 17.7-4 Proposed Area for Residential/Regional Microgrid

<u>Sub-plan 4: Collect electricity charge for Greater Cotabato City area</u>

As a measure against electric theft, it is possible to install smart meters in each household. Electricity theft also place a financial burden on distribution operators that supply electricity to the region. To address this issue, everywhere in the world is beginning to install smart meters. In most cases, as an actual method of stealing electricity, electricity is obtained by branching from an electric wire without going through a power meter. As a countermeasure,

- Install a power meter at a high position to reduce power theft by amateurs;
  The introduction of the Elevated Metering Center in the CLUP plan is effective.
- It is considered that the power meter should be replaced with a smart meter and the theft should be detected and monitored by installing software.

Smart meters can be expected to take the following measures against electricity theft.

- The electricity of non-payment households can be turned off remotely.
- Can detect and monitor power theft.
- They are more likely to give up on electricity theft if they know that detection and recording are possible.

Other than anti-theft measures, smart meters are compatible with smart grids. Since the Philippines is aiming for a smart grid in the future, therefore, it is necessary to introduce smart meters in anticipation of electricity theft countermeasures.

If the highest priority project is selected from these four sub-plans, Sub-plan 3 will be selected because of the continuous power supply in the event of a power outage in terms of stable power supply.

17.8 Implementation Schedule

(1) Distribution Network Renovation for CLPC Franchise Area

Implementation Schedule of Distribution Network Renovation is shown in Table 17.8-1.

Table 17.8-1 Implementation Schedule of Short-Term Development Plan of Distribution Network Renovation for CLPC Franchise Area

	Description	2021	2022	2023	2024	2025	2026	2027	2028
1	**Feasibility Study**								
2	**Detailed Design & plan**								
3	**Preparatory for contract**								
4	**Implementation of renovation**								

Source: JICA Study Team

(2) Distribution Substation Rehabilitation and Development for MAGELCO Franchise Area

Implementation Schedule of Distribution Substation Rehabilitation and Development is shown in Table 17.8-2.

Table 17.8-2 Implementation Schedule of Short-Term Development Plan of Distribution Substation Rehabilitation and Development for MAGELCO Franchise Area

Description		2021	2022	2023	2024	2025	2026	2027	2028
1	Feasibility Study								
2	Detailed Design & plan								
3	Procurement plan								
4	Preparatory for contract								
5	Implementation of renovation								
6	Soft Components								

Source: JICA Study Team

(3) Power Capacity Enhancement in the Event of a Power Outage for MAGELCO and COTELCO-PPALMA Franchise Area

Implementation Schedule of Power Capacity Enhancement in the event of a power outage is shown in Table 17.8-3.

Table 17.8-3 Implementation Schedule of Short-term Development Plan of Power Capacity Enhancement in the Event of a Power Outage for MAGELCO and COTELCO-PPALMA Franchise Area

Description		2021	2022	2023	2024	2025	2026	2027	2028
1	Feasibility Study								
2	Detailed Design & plan								
3	Procurement plan								
4	Preparatory for contract								
5	**Construction of PV system** (Residential/Regional microgrid for Surrounding Municipalities of Cotabato City)								
6	Soft Components								

Source: JICA Study Team

(4) Installation of Smart Meters for Collecting Electricity Charge for Greater Cotabato City

Implementation Schedule of the installation of smart meters for collecting electricity charge is shown in Table 17.8-4.

Table 17.8-4 Implementation Schedule of Medium-Term Development Plan of Installation of Smart Meters for Collecting Electricity Charge for Greater Cotabato City

Description		2021	2022	2023	2024	2025	2026	2027	2028
1	Feasibility Study								
2	Installation plan								
3	Procurement plan								
4	Preparatory for contract								
5	Installation Smart meters								

Source: JICA Study Team

17.9 Environmental and Social Considerations for Power Supply Sector Plan

The required Environmental and Social Considerations items for the following programs are shown in Table 17.9-1.

(1) Distribution Network Renovation for CLPC Franchise Area
(2) Distribution Substation Rehabilitation for MAGELCO Franchise Area
(3) Power Capacity Enhancement in the Event of Power Outage for MAGELCO and COTELCO-PPALMA Franchise Area
(4) Collections Electricity Charge for Greater Cotabato City

Table 17.9-1 Environmental and Social Considerations for Power Supply Sector Plan

		Pollution control								Natural				Social environment																Others			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Type of Permit	Remarks
Project/ Program	Phases	Air quality	Water quality	Wastes	Soil contamination	Noise and vibration	Subsidence	Odor	Sediment	Protected areas	Ecosystem	Hydrology	Topography and geology	Involuntary resettlement	Poor people / vulnerable people	Indigenous or ethnic minority	Local economies, such as employment, livelihood	Land use and utilization of local resources	Water usage	Existing social infrastructures and services	Social institutions such as social infrastructure and local decision-making institutions	Misdistribution of benefits and damages	Local conflicts of interest	Cultural heritages	Landscape (including visual impacts)	Gender	Children's rights	Infectious diseases such as HIV/AIDS	Labor conditions	Accident	Trans-boundary impacts / global warming	Most likely permit required by DENR	
1. Distribution Network Renovation for CLPC franchise arera	Pre-construction	N/A								N/A				N/A																N/A			
	Construction	D	D	B-	D	B-	D	C	C	D	D	D	D	C	C	D	C	D	D	D	D	C	D	C	D	D	D	D	D	C	C	ECC	
	Operation & Maintenance	D	D	C	D	D	D	C	C	D	D	D	D	C	C	D	C	D	D	D	D	C	D	C	D	D	D	D	D	C	C		
2. Distribution Substation Rehabilitation for MAGELCO franchise area	Pre-construction	N/A								N/A				N/A																N/A			
	Construction	D	D	B-	C	C	D	C	C	C	D	D	D	C	C	D	C	D	D	D	D	C	D	C	D	D	D	D	D	C	C	ECC	
	Operation & Maintenance	D	D	B-	C	B-	D	C	C	C	D	D	D	C	C	D	C	D	D	D	D	C	D	C	D	D	D	D	D	C	C		
3. Power Capacity Enhancement in the event of power outage for MAGELCO and COTELCO-PPALMA franchise area	Pre-construction	N/A								N/A				N/A																N/A			
	Construction	D	D	C	D	B-	D	D	C	C	D	D	D	C	C	D	C	D	D	D	D	C	D	C	D	D	D	D	D	C	C	ECC	
	Operation & Maintenance	D	D	C	D	D	D	D	C	C	D	D	D	C	C	D	C	D	D	D	D	C	D	C	D	D	D	D	D	C	B+		
4. Collections Electricity Charge for Greater Cotabato City	Pre-construction	N/A								N/A				N/A																N/A			
	Construction	D	D	C	D	D	D	D	C	C	D	D	D	C	C	D	C	D	D	D	D	C	C	C	D	D	D	D	D	C	C	CNC	
	Operation & Maintenance	D	D	D	D	D	D	D	C	C	D	D	D	C	C	D	C	D	D	D	D	C	C	C	D	D	D	D	D	C	D		

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of positive/negative impact is unknown. A further examination is needed, and the impact could be clarified as the study progress.
D: No impact is expected.
N/A: Not applicable (for exaple, Capacity Building Project)

ECC: Environmental Compliance Certificate
CNC: Certificate of Non-Coverage

17.10 Governance and Peacebuilding

(1)Governance

Discussions are underway to ensure that distribution operators (MAGELCO, CLPC and COTELCO-PPALMA) are under the supervision of the BARRM government.

(2)Land issue

In the past, Mindanao was damaged by a power transmission tower bombing. This was a retaliation for unilaterally constructing a transmission line without the permission of the landowner, and was caused by the land acquisition problem. Be sure to explain and discuss with the landowner, such as new construction / replacement of power distribution equipment and installation work of solar panels, and obtain permission, which will lead to avoidance of blast damage.

(3)Power outage problem

In the CLPC service area, power is supplied by the backup generator owned by CLPC in the event of a system power outage. However, since there is no backup generator in the service area of MAGELCO and COTELCO-PALMMA, a power outage will occur during a system power outage. The fact that the services differ depending on the distribution operator in this way may promote a sense of unfairness to electric power consumers. It will be important for each distribution operator to be able to provide services equally.

CHAPTER 18
DISASTER RISK REDUCTION (DRR) PLAN

18.1 Background on Disaster Risk Reduction (DRR) Plan

18.1.1 Premises

(1) Background of Local Disaster Risk Reduction and Management Plan in the Philippines

The enactment of RA10121 (The Philippine Disaster Risk Reduction and Management Act of 2010) emphasized strengthening of local governments and institutionalized the participation of civil society organizations and the private sector in disaster risk reduction and management (DRRM) at the local level. Cotabato City Disaster Risk Reduction Management Council, as the lead local government organization in-charge in formulating DRRM plan, spearheaded the risk profile assessment of 37 barangays of Cotabato City as basis for developing the city disaster risk reduction management plan. Results from the assessment during the participatory vulnerability analysis (PVA) in 2016 showed that the top 4 priority hazards that may bring disaster impacts in the city include: earthquake/tsunami (1^{st}), flood (2^{nd}), fire (3^{rd}) and drought (4^{th}). Pre-disaster and post disaster DRRM programs must be included in the local development investment program of the city with allocation for a given timeframe.

The Housing and Land Use Regulatory Board (HLURB) regulates and supports the local government units (LGU) in cooperation with the department of the interior and local government (DILG) to develop the comprehensive land use plan (CLUP) and the local disaster risk reduction and management plan (LDRRMP). With the HLURB supplemental guidelines issued in 2014, the city is mandated to formulate climate and disaster risk-sensitive plan and zoning ordinance that regulate the allocation of land use so that exposure of population, infrastructure, economic activities to hazards can be minimized. The consistency with the HLURB Guidelines on CLUP preparation is strongly encouraged by the DILG memorandum circular No. 2015-77 issued on 21^{st} July 2015. The DILG memorandum circular also notes that "to ensure that identified programs and projects that would address disaster and climate risks are implemented, these should be included in the Local Development Investment Program (LDIP) and the Annual Investment Program (AIP)".

(2) Scope of the DRR Plan in this study

Since disaster issues cover a broad range of topics, target disaster and study area were focused as shown in Table 18.1-1 based on the present condition analysis described in Chapter 5.8.

The approaches to disaster risk reduction also have various ways. For example, to enhance disaster risk understanding is one way. To strengthen disaster risk governance to manage disaster risk in terms of legal system, organizational structure or capacity, budget allocation, disaster-related plans (in national to local level and in multi-sector) is another way. This DRR plan aims to build a safe and disaster-resilient community in the target area by promoting investments for disaster risk reduction, focusing on structural measures and early warning systems.

Figure 18.1-1 shows the location and topography of Cotabato City and neighbor municipalities.

Table 18.1-1 Scope of DRR Plan

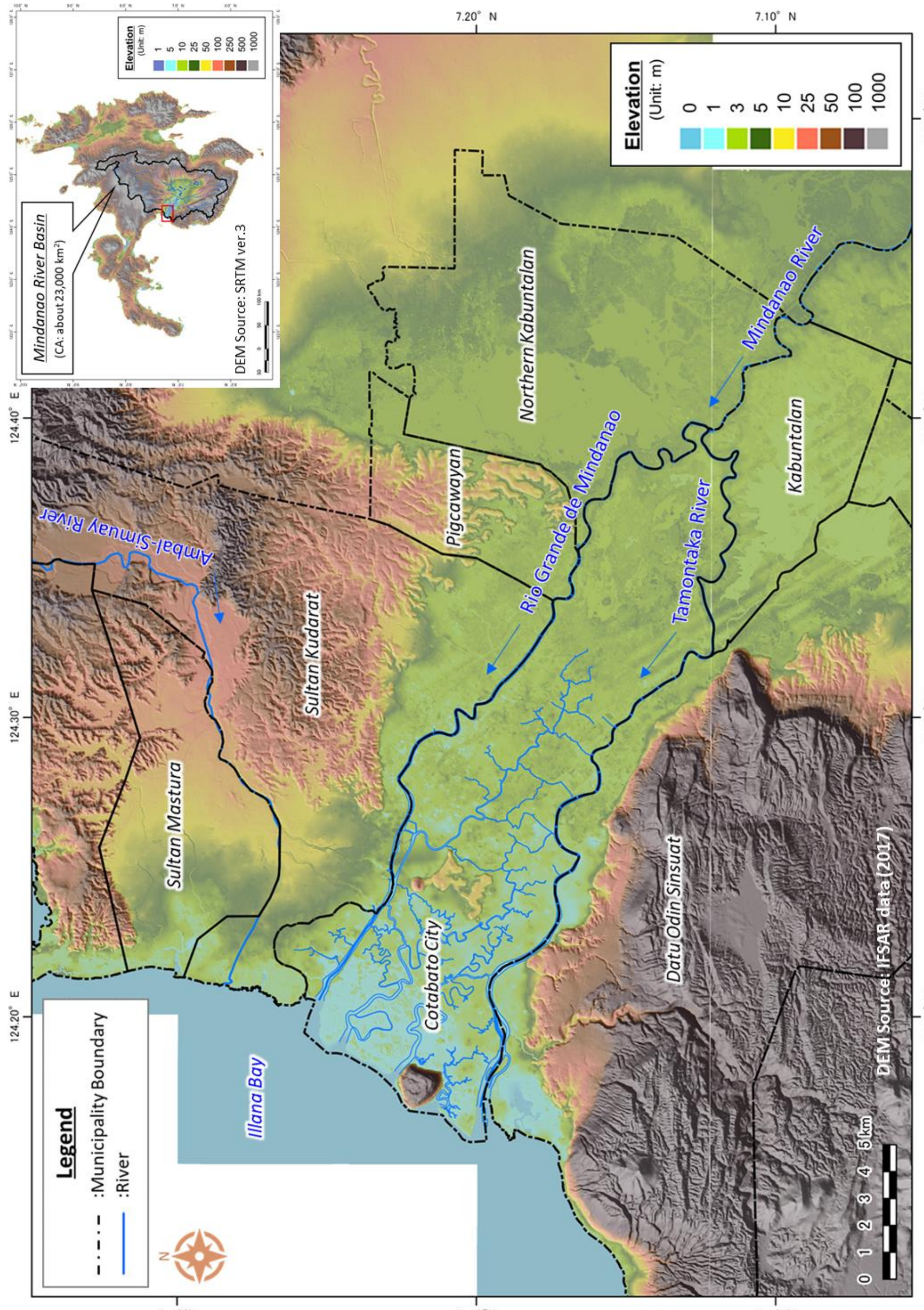
Item	Target
Disaster	The target disasters are focused on flood, earthquake and tsunami, which are the identified major hazards identified in the Cotabato City Disaster Risk Reduction and Management Plan.
Target Area	The target area is Cotabato City, but when considering countermeasures against the target disasters, relevant wider area is also considered in terms of integrated approach and investment efficiency. (For example, when considering flood countermeasures for Cotabato City, basin-scale point of view is necessary.)
DRR Plan	The DRR Plan contains information on natural and climate hazards that can help the city determine the kind of intervention that will mitigate if not totally prevent their impacts and adds to the responsiveness and effectiveness of a particular policy intervention. It identifies vulnerable areas and sectors by analyzing exposure, sensitivity, and adaptive capacity to hazards. It aims to build s safe and disaster-resilient community by promoting investments for disaster risk reduction. The objectives of DRR Plan are to prevent new and reduce existing disaster risk and manage residual risk. Residual risk management is focused on disaster preparedness activities to minimize disaster losses or damages. The DRR Plan proposes priority actions and projects within a given time frame and estimated cost for promoting DRR investments based on present condition analysis.

(3) Terminology

The United Nations Office for Disaster Risk Reduction (UNDRR) defines disaster risk as the potential loss of life, injury, or destroyed of damaged assets which could occur to a system, society or a community in a specific period of time. Disaster risk is determined as a function of hazard, exposure, vulnerability and adaptive capacity, as shown in the equation below:

$$\text{Disaster Risk} = \text{Hazard with probability} \times \text{Exposure} \times \text{Vulnerability/Adaptive Capacity}$$

The terminology of disaster risk and its components are presented in Table 18.1-2.



Source: JICA Study Team

Figure 18.1-1 Location and Topography of Cotabato City and Neighbor Municipalities

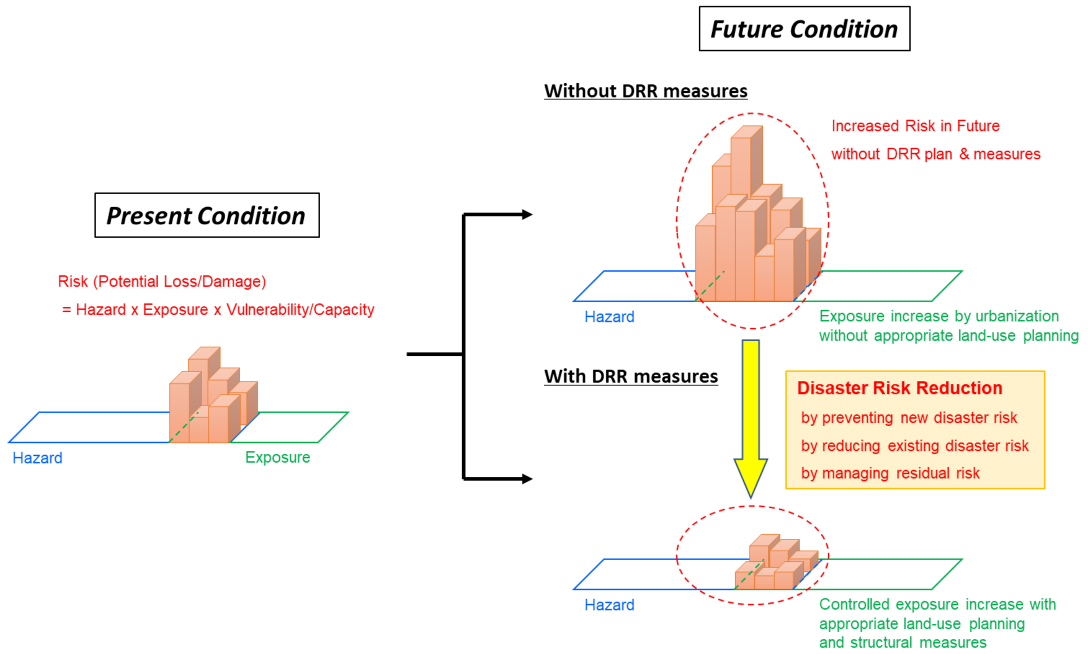
Table 18.1-2 Terminology on "Disaster Risk" by UNDRR

Term	Definition	Annotation
Disaster Risk	The **potential loss of life, injury, or destroyed or damaged assets** which could occur to a system, society or a community in a specific period of time, **determined probabilistically as a function of hazard, exposure, vulnerability and capacity**.	The definition of disaster risk reflects the concept of hazardous events and disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socioeconomic development, disaster risks can be assessed and mapped, in broad terms at least.
Hazard	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.	Hazards may be natural, anthropogenic or socionatural in origin. Natural hazards are predominantly associated with natural processes and phenomena. Anthropogenic hazards, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation. Several hazards are socionatural, in that they are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change.
Exposure	The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.	Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.	For positive factors which increase the ability of people to cope with hazards, see also the definitions of "Capacity" and "Coping capacity".
Capacity	The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience.	Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management. Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks.

Source: UNDRR website (https://www.undrr.org/terminology)

*The terminology is based on the "Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction" which was adopted by the United Nations General Assembly on February 2nd, 2017.

Figure 18.1-2 shows an image of achieving disaster risk reduction in a society by developing a DRR plan and its implementation. In this example, hazard of natural disasters is not changed in the future, while exposure to the disasters will increase with population growth and economic development. As explained in Table 18.1-1, the DRR plan proposes priority actions and project for promoting DRR investments. With its implementation, future disaster risks can be reduced by preventing new disaster risk, by reducing existing disaster risk, and by managing residual risk.



Source: JICA Study Team

Figure 18.1-2 Image of DRR by Developing DRR Plan and its Implementation

18.1.2 Summary of Present Condition

Based on the present condition analysis on disaster risk reduction in Chapter 5.8, natural and social conditions on DRR are summarized in the table below.

Table 18.1-3 Summary of Natural Condition on DRR

Item	Characteristics
Topography	➢Cotabato City situated in lowland area at the outlet of the Mindanao River Basin (MRB) whose catchment area is about 23,000km^2. The Lower Mindanao is prone to flood, storm surge and tsunami.
Climate	➢Most of the catchment area of Mindanao River Basin (MRB) is classified to Type III based on the Modified Coronas Classification, which have relatively dry season from November to April and relatively wet season during the rest of the year. ➢The MRB is bit apart from typhoon belt and is rarely hit directly by typhoon, however, it is still sometimes severely affected by typhoons and causes floods. ➢Climate change impacts on rainfall and sea level will exacerbate flood and storm surge.
River	➢The Mindanao River Basin (MRB) can be characterized as upper mountainous area and lower swampy lowland. ➢The MRB has vast wetlands called 'Ligawasan Marsh' which covers approximately 280,000 hectares in the downstream. ➢Braided channels are developed in the downstream of the Mindanao River and Ambal-Simuay River.
Geology	➢Quaternary alluvium is densely accumulated around the downstream of the Mindanao River and makes the land vulnerable to earthquake
Tectonic Plates and Faults	➢Trench-type earthquakes along the Cotabato Trench generated big tsunamis in 1918 and 1976 ➢Several faults in the Mindanao Island are quite active and generated relatively large earthquakes (>M5.0) more than 5 times in 2019

Table 18.1-4 Summary of Social Condition on DRR

Item	Situation
City Planning and CLUP	➢Cotabato City is going to expand the residential and commercial area to disaster-prone area by pressure from population increase and economic development
Ongoing DRR Plan & Project	➢Cotabato City Local Disaster Risk Reduction and Management Plan (LDRRMP) 2016-2022 is valid. ➢Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP) was formulated in 2012. ➢Ambal-Simuay River and Rio Grande de Mindanao River Flood Control Project is ongoing by DPWH national. ➢Scheduled river dredging and riverbank protection work is ongoing by DPWH regional & district offices and Cotabato City Government.
DRR Investment	➢The DPWH budget was allocated for infrastructure projects in Cotabato City with a total of PhP 5.6 billion from 2015 to 2020. Among the different project categories, the project for riverbank protection and drainage structure occupies about 40% of the budget. ➢The indicative cost of the identified projects in the Cotabato City LDRRMP (2016-2022) is about PhP 1.15 Billion rolled into six years. About 93% of the cost is allocated for prevention and mitigation purpose.
Observation and Early Warning System	➢Meteorological and hydrological observation system is quite poor in the Mindanao River Basin. ➢PHIVOLCS-DOST has established a staff-controlled (manned) seismic station in Cotabato City and monitors earthquakes. ➢Flood forecasting and warning system (FFWS) and Tsunami early warning system (TEWS) are not established yet.
Hazard and Risk Mapping	➢Hazard maps are developed for flood, tsunami, storm surge, etc. ➢Risk maps are not developed yet.

18.1.3 Problem Analysis

Current disaster problems were analyzed by disaster type (flood, earthquake, tsunami), risk components (hazard, exposure, vulnerability/adaptive capacity), and positive or negative elements. The result is shown by disaster type in Table 18.1-5, Table 18.1-6 and Table 18.1-7 and is summarized as follows.

Cotabato City is highly exposed to flood, earthquake and tsunami hazards due to its geographical and hydrometeorological condition. Under the circumstances, most people do not live in disaster-prone area and the urban area is limited to relatively disaster-less area, which is one of the positive aspects. Another good aspect is that Cotabato City local disaster risk reduction and management plan (LDRRMP) was published, and the government acknowledges the disaster risks based on local hazard maps.

However, only a few structural measures for disaster risk reduction were implemented so far, and non-structural measures such as flood forecasting and warning system (FFWS) and tsunami early warning system (TEWS) are still under development. As a result, Cotabato City is still subjected to frequent floods and threatened by catastrophic earthquakes and tsunamis.

The prime reason why DRR measures have not progressed is the unstable peace and order situation in the area. Another main reason is that floods, earthquakes, and tsunamis that are the most problematic for Cotabato City are all significantly large in magnitude and scale and exceed the level that can be dealt with by Cotabato City or DPWH regional and should be addressed at the national level. Since structural measures for such severe hazards significantly impact both natural and social environment and require enormous investment, holistic, inclusive, and detailed studies and plans are indispensable. The Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP) was formulated and endorsed by the Regional Development Councils of Region X and XII, and ARMM Regional Economic and Development Planning Board in 2014. Subsequently, the feasibility study on "Ambal-Simuay River and Rio Grande de Mindanao Flood Control Project" was completed in 2017, and land acquisition plan and resettlement action plan (LAPRAP) are ongoing for the project. DPWH plans to implement the project with a loan from China, but the procurement process and loan signing was behind schedule. Also, there is no specific plan to reduce the risks in the event that an earthquake and tsunami may occur.

Now, Cotabato City is facing a turning point for future development. After more than forty years of conflict, the Comprehensive Agreement on Bangsamoro (CAB) was signed between the Government of the Philippines (GOP) and the Moro Islamic Liberation Front (MILF) in March 2014, and the Bangsamoro Autonomous Government was established. The ensuing plebiscite included Cotabato City as now part of the BARMM. Thus, the city shall continue to serve as the regional center of the autonomous region.

The Comprehensive Land Use Plan (CLUP) of Cotabato City is seen to expand its residential and commercial areas to disaster-prone area due to the pressure from population increase and economic development. In terms of disaster risk reduction, it can significantly increase disaster risks and may cause devastating damage on the society in the near future, which could hamper the sustainable development of the city.

To make things worse, climate change is likely to cause adverse effect on disaster risk reduction. Most emergent risk would be sea level rise. Due to the low elevation of the land and developed rivers, some areas will be directly affected, and the risks of flood, storm surge and tsunami will be exacerbated. Climate change impacts on rainfall is also a big concern in disaster risk reduction. Based on the report of "Observed climate trends and projected climate change in the Philippines" by DOST-PAGASA in 2018, the report says that increasing trends in annual and seasonal rainfall were observed in many parts of the country. On the other hand, the report also says that a noticeable drying trend can be observed over the northeastern portion of Luzon, and in central and northwestern sections of Mindanao in almost all seasons. Therefore, considering uncertainty and variety of GCM-based future projection, climate change impacts on rainfall should be carefully studied in river-basin scale. Another risk of climate change will be changes in tropical cyclones.

Considering existing and expected new risks as mentioned above, local DRR Plan was studied to promote DRR investments for reducing disaster risks and for strengthening disaster resilience.

Table 18.1-5 Breakdown of Flood Problem

Category	Negative	Positive
Hazard	➢ Cotabato City locates at the most downstream of the great Mindanao River, which exposes to severe floods frequently whose hydrographs have large peak discharge and long duration. ➢ The river-bed slope of the Mindanao River downstream is very gentle and highly affected by tide level, which makes the flow capacity low. ➢ Large sediments from upstream of the Mindanao River. ➢ The downstream of Ambal-Simuay River is braiding in the alluvial fan and the channels are not stable. ➢ Flood hazard will be exacerbated by climate change impacts on rainfall and sea level. ➢ Flood discharge in the downstream can be increased by uncontrolled logging, resource exploitation, and urbanization in the upstream.	➢ Vast marshlands locate at the mid-stream of the Mindanao River and have large retarding effect for floods. ➢ The flow velocity in the downstream of the Mindanao River will not be so fast due to its gentle river-bed slope.
Exposure	➢ Most of the land of Cotabato City is lowland flood-prone area. ➢ Difficult to evacuate due to a few highlands and developed braided channels ➢ Urban area is going to expand to flood-prone area under the land-use plan.	➢ City Land-Use Plan (CLUP) and zoning ordinance (ZO) are planned considering relevant disaster hazards. ➢ Most people do not live in flood-prone area and the urban area is limited to relatively flood-less area.
Vulnerability/ Adaptive Capacity	➢ Lack of disaster-related plans (flood control plan, river channel and course plan, storm water drainage plan) ➢ Poor meteorological and hydrological observation system ➢ Lack of flood forecasting and warning system (FFWS) ➢ Lack of DRR investments for structural and non-structural measures against floods ➢ Flood risk maps are not developed yet. ➢ Informal settlers violate the easement of rivers	➢ Cotabato City Local Disaster Risk Reduction and Management Plan (LDRRMP) and Climate Change Action Plan (CCAP) are developed. ➢ Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP) was published in 2012. ➢ Flood hazard maps are published. ➢ Diversion channel was constructed for the Ambal-Simuay downstream by DPWH. ➢ Ambal-Simuay River and Rio Grande de Mindanao Flood Control Project is ongoing. ➢ Evacuation sites are declared in local shelter plan.

Table 18.1-6 Breakdown of Earthquake Problem

Category	Negative	Positive
Hazard	➢Cotabato Trench and Mindanao Fault locate vicinity of Cotabato City and generate earthquakes relatively frequently	➢None
Exposure	➢Most area of Cotabato City lie on densely accumulated quaternary alluvium, so that seismic motion tends to be amplified and liquefaction is easily triggered.	➢The city center of Cotabato City locates on limestone hill, so that the ground is stronger than densely accumulated deltaic deposits.
Vulnerability/ Capacity	➢Lack of disaster-related plans (Plan for seismic countermeasures) ➢Not all public facilities (city hall, disaster-related offices, schools, hospitals) are quake-resistant. ➢Not all critical infrastructure (emergency transport roads and bridges, telecommunication, power, water-supply, etc.) are quake-resistant. ➢Many houses and buildings do not comply with the seismic design standard.	➢Cotabato City Local Disaster Risk Reduction and Management Plan (LDRRMP) is developed. ➢National building code has regulation on quake resistant. ➢PHIVOLCS-DOST has established a staff-controlled (manned) seismic station in Cotabato City and monitors earthquakes.

Table 18.1-7 Breakdown of Tsunami Problem

Category	Negative	Positive
Hazard	➢Cotabato Trench periodically generates significant earthquakes and tsunamis ➢Height of tsunami can be elevated in the process of tsunami wave propagation and running-up lands. ➢Tsunami waves will surge up rivers preferentially and expand the damage along the rivers.	➢For small or medium-sized tsunamis, coastal mangrove forests can mitigate the tsunami damage.
Exposure	➢Large area of Cotabato City is exposed to tsunami hazard due to its low elevation. ➢Difficult to escape due to a few highlands and developed braided channels	➢Center of Cotabato City locates relatively highland and is less exposed to tsunami hazard.
Vulnerability/ Capacity	➢Lack of disaster-related plans (Plan for tsunami countermeasures) ➢Lack of DRR investments for structural and non-structural measures against tsunami	➢Cotabato City Local Disaster Risk Reduction and Management Plan (LDRRMP) is developed. ➢Tsunami hazard map is published by PHIVOLCS-DOST. ➢Tsunami early warning system (TEWS) is under development.

18.2 Issues on DRR Plan

Issues were extracted by comparing the present condition to a desired condition. The following desired condition was targeted in this study. Subsequently, the extracted issues were described by flood, earthquake and tsunami.

18.2.1 Desired Condition in Disaster risk Management

Disaster risk is defined as a function of hazard, exposure, and vulnerability/adaptive capacity as seen in the subsection 18.1.1. Since natural hazards cannot be controlled, exposure and vulnerability should be reduced by disaster risk management as follows.

(1) Preventing New or Increasing Risks

Exposure to natural hazard basically increase with population growth and economic development. Yet it can be partly controlled for preventing new or increasing risks by risk-sensitive city development and land-use planning. Better city development and land-use planning is also important to enhance efficient structural measures for disaster risk reduction.

(2) Reducing Existing Risk

Generally, extensive disaster risk should be prevented, and intensive disaster risk should be mitigated. The UNDRR[1] defines extensive disaster risk as "the risk of low-severity, high-frequency hazardous events and disasters, mainly but not exclusively associated with highly localized hazards." and intensive disaster risk as "the risk of high-severity, mid- to low-frequency disasters, mainly associated with major hazards."

For example, the damage from frequent floods should be prevented by structural measures or resettlement, and the damage from a big tsunami whose annual recurrence interval is more than 100 years should be mitigated by all conceivable structural and non-structural measures.

(3) Managing Residual Risk

Residual risk is defined by UNDRR as "The disaster risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained". The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery, together with socioeconomic policies such as safety nets and risk transfer mechanisms, as part of a holistic approach.

As noted in Table 18.1-1, disaster-preparedness activities for minimizing disaster loss or damage are targeted on residual risk management in this DRR plan. Accordingly, enhanced evacuation activities by developing early warning system and by improving the access to evacuation centers are pursued in this DRR plan.

18.2.2 Issues on Flood

(1) Flooding in the Mindanao River Downstream

Floods often happen in the downstream of the Mindanao River. Cotabato City was greatly affected by the big floods in 2008, 2009 and 2011. The former two flood events were triggered by typhoons, while the last one was caused by heavy rains not attributed to typhoon. An interview with the Cotabato City risk reduction and management office (CDRRMO), stated that with the continued efforts to remove sediments and water hyacinth in the Mindanao River downstream, the city has not experienced any big floods since 2011. However, a huge flood has been affecting the city since 20 October 2020, and the scale of the damage is still under evaluation.

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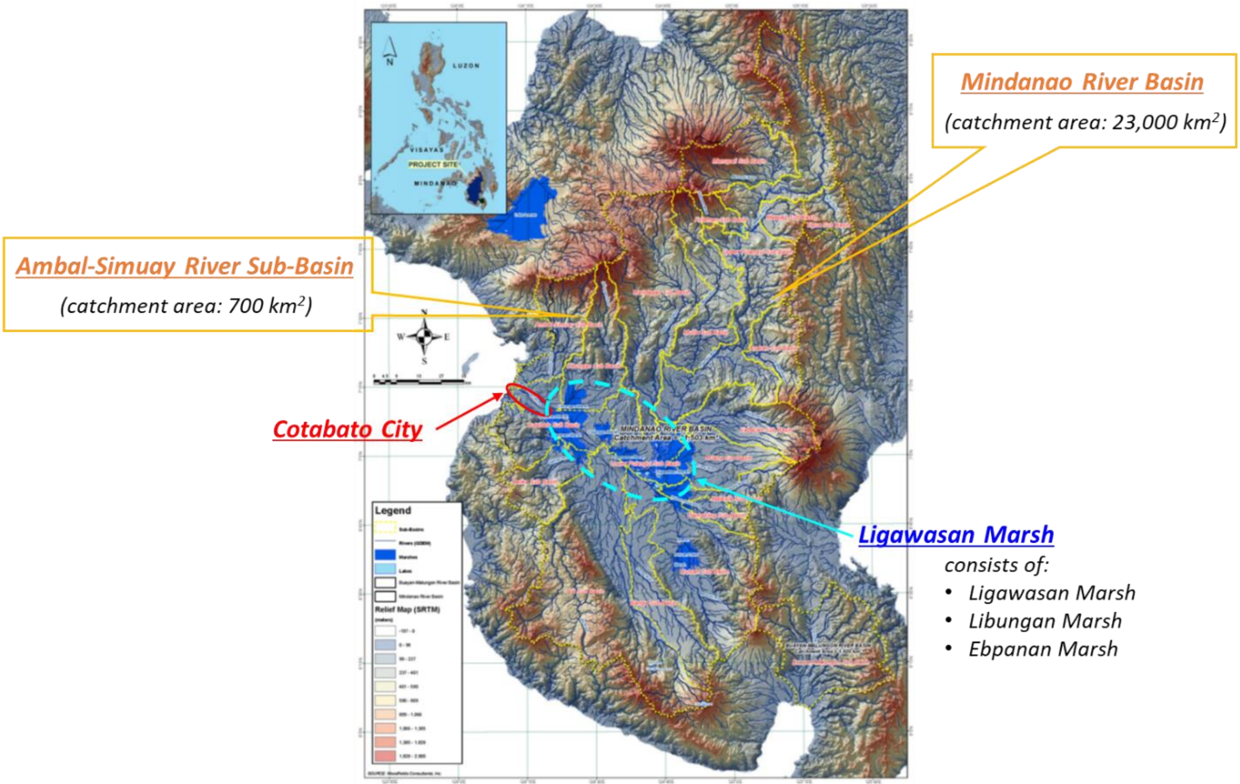
[1] Terminology of UNDRR-website (https://www.undrr.org/terminology)

As the physical characteristics of floods in the Mindanao River downstream, the flood hydrographs tend to have significantly large volume and long flooding time due to its vast catchment area (about 23,000 km^2) and pluvial climate. On the other hand, the peak discharge tends to be relatively small due to its low river-bed slope and the natural retarding effect of Ligawasan Marsh which covers approximately 280,000 hectares based on the Liguasan Marsh Development Plan (1999-2025). Therefore, the flood hydrographs in the most downstream of the Mindanao River are characterized by having relatively low peak discharge compared to the huge catchment area and the humid climate but lasting significantly long time.

Climate change is a big concern especially in the lower Mindanao River. Sea level rise will directly increase water level in the downstream and will affect wide range of the downstream due to the very gentle river-bed slope. As noted in the subsection 18.1.3, climate change may increase intensive rainfalls or heavy rainfall events, although detailed studies in a river-basin scale considering uncertainty and variety of GCM-based future projection are required. Accordingly, the impact assessment and adaptive measures are indispensable.



Source: Mindanao River Basin Integrated Management and Development Master Plan (2012)
*Location of Cotabato City and Ligawasan Marsh were added by JICA Study Team

Figure 18.2-1 Topography of the Mindanao River Basin with its Sub-basins

The Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP) was developed by the presidential task force for Mindanao river basin rehabilitation and development in 2012. Subsequently, the feasibility study on “Ambal-Simuay River and Rio Grande de Mindanao Flood Control Project” was completed in 2017, and land acquisition plan and resettlement action plan (LAPRAP) are ongoing for the project. Then, DPWH plans to implement the project with a loan from China, but the process of procurement of implementing firm and loan signing is behind schedule.

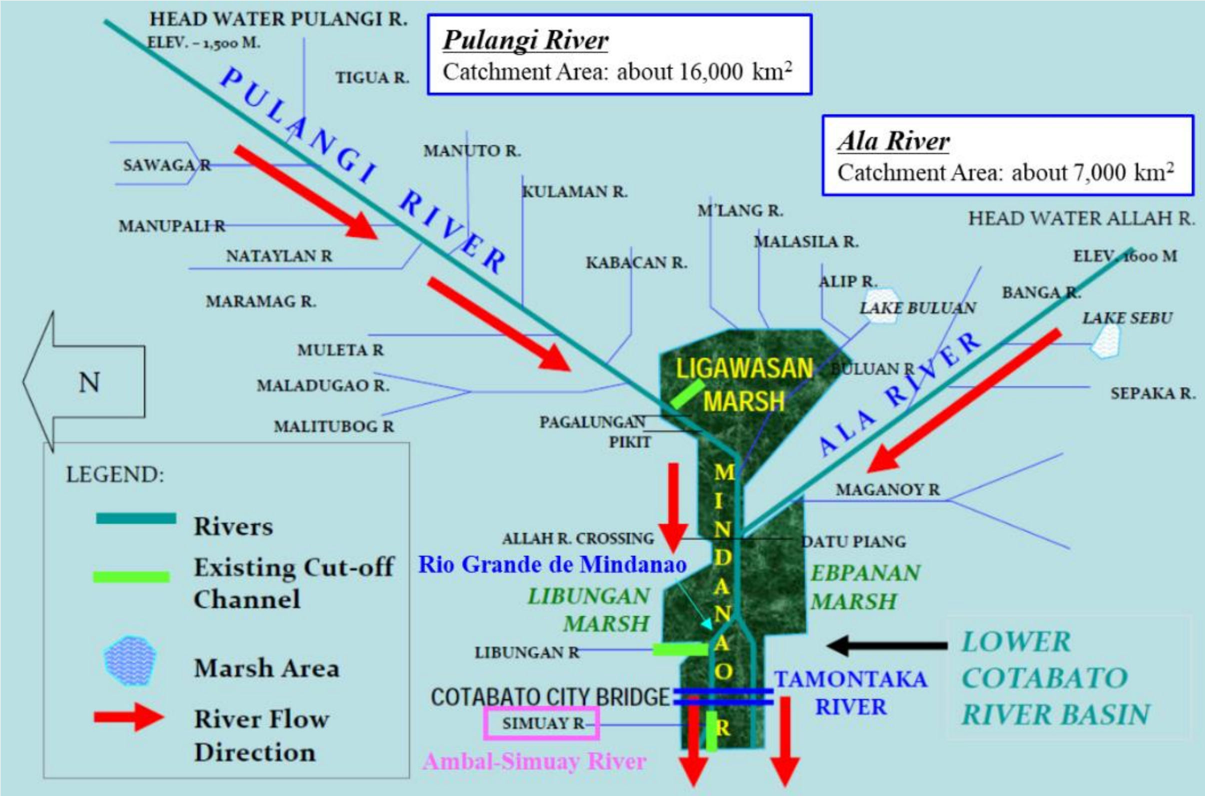
The MRBIMDMP focuses on two inter-related broad areas of concerns: the problem on the increase in the frequency and magnitude of flooding particularly within the lower floodplain; and the problem on how best to rehabilitate and develop the rivers within the basin. The plan included: (i) conducting a detailed hydrology and basin simulation study as bases for the preparation of water resources development and flood hazard management plan of the Mindanao River Basin, (ii) identifying development issues and concerns affecting the Mindanao River Basin and recommend appropriate development policies, strategies and program/project interventions, (iii) conducting feasibility studies for priority and high impact projects identified, (iv) recommending an appropriate institutional arrangement for coordinated basin-wide resource management and other development programs, and (v) improving linkages and institutional capability of concerned stakeholders in plan preparation process and other related activities. The plan proposed 10 priority projects as shown in Table 18.2-1. As shown in the Figure 18.2-2, flood control projects in the Rio Grande de Mindanao River and the Ambal-Simuay River are directly relevant to the Lower Cotabato River Basin.

Broad range of issues were holistically and specifically studied in the plan, however, the hydrological analysis was based on very limited hydrometeorological observation data and geological surveyed data under the unstable peace and order situation in the area. Besides, the basic information for planning structural measures such as target safety level, design flood hydrograph, flood-water allocation plan, design high-water level, and the like were not provided in the plan.

Table 18.2-1 Proposed High Priority Projects in the MRBIMBDMP

Study Areas	Selected High Priority Projects
(1) Basin Wide (MRB and BMRB)	PFS of the Development of Early Warning and Flood Forecasting Project
(2) Rio Grande de Mindanao River	FS of Siltation Control and Management Project for Rio Grande de Mindanao River
	PFS of an Integrated Flood Control, River Bank Protection and Rehabilitation Project for Rio Grande de Mindanao River
	PFS of Dendro Thermal Power Project
(3) Ala River (Including Banga River)	FS of Siltation Control and Management Project for Ala River
	PFS of an Integrated Flood Control, River Bank Protection and Rehabilitation Project for Ala River
(4) Buayan-Malungon River	FS of Siltation Control and Management Project for Buayan-Malungon River
	PFS of an Integrated Flood Control, River Bank Protection and Rehabilitation Project for Buayan-Malungon River
(5) Ambal-Simuay River	FS of an Integrated Flood Control, River Bank Protection and Rehabilitation Project for Ambal-Simuay River
(6) Pulangi River	PFS of an Integrated Flood Control, River Bank Protection and Rehabilitation Project for Pulangi River

Source: Mindanao River Basin Integrated Management and Development Master Plan (2012)
*Buayan-Malungon River is outside of the Mindanao River Basin

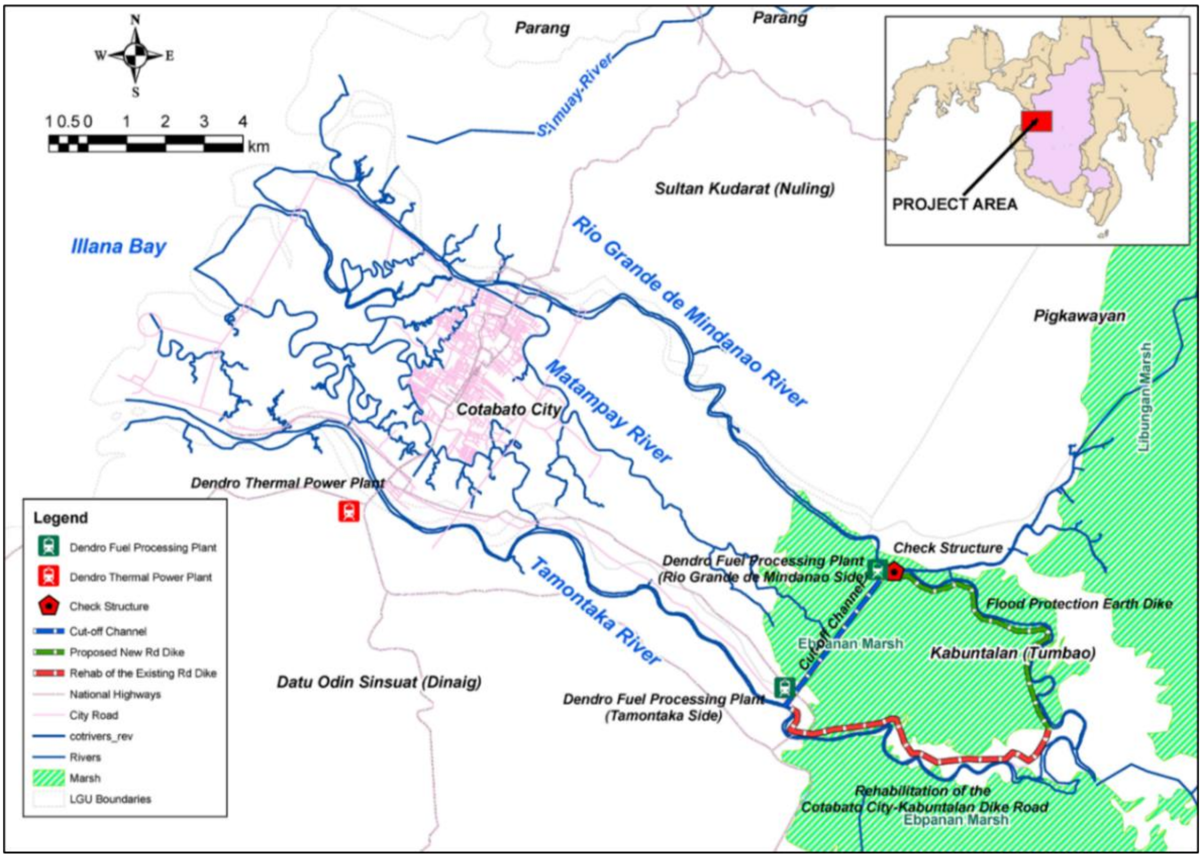


Source: A Brief on Presidential Task Force for Mindanao River Basin Rehabilitation and Development, Executive Order No. 753-B (Feb 2010)
*Some information was added by JICA Study Team

Figure 18.2-2 Schematic River Flow of the Mindanao River

The proposed flood-control structural measures for the Rio Grande de Mindanao River in the MRBIMDMP (2012) are: (i) excavation of a cut-off channel, (ii) construction of a check structure, and (iii) construction of pocket dike as shown in Figure 18.2-3 in addition to dredging works. The alignment of the cut-off channel is located on the edges of Ebpanan Marsh which is itself a receptacle of flood waters from the upper reaches of Rio Grande de Mindanao and Tamontaka Rivers. The purpose of the cut-off channel is to divert excess flood waters in Rio Grande de Mindanao to Tamontaka River limiting the maximum flood inflow to Rio Grande de Mindanao to 800 m^3/s. Secondly, the purpose of the check structure is to stop the inflow of silt materials towards the downstream stretch of Rio Grande de Mindanao. The future accumulated silt materials are planned to be used for elevating the lower portion of the Ebpanan Marsh to convert the area into productive agricultural land. The check structure will also serve as the collection site for floating debris in the river. Finally, the purpose of pocket dike is to minimize the exposure of the proposed cut-off channel from the flood waters from Ebpanan Marsh and to protect the inside agricultural land from perennial floods. The pocket dike consists of earth dike along the left bank of the Rio Grande de Mindanao and road dike along the right bank of the Tamontaka River between the proposed cut-off channel and the bifurcation point of the Mindanao river to the Rio Grande de Mindanao and the Tamontaka River.

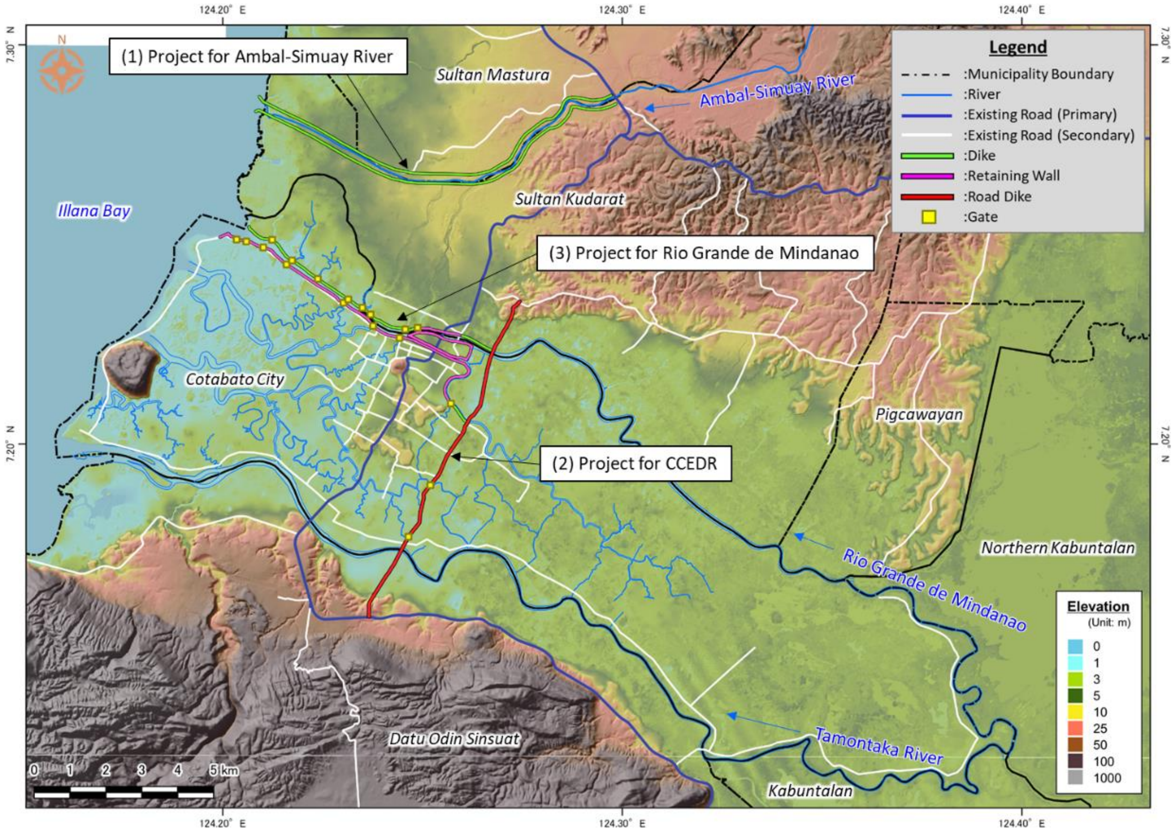
The proposed flood control measures will mitigate flood situation in the Rio Grande de Mindanao downstream by reducing sediments and suspended materials from the upstream and by maintaining the flow capacity with dredging works. However, the effect of the proposed cut-off channel is uncertain because the flow capacity of the Tamontaka River is not clear in the MRBIMDMP. Besides, reducing the retarding effect of Ebpanan Marsh by the proposed pocket dike may exacerbate floods in the downstream without securing enough flow capacity in the downstream beforehand.



Source: Mindanao River Basin Integrated Management and Development Master Plan (2012)

Figure 18.2-3 Proposed Structural Measures in the Mindanao River Downstream in MRBIMDMP

Subsequently, the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects (hereinafter referred to as DPWH national project) was emerged based on the feasibility study on the flood control plan for Rio Grande de Mindanao River and Ambal-Simuay River conducted by local consulting firm, Woodfields Engineers Company, completed in April 2017. The DPWH national project consists of the three components: (i) Project for the Ambal-Simuay River, (ii) Project for Cotabato City East Diversion Road (CCEDR), and (iii) Project for Rio Grande de Mindanao as shown in Figure 18.2-4. Since the issues on the Ambal-Simuay river are described in the next subsection, the projects for CCEDR and for Rio Grande de Mindanao are explained as follows.

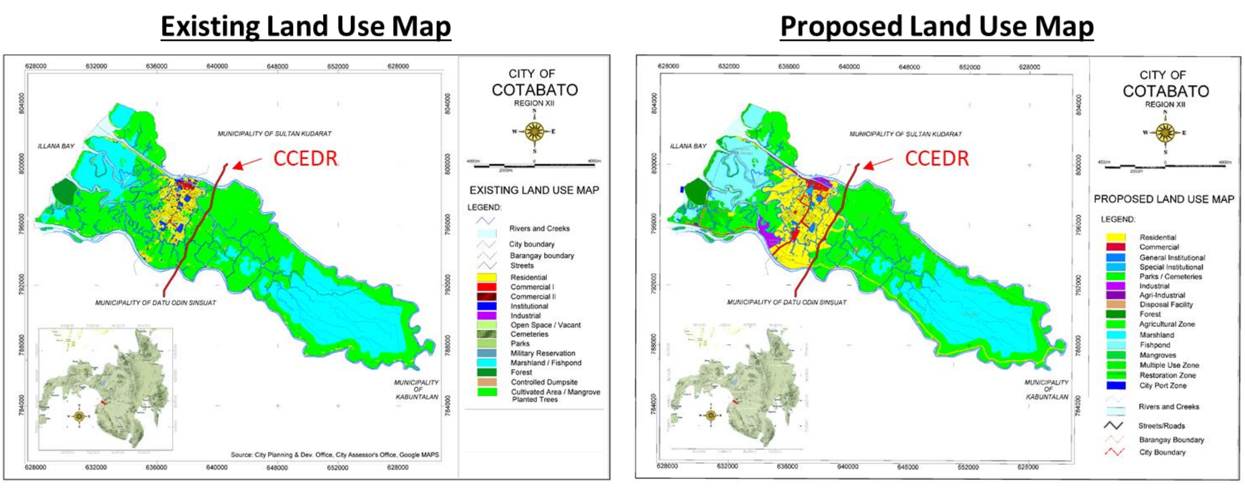


Source: Created by JICA Study Team based on the FS report2 of the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects and IFSAR based DEM data (2017)

Figure 18.2-4 Location Map of the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects

The project for CCEDR is to raise the existing Cotabato City East Diversion Road as road dike to prevent flood water from the upstream. As shown in

Figure 18.2-5, the CCEDR is located at the east border of the urban area in the current land-use plan of Cotabato City. Thus, the CCEDR road dike will work as part of the ring dike for the urban area of Cotabato City.



Source: Created by JICA Study Team based on The Comprehensive Land Use Plan (Cotabato City, 2011-2020)

Figure 18.2-5 Location of CCCER comparing to Cotabato City's CLUP

[2] Feasibility Study on the Flood Control Plan for Rio Grande de Mindanao River and Ambal-Simual River (April 2017)

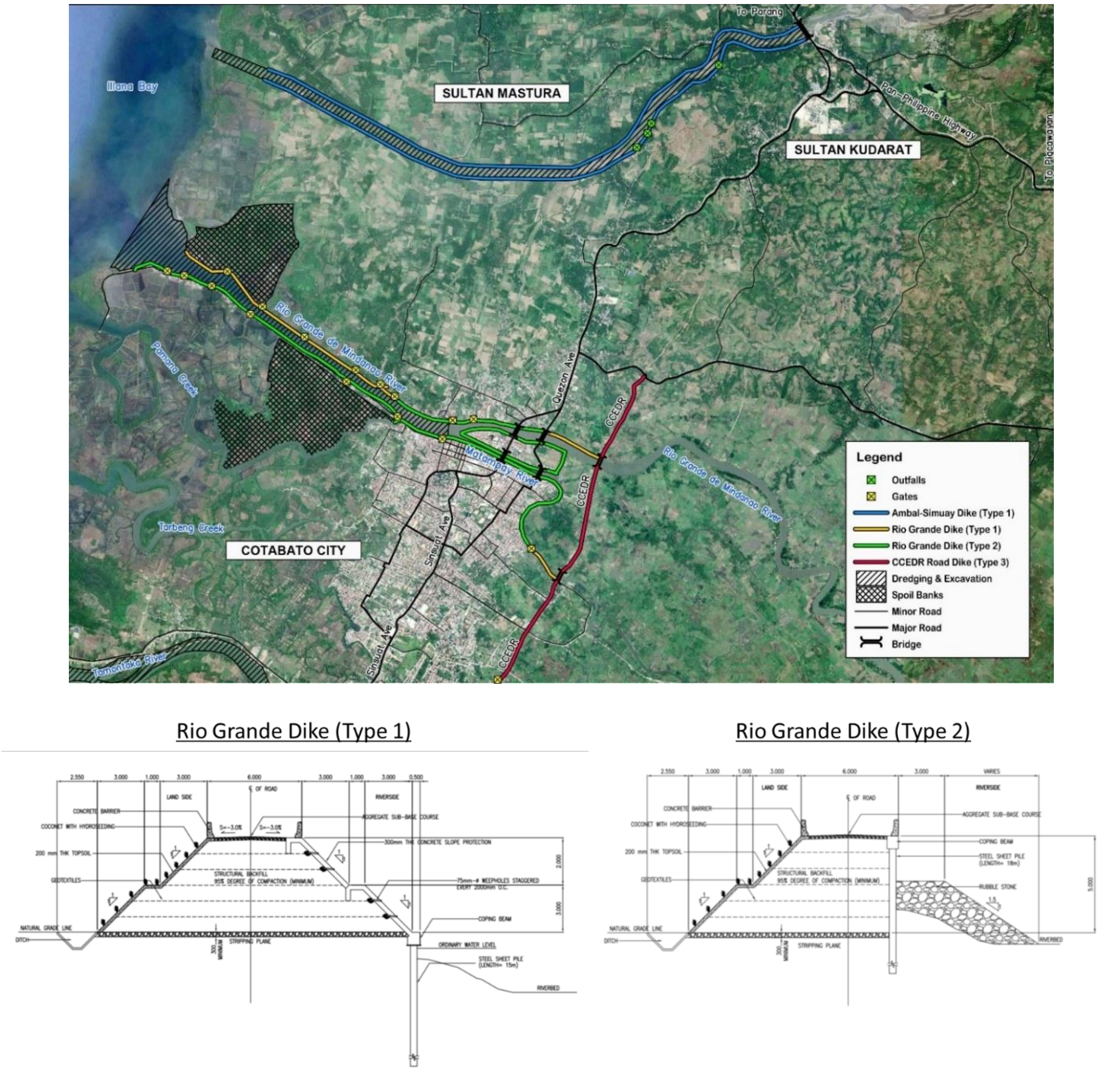
The project for Rio Grande de Mindanao includes: (a) dredging works; (b) construction of dike; and (c) installation of gates as shown in Figure 18.2-6. Dredging works are planned in the downstream of the confluence of the Rio Grande de Mindanao and the Matampay river (7.87 million m^3, 6.2 km), and the dredged sediments will be used for landfilling. Construction of dikes is proposed along both left and right sides of Rio Grande de Mindanao and the Matampay River in the downstream of CCEDR. The barangay, Poblacion 1, which is located on a sandbar island at the confluence of the Rio Grande de Mindanao and the Matampay river are also planned to be protected by a ring dike. Since some houses and buildings are erected just beside the rivers, two type of dikes are proposed depending on land-acquisition difficulty.

The proposed flood control project will directly contribute to the reduction of flood risks in Cotabato City. The conceivable issues founded by reviewing the feasibility study report of the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects are as follows:

A) Hydrological and hydraulic analysis is based on very limited hydrometeorological observation data and geological surveyed data due to the unstable peace and order situation in the area. Hence, the need to address the following issues: (i) design storm hyetograph of the Mindanao river is based on rainfall intensity-duration-frequency (RIDF) curves whose method is not suitable for the large watershed; (ii) hydrological and hydraulic models lack enough calibration and validation; and (iii) present flow capacities of the rivers are not clarified.

B) The proposed dikes for the Rio Grande de Mindanao shall be located along the present left and right banks. However, widening the breadth of the river should be studied as much as possible considering flood characteristics in the Mindanao River downstream: especially because (i) the flood hydrographs have large discharge for long time; (ii) dredging the river bed cannot effectively increase the flow capacity due to the tidal reach; and (iii) the longer the water level exceeds the ground level, the higher the risk of a dike breach.

C) Flood control projects for the Tamontaka River are not included in the project. Since the river also floods frequently, flood control projects for the Tamotaka River are also urgent and indispensable.

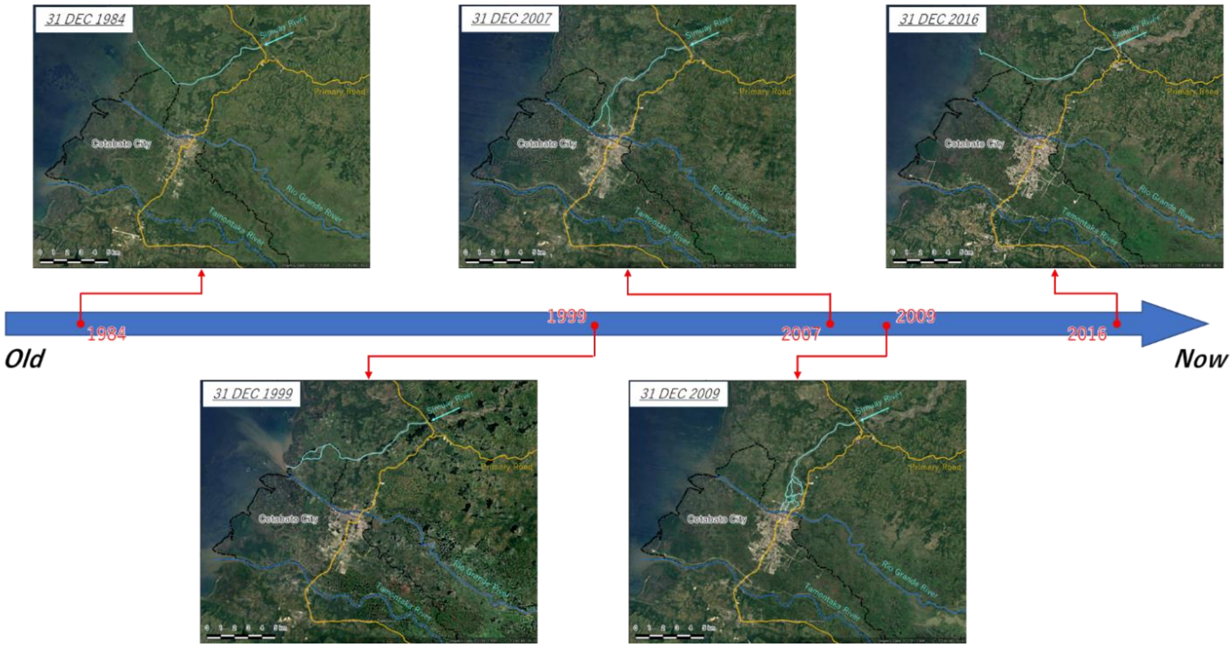


Source: Joint DPWH and DOTr Presentation entitled "Strengthening Economic Resilience and Spurring Infrastructure Development for Inclusive Growth, 20 March 2019 (up); DPWH Presentation entitled "Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects", 2018 (down)

Figure 18.2-6 Overview of the Rio Grande de Mindanao Flood Control Project

(2) Flooding in the Ambal-Simuay River Downstream

Flooding in the Ambal-Simuay River downstream was one of main causes that exacerbate flood damages in the 2008 flood. The Ambal-Simuay River is characterized by a high bed slope on the average, conveys large volume of sediments, and develops the alluvial fan in the downstream of the intersection of the Pan-Philippine Highway. In the alluvial fan, the river course continually changes as shown in Figure 18.2-7. During the 2008 flood caused by Typhoon Frank, the river course moved to the eastern side and inundated a number of houses and buildings in the municipality of Sultan Kudarat. Subsequently, the floodwater rushed into the Rio Grande de Mindanao (Rio Grande River) and which also triggered flood in the Rio Grande River by its flow and sediments.



Source: Created by JICA Study Team using Google Earth

Figure 18.2-7 Changes in the Ambal-Simuay River Downstream

To address the flood risk of the Ambal-Simuay River downstream, DPWH started to excavate the cut-off channel with the total length of 6.1 km to discharge excess water directly to the sea in 2009. However, the cut-off channel did not secure sufficient flow capacity at that time.

In the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP, 2012), the proposed flood control plan for the Ambal-Simuay river is based on the strategy that excess water of the Ambal river should be allocated to the Nituan river which is the original course of Ambal river in order to reduce the flood inflow to the Simuay river. The proposed flood control works are the following:

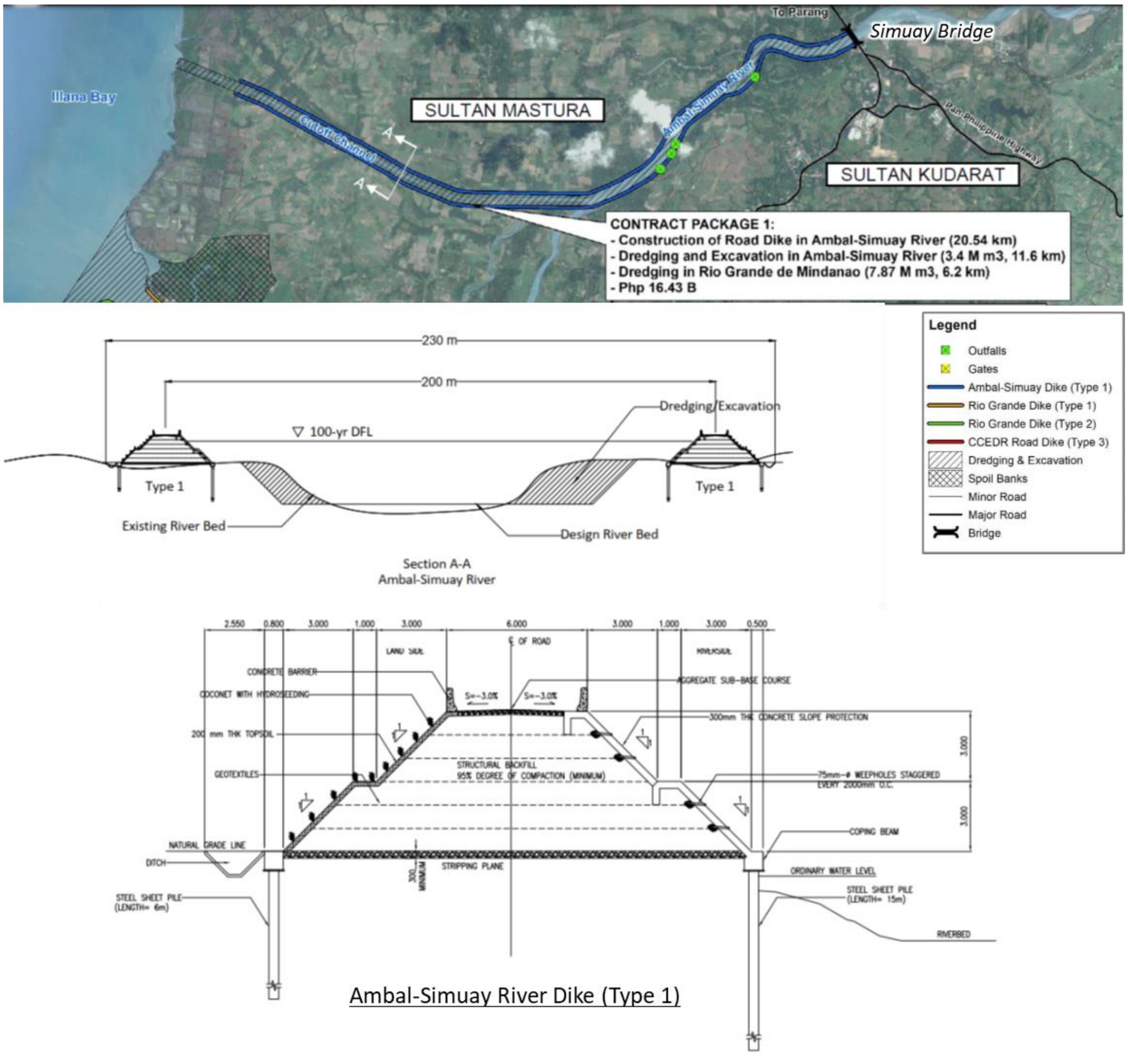
i. Construction of multipurpose dam structure that will divert inflow from Ambal River to Nituan River with an outlet in Illana Bay in the vicinity of Parang, Maguindanao.
ii. Widening of the cut-off channel to 134 m to accommodate the 457 m^3/s design inflow.
iii. Construction of earth dike along the left bank of the river with minimum height enough to hold the current capacity of 150 m^3/s.

Figure 18.2-8 shows the location of the proposed structural measures for the Ambal-Simuay river. In the plan, the flood discharge is to reduce first in the upstream by diverting excess water from the Ambal river to the Nituan river, and the overflow in the downstream is to be protected by construction of earth dike along the left bank and by strengthening the flow capacity of the cut-off channel.

Source: Mindanao River Basin Integrated Management and Development Master Plan (2012)

Figure 18.2-8 Proposed Structural Measures in the Ambal-Simuay River Downstream in the MRBIMDMP

As described in the previous subsection, Ambal-Simuay River and Rio Grande de Mindanao Flood Control Project (hereinafter referred to as DPWH national project) is ongoing and includes flood control works for the Ambal-Simuay River as shown in Figure 18.2-9. Under the project, the cut-off channel is planned to be the main course by widening and deepening the channel and the other old courses are to be closed. Continuous earth dikes are proposed along both left and right banks from the Simuay bridge to the Illana Bay. The project will contribute not only to preventing the overflow in the Ambal-Simuay river downstream but also in reducing flood risk in the Rio Grande de Mindanao downstream by stopping flood water and sediments from the Ambal-Simuay river.



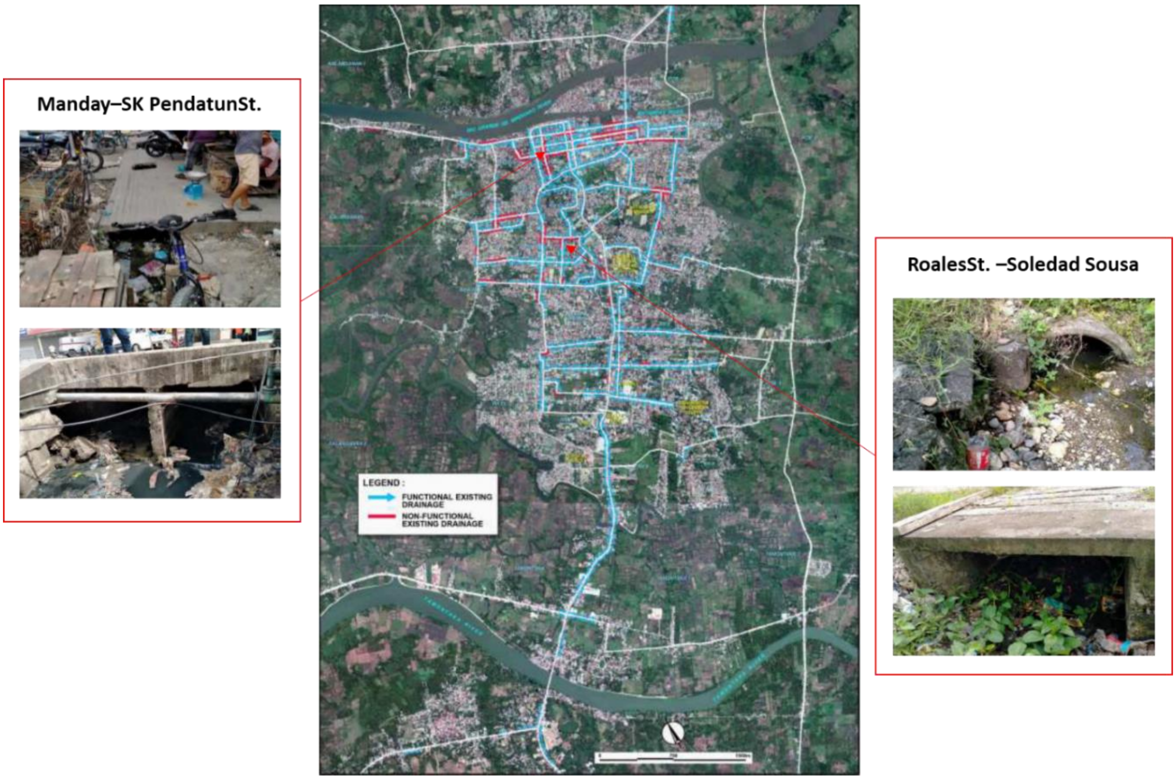
Source: DPWH Presentation entitled "Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects", 2018

Figure 18.2-9 Proposed Structural Measures in the Ambal-Simuay River Downstream in the DPWH National Project

(3) Inland Flooding in Urban area due to Poor Drainage

Inland flooding in the urban area of Cotabato City sometimes happen by intensive rain storms due to poor drainage. At present, drainage facilities are only established at the CBD (the old historic core), national highway and in some major roads and are not established in the lowland. Based on the local survey to check the current condition of drainage channels conducted in this project, existing drainage channels are not well maintained, and some parts are broken or clogged with debris as shown in Figure 18.2-10.

Cleaning and de-clogging of the drainage channels are regularly conducted by the DPWH local or regional offices.



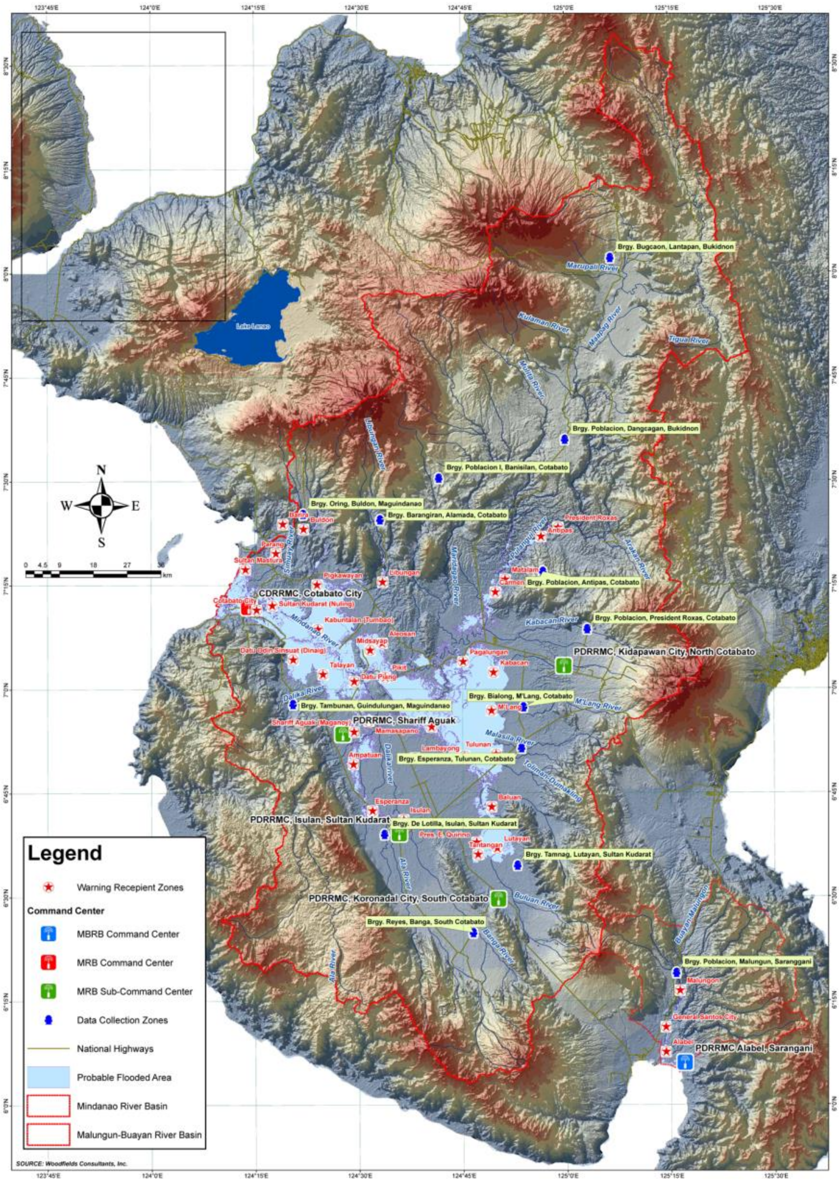
Source: JICA Study Team

Figure 18.2-10 Current Condition of Drainage Channels Based on the Drainage Survey in this Project

(4) Residual Risk

As noted above, only a few structural measures were implemented in the Mindanao River downstream and the Ambal-Simuay River downstream so far, and the proposed Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects are going to be implemented in the next 5 years. Therefore, the residual risk on floods will almost remain as what it is in natural condition until the project completion, and the residual risk will be reduced up to the target safety level, which was within the 100-year return period stated in the feasibility study of the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects. Even after the completion of all structural measures, flood risks cannot be completely eliminated, so that there remains a continuing need to develop or maintain preparedness, response and recovery activities to minimize the damage and the negative impacts from the extreme floods over the target safety level.

In the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP, 2012), the development of early warning and flood forecasting system (EWFFS) was proposed as one of the 10 priority projects. The proposed EWFFS is an integrated package of data collection and transmission equipment, forecasting models, response plans and procedures, and human resources capacity building. The command center which issues flood warning bulletins by evaluating and processing the collected information from data collection zones is proposed to be located at the CDRRMC Cotabato City as shown in Figure 18.2-11. Pre-feasibility study of the project was also conducted by PAGASA in line with the MRBIMDMP. However, based on the interview with the Cotabato City government as of October 2020, the EWFFS is not yet established.



Source: Mindanao River Basin Integrated Management and Development Master Plan (2012)

Figure 18.2-11 Proposed Early Warning and Flood Forecasting System in the MRBIMDMP

(5) Management of Rivers and Creeks in Cotabato City

At present, most people of Cotabato City are residing outside of the flood-prone area but live in relatively higher land such as the PC hill or natural embankments due to high risk of floods from the Mindanao River downstream. Thus, the rivers and creeks in Cotabato City are almost still in their natural condition.

As described in subsection (1) , the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP) was published in 2012. However, the hydrological analysis was based on very limited hydrometeorological observation data and geological surveyed data under the unstable peace and order situation in the area. The basic information for planning structural measures against floods such as target safety level, design flood hydrograph, floodwater allocation plan, design high-water level, are not provided in the plan.

On the other hand, due to the increasing pressure form population and economic development, the Cotabato City comprehensive land use plan (CLUP) presents its direction to expand its residential and commercial areas towards the flood-prone area. The planned development zone is currently lowland surrounded by braided natural rivers and creeks. Therefore, river planning for flood control, rainstorm drainage, river channel and course is urgently needed. If the city would expand towards the flood prone area without undertaking the necessary river planning, it would be confronted with the following issues: (i) flood risk increase by overflowing from the Mindanao river downstream and the natural creeks in Cotabato City; (ii) inland flooding (pluvial flood) due to difficulty to make enough water head in drainage channels; (iii) low investment efficiency for developing infrastructures such as river revetments and dikes, roads, bridges.

The city should consider enacting a local ordinance or put up signage to prevent the local people from occupying the river area so that flood control and operation and maintenance for the rivers can be carried out. The easement of rivers and streams is ruled by Presidential Decree No. 1067 as 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. Presently, a number of houses stand on the river bank or even part of these houses are in the river as shown in Figure 18.2-12.

Table 18.2-2 Ruled Easement of Rivers in Presidential Decree No. 1067 (1976)

Presidential Decree No. 1067 (1976)

ARTICLE 51. 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, floatage, fishing and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, floatage, fishing or salvage or to build structures of any kind.

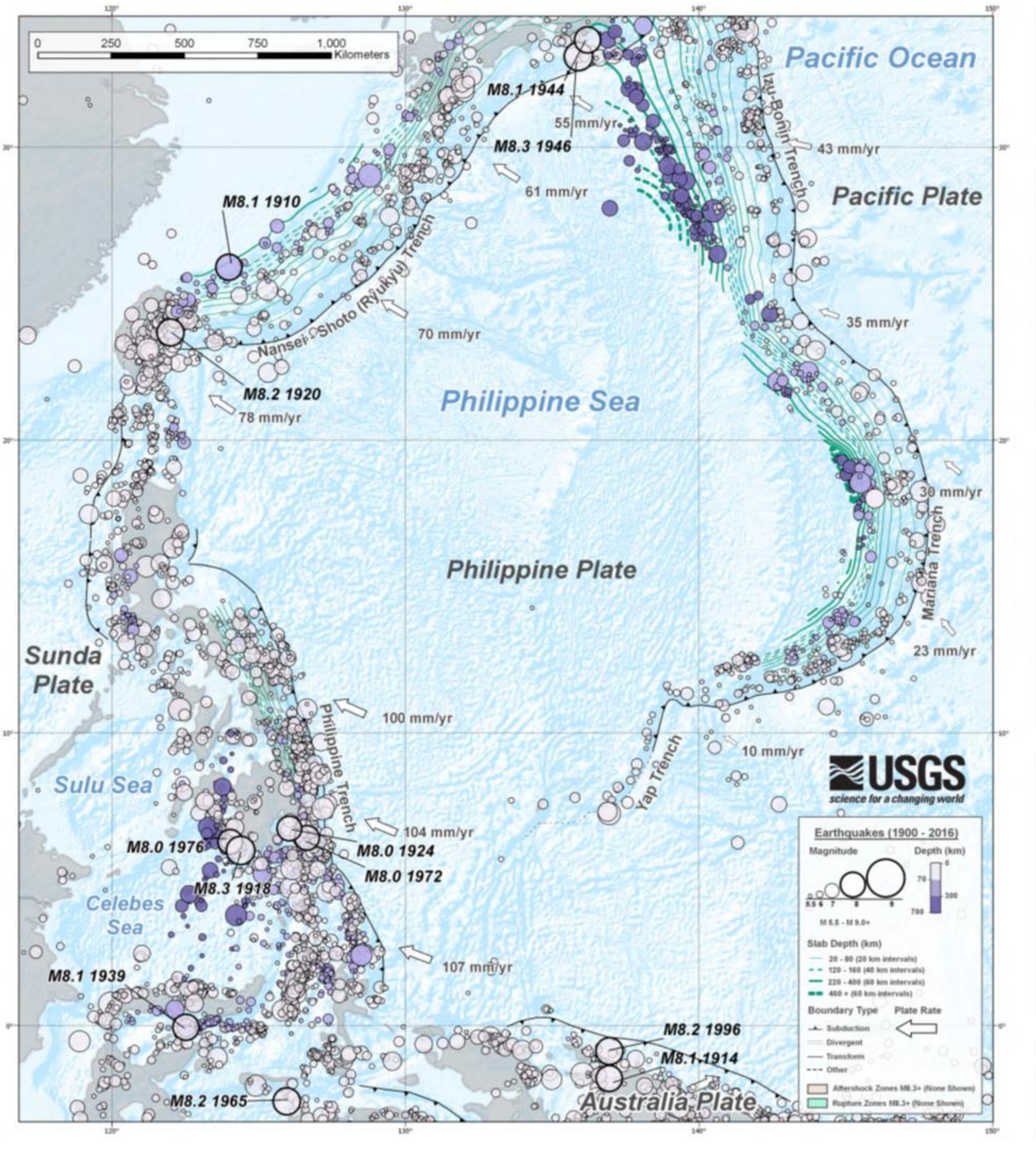
Source: JICA Study Team

Figure 18.2-12 Present Riverside Condition Along Natural Rivers and Creeks in Cotabato City

18.2.3 Issues on Earthquake

(1) Existing Risks

Seismic activity within the vicinity of the Mindanao island is quite active. As apparent from Figure 18.2-13, large seismic events (>M5.5) are concentrated on both west and east sides of the Mindanao island due to the existence of Cotabato Trench and Philippine Trench. Great seismic events (>M8.0) were generated only around the Mindanao island in the Philippines. In 2019, series of strong earthquakes (>M5.5) happened five times in the Mindanao island. Cotabato City and its vicinity are highly exposed to earthquake hazard.



Source: USGS (https://earthquake.usgs.gov/earthquakes/tectonic/images/philippinesea_tsum.pdf)

Figure 18.2-13 Large (>M5.5) Seismic Events Around Philippine Sea Plate (1900-2016)

Geological condition is one of main factors of vulnerability against earthquakes. According to the Earthquake Engineering Research Institute (EERI) report[3] after the Moro Gulf Earthquake on 17 August 1976, the ground motion characteristics in Cotabato City were described by the following conditions: 1) a Magnitude 8 earthquake; 2) epicentral distance of 100 km; and 3) a distinct variation in local site conditions. These conditions were dominant factors influencing the following points concerning the damage:

1) All damages were concentrated on the soft marshy soils.
2) The magnitude of an earthquake cannot by itself be an indication of the extent or severity of damage that may be expected.
3) All collapsed concrete buildings, although supported on small wood piles, were strongly affected by increased ground shaking due to soft foundation materials.

As noted in the report, the damage on buildings is strongly influenced by ground condition. The average values of the maximum acceleration by geological strata based on the loose muddy sediments (such as delta, floodplain) as "1.0" are as follows: (a) the sandy gravel alluvium (such as alluvial fan) as "0.8 to 0.85"; (b) diluvial deposit consisting of compacted sand and mud (such as diluvial upland) as "0.7 to 0.75"; and (c) consolidated rock layer (such as mountain or hill) as "0.5 to 0.55". This indicates that, for example, the maximum acceleration of the hard rock layer is about half than that of the soft, muddy layer. Amplification of seismic shaking by topography is summarized in Table 18.2-3. Since most parts of Cotabato City stand on densely accumulated deltaic deposits, the land is highly exposed to seismic hazard.

Table 18.2-3 Amplification of Seismic Shaking by Topography

Topography	Amplification factor
Lowland delta	1
Lowland alluvial fan	0.83
Plateau or terrace	0.73
Mountain or hill	0.56

Source: The website[4] of Disaster Information Laboratory of NIED, Japan (translated by JICA Study Team)

To minimize the seismic damage, seismic strengthening for priority facilities such as public buildings (government offices, schools, hospitals, malls, and other important public buildings) and critical infrastructures (main roads and bridges, water & power & gas supply, transmission facilities) is important. It is also important to prevent subsequent disasters such as fire.

At present, the proportion of earthquake-resistant structures for the priority facilities is not clear. With the conduct of seismic capacity assessment, a plan to enhance earthquake-resistant structures

[3] Stratta, J.L. et al, "Reconnaissance Report Mindanao, Philippines Earthquake August 17, 1976", The EERI Reconnaissance Team, 1977

[4] https://dil.bosai.go.jp/workshop/03kouza_yosoku/08kyoushin_table08_03.html

for the priority facilities should be undertaken. The plan should also identify the designated emergency road and open spaces to prevent ensuing disasters such as fire and to enhance disaster-response activities.

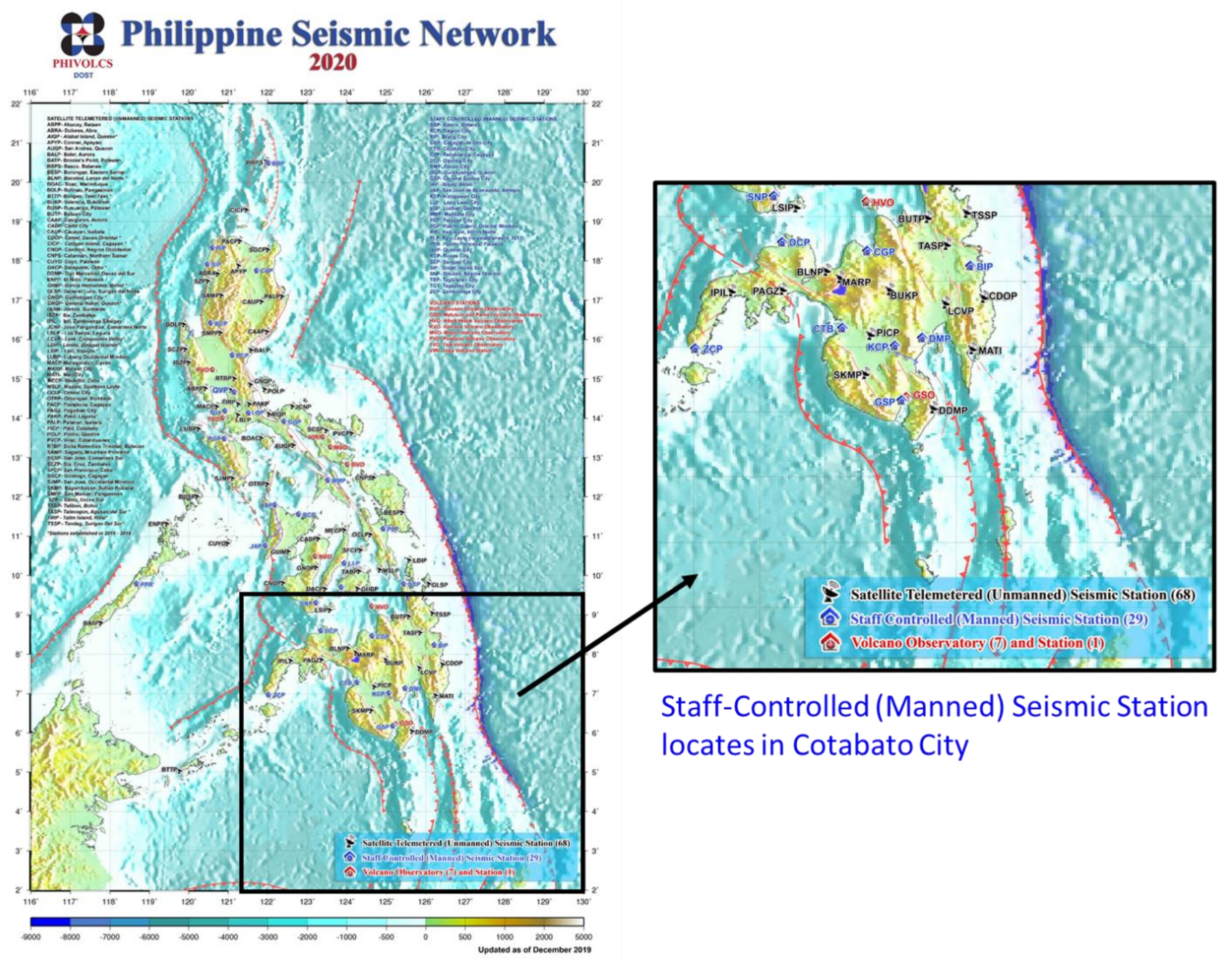
(2) Residual Risks

As one of the characteristics of earthquake hazard, the exposure cannot be effectively reduced in block by structural measures. Foundation improvement (soil stabilization) works in large scale through land reclamation can be an option but will not be feasible. Thus, private houses or buildings should be strengthened to make them earthquake resistant through individual efforts.

One of the mechanisms to enhance earthquake resistance in private houses or buildings is a subsidy system. For example, local governments can subsidize local people to conduct seismic capacity assessment for their houses or to construct a new or rehabilitate their residential houses to become earthquake resistant. Tax benefits can be another mechanism for the purpose.

In terms of evacuation activity, reliable earthquake forecasting system is still under development in the world. On the other hand, developing an emergency earthquake alert and information sharing system is important to give the people a few moments to prepare and the important information for proper action after the earthquake.

The National Earthquake Monitoring and Information of DOST-PHIVOLCS aims to provide accurate and timely information on significant earthquakes and tsunami events that may significantly affect the Philippines; and to ensure the accessibility and integrity of earthquake data. As of 2020, earthquake monitoring in the country has been enhanced with the operation of 29 staff-controlled (manned) seismic stations, 68 satellite-telemetered (unmanned) seismic stations, and 8 volcano observatories as shown in Figure 18.2-14. One of 29 staff-controlled (manned) seismic stations locates in Cotabato City.



Source: PHIVOLCS (https://www.phivolcs.dost.gov.ph/index.php/earthquake/earthquake-monitoring)

Figure 18.2-14 Philippine Seismic Network

18.2.4 Issues on Tsunami

(1) Existing Risks

Many submarine shallow earthquakes of great magnitude (7.9 or greater) occurred in the Mindanao area[5]. Beneath the Moro Gulf area or the immediately neighboring Celebes Sea alone five great earthquakes have occurred since 1897 as shown in Table 18.2-4. In a statistical study of tsunamis in the Philippines, Nakamura (1977)[6], it was reported that the Moro Gulf area is the most tsunami prone, followed by Eastern Mindanao, then by Western Luzon.

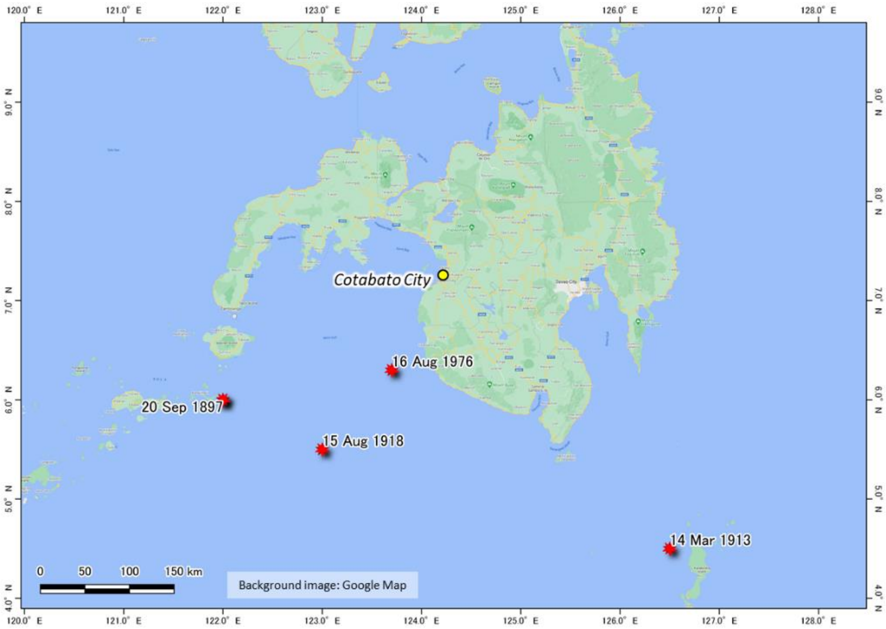
[5] Tichter, C.F., Elementary Seismology, San Francisco: W.H. Freeman, 1958

[6] Nakamura, S., On Statistical Tsunami Risk in the Philippines, Kyoto: Kyoto University, 1977

Table 18.2-4 Historical Great Earthquakes Beneath the Moro Gulf Area or the Immediately Neighboring Celebes Sea since 1897

Date	Magnitude	North	East	Reference
20 Sep 1897	8.6	6.	122.	S
21 Sep 1897	8.7	6.	122.	I, S
14 Mar 1913	8.3	4.5	126.5	I
15 Aug 1918	8.3	5.5	123.	I, S
16 Aug 1976	8.2	6.3	123.7	

(References: I-Iida et al, 1967; R-Repetti, 1948; S-Soloviev and Go, 1969, 1974)
Source: "Moro Gulf Tsunami of 17 August 1976", Victor L. B. et al, 1978



Source: Created by JICA Study Team based on Table 18.2-4
Figure 18.2-15 Estimated Epicenters of Historical Large Tsunamigenic Earthquakes

The Moro Gulf tsunami of 17 August 1976 was the most disastrous tsunami experienced by the Philippines. There had been more severe tsunamis, but areas hit were less populated and had less manmade structures. According to the PHIVOLCS website[7], there were three destructive tsunami events in 1990, 1992 and 1994 after the tsunami in 1976, but the Moro Gulf tsunami is still recognized as the most destructive tsunami event in the Philippines.

Victor L. B. and Zinnia C. A. (1978)[8] reported that a few minutes after midnight on 17 August 1976, a violent earthquake originating beneath Moro Gulf spawned a tsunami that affected 700 km of coastline bordering Moro Gulf. About 8,000 were dead or missing, about 10,000 were injured, and about 90,000 were rendered homeless. About 95% of the casualties in Regions IX and XII can be considered due to the tsunami. No breakdown is given according to sex or age.

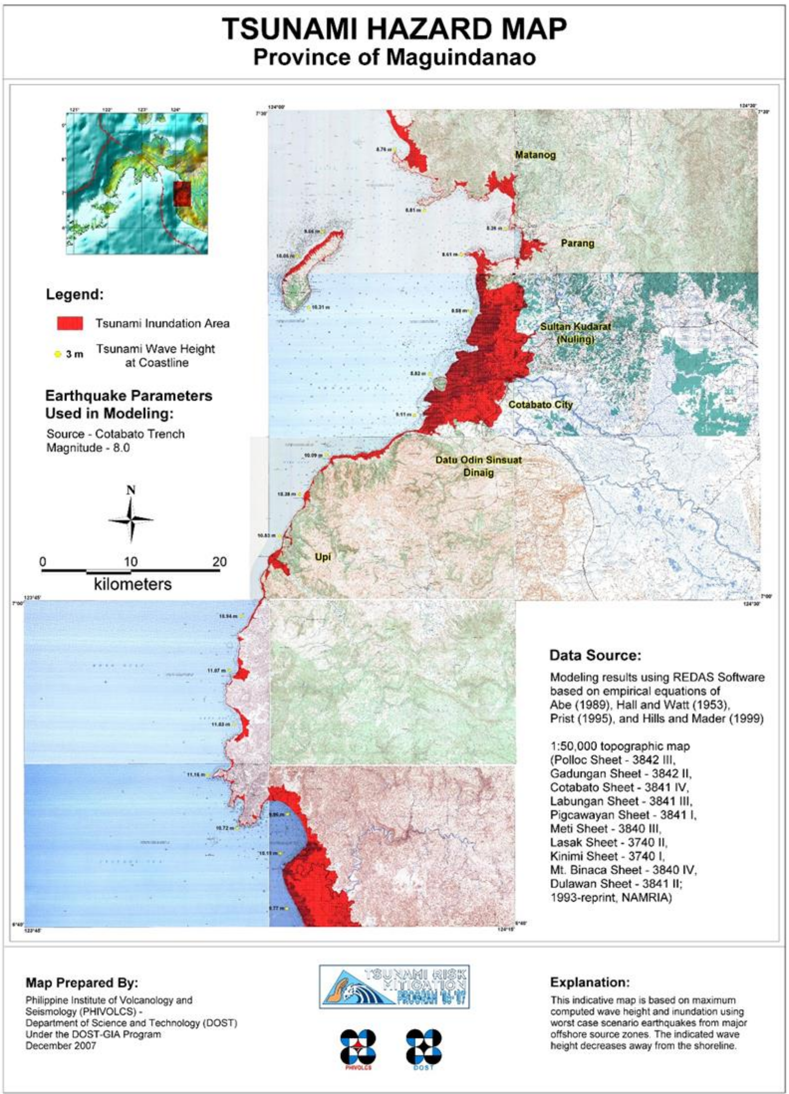
[7] https://www.phivolcs.dost.gov.ph/index.php/tsunami/historical-tsunamis

[8] Victor L. Badillo and Zinnia C. Astilla, Moro Gulf Tsunami of 17 August 1976, Quezon City: Manila Observatory, 1978

However, a reliable source has stated that casualties were mainly children and women, and that the child-adult ratio was four: one.

Victor L. B. and Zinnia C. A. (1978)[8] also reported that the measured and estimated values of wave heights by PAGASA/ITIC never exceeded 4.3 meters. As expected these values are less than those given by survivors, considering their state of mind at the time. Estimates of wave heights had to be based on qualitative descriptions of the waves being as tall as a coconut tree, a two-story house, twice a man's height or had to be deduced from photographs of damaged structures. Places where waves were reported to be higher than five meters are: Linek (Maguindanao), Kalanganan (Cotabato City), Pagadian City, Sacol Island (Zamboanga City) and Lebak (Sultan Kudarat). In Lebak waves may have been as high as nine meters.

Since it is believed that a trench-type earthquake generates periodically, the risk of a possible large tsunami is increasing. A tsunami hazard map was prepared by the DOST-PHIVOLCS in 2007 as shown in Figure 18.2-16. However, a plan for tsunami countermeasures has not been prepared yet.



Source: PHIVOLCS

Figure 18.2-16 Tsunami Hazard Map by PHIVOLCS

(2) Residual Risk

As noted in the previous subsection, a plan for tsunami countermeasures is not yet prepared, which means that such destructive tsunami risk has not been reduced. Thus, effective tsunami early warning system (TEWS) and appropriate evacuation activity are primary issues as residual risk management.

Globally, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization's (IOC UNESCO) oversees the coordination of the global tsunami warning and mitigation system. Presently, there are 4 systems, each coordinated through Intergovernmental Coordination Groups (ICG) comprised of Member States or Countries. The systems are the: Pacific Tsunami Warning and Mitigation System (ICG/PTWS), Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS), Indian Ocean Tsunami Warning and Mitigation System (ICGIOTWMS), and Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS).

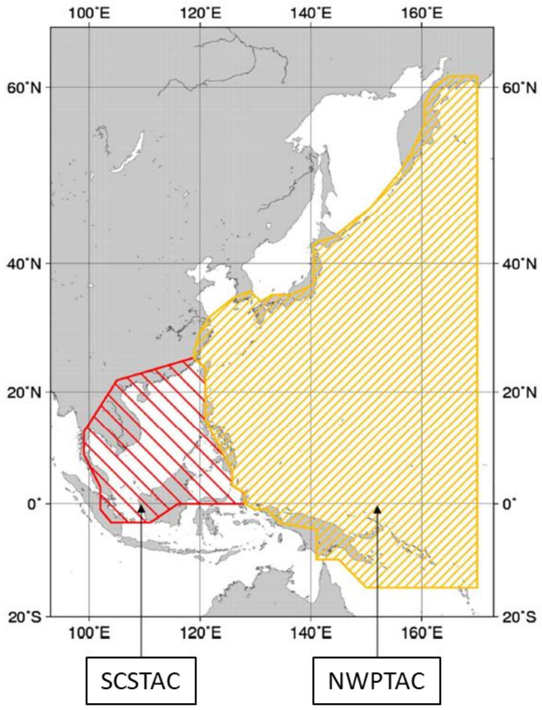
In each region, event information services are provided by Tsunami Service Providers (TSP). The TSPs provide guidance to Country Tsunami Focal Warning Points (TWFP) and their National Tsunami Warning Centers (NTWC). Each country is solely responsible for determining the alert level (such as warning, advisory, watch) for their coasts using the international information and/or their own national assessment.

The current Tsunami Service Providers (TSP) of Pacific Tsunami Warning and Mitigation System (PTWS) are:

- Pacific Tsunami Warning Center (PTWC, operating from 1965)
- Japan Meteorological Agency Northwest Pacific Tsunami Advisory Center (NWPTAC, operating from Mar 2005)
- South China Sea Tsunami Advisory Center (SCSTAC, operating from Nov 2019)
- Central America Tsunami Advisory Center (CATAC, experimental operation from Aug 2019)

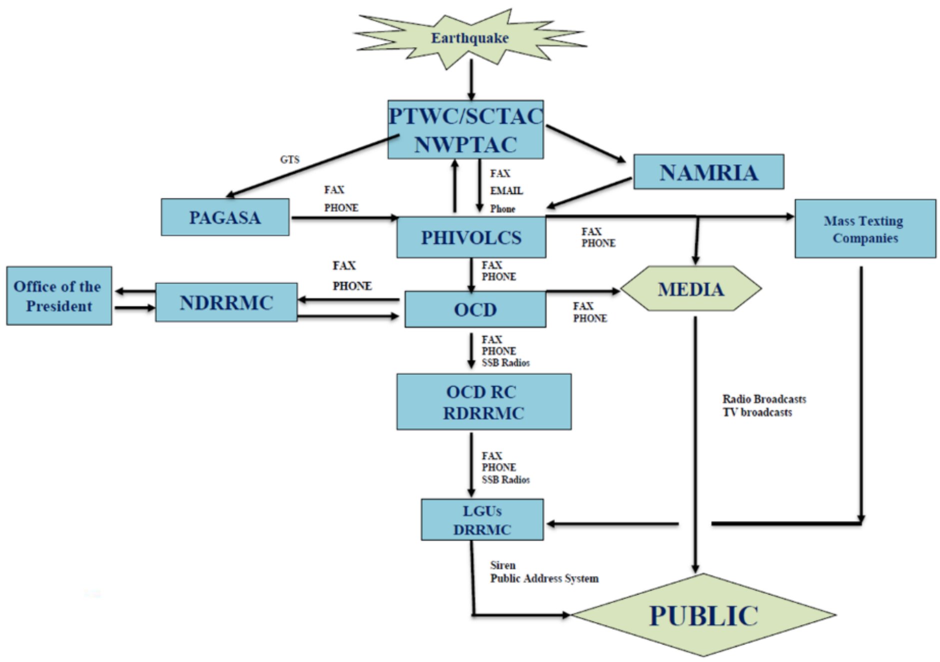
The SCSTAC became fully operational on 5 November 2019, which is the newest addition to the Pacific Tsunami Warning and Mitigation System, the oldest and largest regional tsunami program. This system provides tsunami alerts to Pacific countries and territories via the Pacific Tsunami Warning Center (PTWC) hosted by the United States, and the Northwest Pacific Tsunami Advisory Center (NWPTAC) hosted by Japan. The SCSTAC covers a part of the territory where NWPTAC previously covered since 2005. The demarcation between SCSTAC and NWPTAC is shown in Figure 18.2-17. As shown in the figure, the SCSTAC is responsible for the west coast of the Mindanao island.

Dissemination scheme of tsunami information in the Philippines is shown in Figure 18.2-18. The DOST-PHIVOLCS, as the Country Tsunami Focal Warning Points (TWFP), receives tsunami advisory from the SCSTAC and provides tsunami early warning in the Philippines. PHIVOLCS has been developing the tsunami early warning system (TEWS) in the country, however, the system seems to be still not well coordinated with LGUs. Based on the interview with an officer of city planning and development office of Cotabato City on this project, the city does not have a TEWS.



Source: Japan Meteorological Agency (https://www.jma.go.jp/jma/press/1910/18a/south-china-sea.pdf)

Figure 18.2-17 Demarcation of SCSTAC and NWPTAC from 6 November 2019



Source: DOST-PHIVOLCS Presentation entitled "Tsunami Monitoring in the Philippines", 2019

Figure 18.2-18 Communication Scheme for Trans-Pacific Tsunami Warning Information

18.3 Objectives of DRR Plan

The DRR Plan aims to build a safe and disaster-resilient community by promoting investments to reduce disaster risks and strengthen disaster resilience as shown in Table 18.3-1. This objective is consistent with the seven global targets of the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR), especially focusing on priority action 3, investing in disaster risk reduction for resilience, as presented in Table 18.3-2.

Table 18.3-1 Goal and Objective of DRR Plan

Goal	To build a safe and disaster resilient community by: - preventing new or increasing existing risks - reducing existing disaster risks - managing residual risks (minimizing disaster damage)
Objective	To promote DRR investments by proposing priority actions and projects with time frame and estimated cost based on present condition analysis

Table 18.3-2 7 Global Targets and 4 Priority Actions of SFDRR

7 global targets	(a) Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015. (b) Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015. (c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030. (d) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them, health and educational facilities, including through developing their resilience by 2030. (e) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020. (f) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030. (g) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.
4 priority actions	1)Understanding disaster risk; 2)Strengthening disaster risk governance to manage disaster risk; 3)Investing in disaster risk reduction for resilience; and, 4)Enhancing disaster preparedness for effective response, and to “Build Back Better” in recovery, rehabilitation and reconstruction.

Source: the Sendai Framework for Disaster Risk Reduction 2015-2030

18.4 Strategies of DRR Plan

18.4.1 Preventing/Controlling New or Increasing Risks

At present, most residents of Cotabato City do not live in natural disaster-prone area. Likewise, the urban area of the City lies within the disaster-less or safe area. However, due to pressure caused by continuous population increase and fast-growing economy, Cotabato City has to expand its residential and commercial sites and occupy parts of the declared disaster-prone area. If urbanization expands without an appropriate plan to address any adverse consequence, the exposure to natural hazards will dramatically increase. Once a severe disaster happens, it will cause disastrous damage to the community and will certainly hamper the sustainable development of the City. Even if severe hazards luckily do not occur, the sprawled city will lead to inefficiency in DRR investment in the future. Therefore, it is primarily important to control the probability of increasing the disaster-exposure in the future and to enhance efficient DRR investment by giving due consideration in city development and land-use planning.

Considering the above issue, the Housing and Land Use Regulatory Board (HLURB) of the Philippines, upgraded to the Department of Human Settlements and Urban Development (DHSUD) in 2019, regulates and supports the local government units (LGUs) in cooperation with the Department of the Interior and Local Government (DILG) to develop the comprehensive land use plan (CLUP). A series of CLUP guidebooks were made available and published on the website[9] as shown in Table 18.4-1. A supplemental guideline on mainstreaming climate and disaster risks in the CLUP was issued by DHSUD in 2014. It advocates that CLUP is effective disaster risk reduction instrument which may at the same time result in climate change adaptation and that land use planning is a cost-effective and proactive approach in managing current and future risks considering the high costs of structural measures to address unplanned spatial development. The supplemental guidelines on mainstreaming CCA/DDR in the CLUP also provides the steps in conducting the climate and disaster risk assessment (CDRA) and the process of formulating a risk sensitive land use plan including implementation of the CLUP and zoning ordinance (ZO). The consistency with the HLURB Guidelines on CLUP preparation is strongly encouraged by the DILG memorandum circular No. 2015-77 issued on 21st July 2015[10]. The DILG memorandum circular also provides that "to ensure that identified programs and projects that would address disaster and climate risks are implemented, these should be included in the Local Development Investment Program (LDIP) and the Annual Investment Program (AIP)". Besides, pursuant to Section 21 of Republic Act No. 10121, LGUs shall set aside not less than 5% of the estimated revenue from regular sources as the Local Disaster Risk Reduction and Management (LDRRM) Fund for disaster preparedness.

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[9] http://hlurb.gov.ph/services/local-government-unit/clup-guidebook/

[10] https://dilg.gov.ph/issuances/mc/Guidelines-on-Mainstreaming-Climate-Change-Adaptation-and-Disaster-Risk-Reduction-in-Local-Development-Planning-/2165

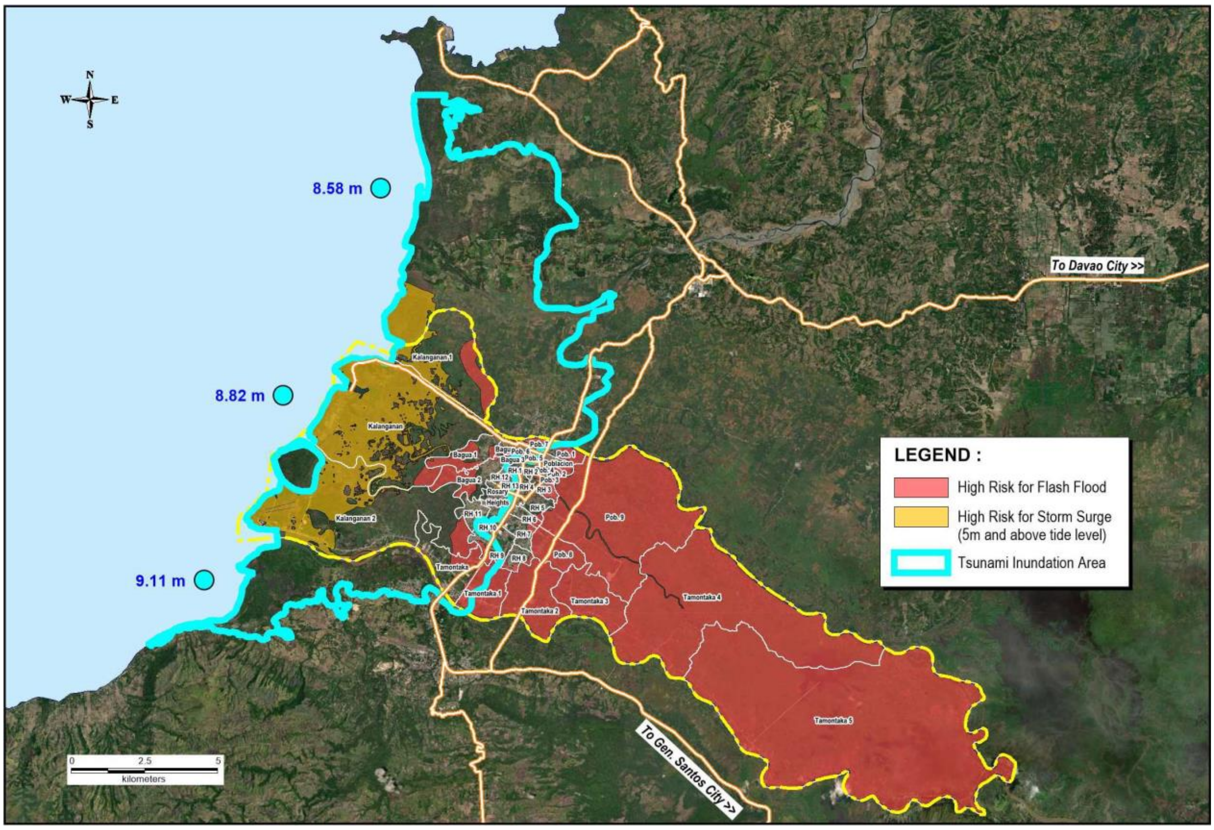
Table 18.4-1 Guidebooks and Frameworks by HLURB

Title	Year
CLUP Guidebook vol.1 -The Planning Process	2013
CLUP Guidebook vol.2 -Sectoral Analysis and Tools for Situational Analysis	2014
CLUP Guidebook vol.3 -Model Zoning Ordinance	2014
CLUP Guidebook -Supplemental Guideline on Mainstreaming CCA/DRR in the CLUP	2014
CLUP Guidebook -Supplemental Guidelines on Mainstreaming Sustainable Land Management in the CLLUP	2019
Planning Strategically -Guidelines for the Application of the Strategic Planning Process in the Preparation of the CLUP and to Important Urban Area Issues and Problems	2001
National Urban Development and Housing Framework 2017-2022	2017
CLUP GIS Guidebook	2007

Again, Cotabato City plans to expand its residential and commercial area to disaster-prone area in line with the previous CLUP 2011-2020, however, when the CLUP was formulated, the process of mainstreaming CCA/DRR in CLUP was not sufficiently established since the guidelines was only made available in 2014. Thus, it is the time to revise the CLUP in 2020 and to reconsider better land-use planning based on current and future disaster risks. In line with the CLUP, river planning for the rivers in Cotabato City is also quite important including flood control plan, river channel and course plan, and rain-storm drainage plan.

18.4.2 Reducing Existing Disaster risks

Based on the disaster risk information on magnitude, frequency, area, and impact presented in previous related studies or plans, the most critical disaster risks to address in Cotabato City are flood, earthquake, and tsunami. Identified hazard areas of main disasters are shown in Figure 18.4-1.



Source: Created by the JICA Study Team based on CLUP (2011-2022) for flash flood; Project NOAH DOST for storm surge, PHIVOLCS for tsunami

Figure 18.4-1 Identified Main Hazards by Previous Studies

Conceivable effective countermeasures against flood, earthquake and tsunami are shown in Table 18.4-3. Among them, the red-colored actions or measures are considered as high priority for DRR investments based on their impacts, urgency and feasibility, the needs of Cotabato City, the consistency with regional or city's development plan and policies, and the SFDRR's seven global targets. In terms of preventing or mitigating existing disaster risks, the following measures are recommended.

Table 18.4-2 Basic Strategy to Prevent or Mitigate Disaster Risks for Cotabato City

Disaster	Priority Measures for Prevention and Mitigation
Flood	➢ River improvement (dredging/ excavation) and land raising with the sediments ➢ Building dikes, gates, drainage pumps, flood diversion channels ➢ Construction of flood fighting stations ➢ Conservation of natural retarding basins
Earthquake	➢ Seismic strengthening for priority facilities (public buildings, critical infrastructures, etc.) ➢ Building the designated emergency roads for the transportation of disaster related goods, machines, etc.
Tsunami	➢ Building road dike ➢ Conservation of coastal mangrove forests

Table 18.4-3 Examples of Countermeasures for Cotabato City and its Vicinity

Disaster	Structural Measures	Non-Structural Measures
All	➢ Building evacuation centers ➢ Improving the access to evacuation centers ➢ Building the designated emergency roads for the transportation of disaster related goods, machines, etc. ➢ Building wide-area disaster-preparedness station	➢ Improving disaster hazard and risk assessment ➢ Mainstreaming DRR in all relevant plans ➢ Regulating building code for resilient buildings to disasters ➢ Planning contingency plan, evacuation plan, business continuity plan, timeline of disaster response, etc. ➢ Education for better understanding of disaster risks and evacuation ➢ Evacuation drills ➢ Socioeconomic policies such as safety nets, risk transfer mechanisms, like insurance ➢ Enhancing disaster resilient buildings by subsidy system or tax benefits
Flood	➢ River improvement (river dredging/ excavation, etc.) ➢ Building (ring) dikes, gates, drainage pumps ➢ Building flood diversion channels, cut-off channels ➢ Construction of dams, retarding basins ➢ Construction of retention pond for large buildings ➢ Construction of flood fighting station ➢ Elevating basement of houses and buildings (Land raising using dredged sediments, etc.) ➢ Building the facilities for rain-storm storage ➢ Building the facilities for enhancing rainfall percolation	➢ Developing river planning including flood control plan, river channel and course plan, rain-storm drainage plan, etc. ➢ Developing a Flood Forecasting and Warning System (FFWS) ➢ Conservation of natural retarding basins ➢ Complying the easement of rivers and drainage channels ➢ Operation and maintenance of rivers and drainage channels (cleaning, dredging, de-clogging, repairing, etc.) ➢ Resettlement from flood-prone area
Earthquake	➢ Seismic strengthening for priority facilities (public buildings, critical infrastructures, etc.) ➢ Foundation improvement (soil stabilization) works especially within land reclamation	➢ Developing a plan for earthquake countermeasures ➢ Developing an emergency earthquake alert system ➢ Issuing the designated emergency road and open spaces to prevent secondary disasters and to enhance disaster-response activities ➢ Conducting seismic capacity assessment of buildings
Tsunami	➢ Building offshore breakwater, coastal dike, estuary barrages ➢ Building road dike ➢ Land raising for residential area	➢ Developing a plan for tsunami countermeasures ➢ Developing a Tsunami Early Warning System (TEWS) ➢ Conservation of coastal mangrove forests ➢ Resettlement from tsunami-prone area

*Highlights by red color means selected prior measures for DRR investments
Source: JICA Study Team

18.4.3 Managing residual risks

Residual risks widely vary by location (country, area, etc.) and by time and depend on current structural stocks for disaster risk reduction in the area. Therefore, residual risks should be clarified by studying current and future hazards and by studying existing plans on disaster risk management and existing structural stocks for disaster risk reduction.

Structural measures to prevent or mitigate disaster risks in Cotabato City had not been much realized in the past due to huge capital outlay requirements hardly able to provide by the government then. But this time, the national government through the "build, build, build" program with strong support from the local government units is determined to pursue these structural measures. Hence, the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects are going to be implemented in the next 5 years. After the completion of these projects, the flood risk in the target area is expected to decrease with the target safety level at 100-year return period including climate change impacts. While any specific plan to reduce risks of earthquake and tsunami does not exist in the meantime.

Noted as the scope of DRR plan in Table 18.1-1, disaster-preparedness activities for minimizing disaster loss or damage are targeted on residual risk management in this DRR plan. Accordingly, enhancing evacuation activities by developing early warning system and by improving the access to evacuation facilities is being pursued in this DRR plan.

Table 18.4-4 Basic Strategy to Minimize Disaster Damage for Cotabato City

Disaster	Priority Measures to Minimize Disaster Damage
Flood	➢ Developing a Flood Forecasting and Warning System (FFWS) ➢ Building evacuation facilities
Earthquake	➢ Developing an emergency earthquake alert system
Tsunami	➢ Developing a Tsunami Early Warning System (TEWS) ➢ Building evacuation facilities and improving their access

18.5 Disaster Risk Reduction (DRR) Plan

18.5.1 Overview of the proposed projects

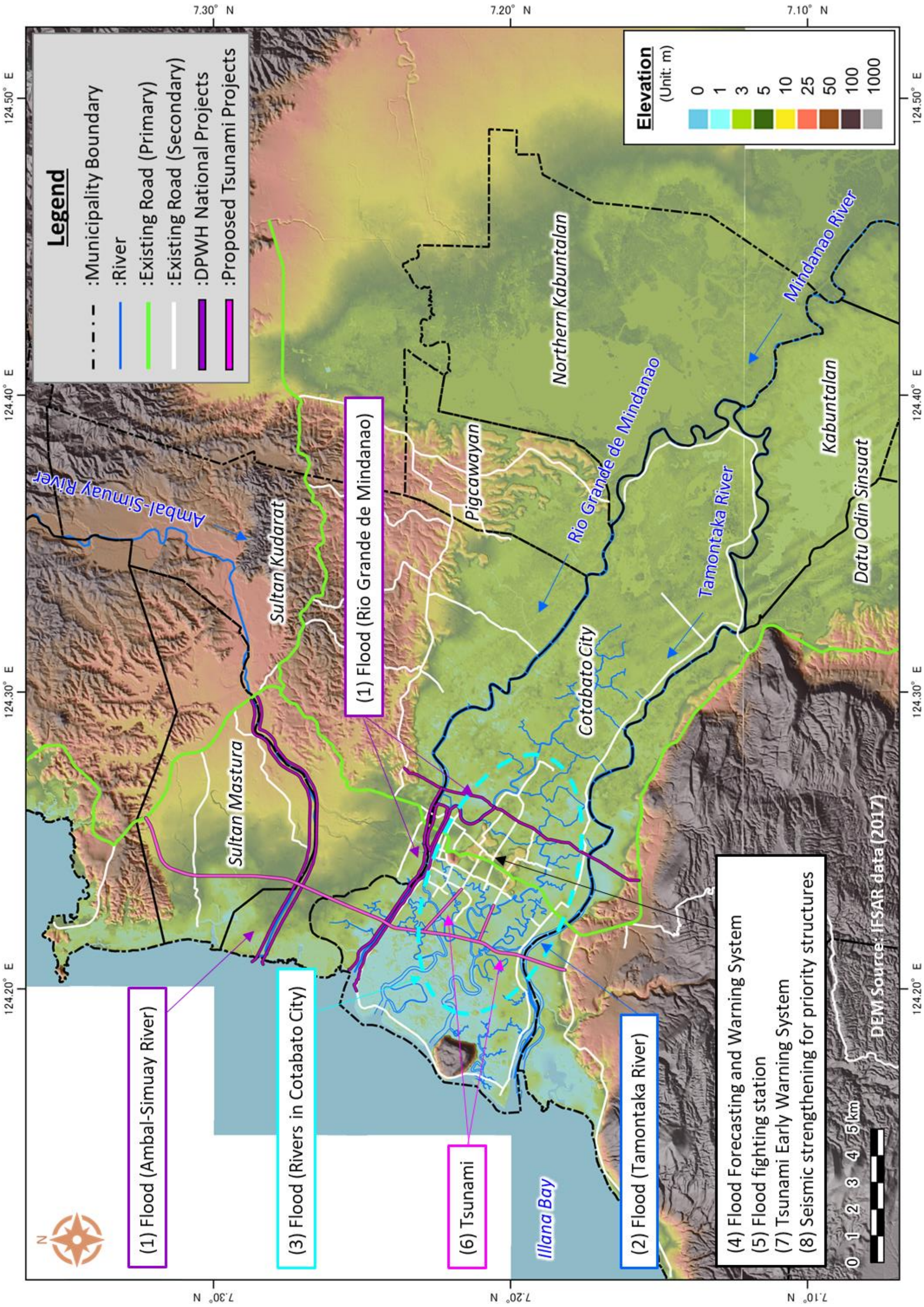
Based on the strategy of DRR Plan as described in the previous section, priority projects were selected including the ongoing DPWH national flood control projects (Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects) as presented in Table 18.5-1. Overview of the proposed priority projects is shown in Figure 18.5-1. More details are explained in the following subsections.

Table 18.5-1 Proposed Priority Projects in DRR Plan

No.	Target Disaster	Proposed Priority Projects	Project Components	Relevant Strategy[1]	SFDRR[2]
1	Flood	Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects (ongoing; led by DPWH national)	for Ambal-Simuay River - River widening, dredging, excavation - Improving the existing cut-off channel - Construction of parallel dikes for Rio Grande de Mindanao - River dredging - Construction of parallel dikes/retaining walls - Construction of road dike (CCEDR) - Construction of gates	1, 2	a, b, c, d
2	Flood	Tamontaka River Flood Control Project	- Basic survey (river cross-section, etc.) - River planning (flood control plan, river improvement plan) - Implementing priority flood control projects	1, 2	a, b, c, d, (f)
3	Flood	Project for Flood Control and Drainage Improvement in Cotabato City	- Basic survey (river cross-section, etc.) - River planning (flood control plan, river improvement plan, rain-storm drainage plan) - Implementing priority flood control projects	1	a, b, c, d, (f)
4	Flood	Project for Developing Flood Forecasting and Warning System for the Lower Mindanao	- Developing flood forecasting and warning system (FFWS) - Capacity development on FFWS	3	a, (f), g
5	Flood	Project for Enhancing Flood Response Capacity of Cotabato City	- Building flood fighting stations - Capacity development for flood response and dike management	3	a, b, c, d, (f)
6	Tsunami	Project for Building Tsunami Disaster Resilient Community	- Building road dike - Building tsunami evacuation facilities and access roads - Capacity development for tsunami preparedness	1, 2	a, b, c, d, (f)
7	Tsunami	Project for Strengthening Capacity of Tsunami Early Warning System	- Developing tsunami early warning system (TEWS) - Capacity development on TEWS	3	a, (f), g
8	Earthquake	Project for Building Earthquake Disaster Resilient Community in Cotabato City	- Basic survey for the ratio of earthquake-resistant public buildings and critical infrastructures - Planning for improving earthquake resistance - Seismic strengthening for priority structures	1, 2	a, (c), d, (f)

1) The number of in the column of the relevant strategy means; 1:Preventing/controlling new or increasing risks, 2:Reducing existing disaster risks, 3:Managing residual risks

2) The column shows contribution for the seven global targets of SFDRR 2015-2030 which are shown in Table 18.3-2. The parenthesis means possible contribution for the target.



Source: JICA Study Team

Figure 18.5-1 Overview of Proposed Priority Projects (Including Existing DPWH National Projects)

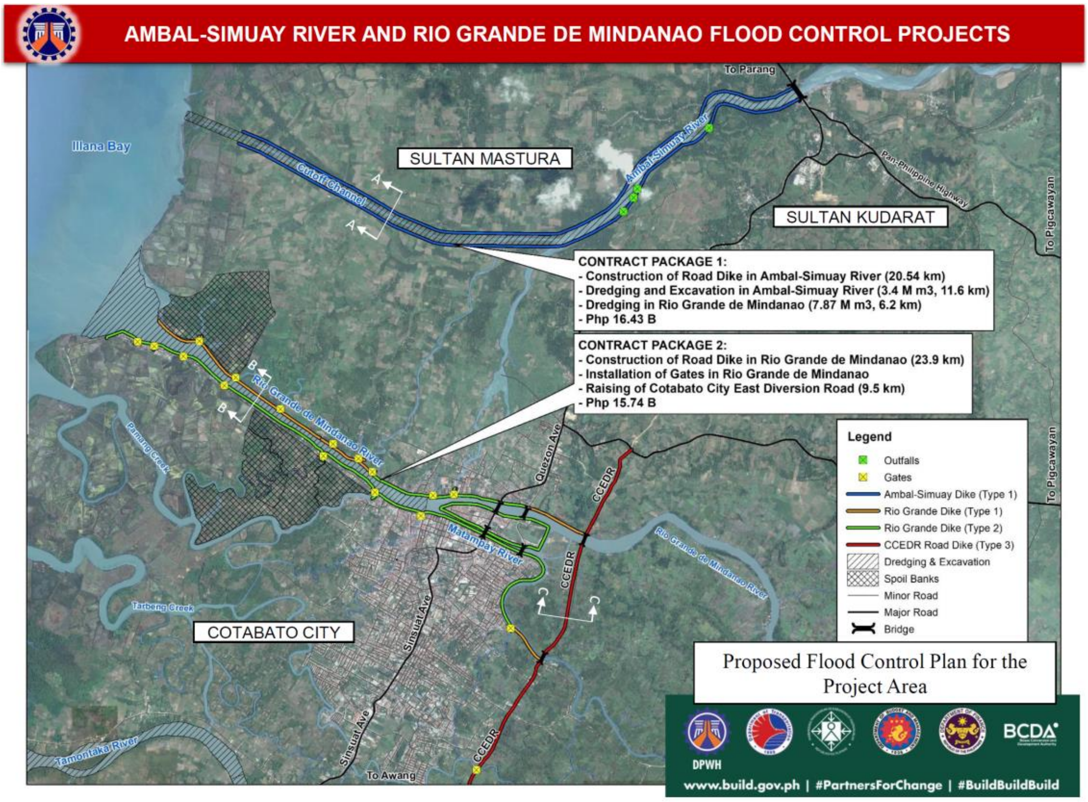
18.5.2 Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects

As noted in the subsection 18.2.2, Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects (hereinafter referred to as DPWH national project) is ongoing based on the feasibility study on the flood control plan for Rio Grande de Mindanao River and Ambal-Simuay River conducted by local consulting firm, Woodfields Engineers Company, completed in April 2017. The DPWH national project consists of the two contract packages (CP): Project for the Ambal-Simuay River as CP1 and Project for Rio Grande de Mindanao as CP2 as shown in Figure 18.5-2. DPWH plans to implement the project with China loan, but the process of procurement of implementing firm and loan signing is behind schedule. The DPWH national project is summarized as shown in Table 18.5-2.

Table 18.5-2 Summary of the Ambal-Simuay and Rio Grande de Mindanao Flood Control Project

Project Description	(as of 30 April 2019) The project involves the construction of various flood management infrastructures such as dikes/revetments and flood gates and conducting channel dredging among others. Detailed description of the scope of works for each component: For Ambal-Simuay: - River widening and construction of parallel dikes along the river to the cut-off channel - A new channel with a dike-to-dike width of 250 meters - Dredging and excavation of an estimated 2.87 million m^3 of materials to achieve the design river width, covering a total length of 11.2 km - Construction of an 11.6-km dike and a 9.1-km dike along the left and right banks, respectively For Rio Grande de Mindanao: - Channel dredging and construction of dikes, retaining walls and flood gates - Dredging works covering a total length of 6.1 km and an estimated volume of 7.87 million m^3 of dredged materials - Construction of the dikes and retaining walls with a total length of 25 km - Installation of flood gates at every entrance or exit of the creeks connected to Rio Grande de Mindanao, with 23 flap gates
Project Impact	➢ It will mitigate frequent flooding in the flood vulnerable areas along Mindanao River Basin (MRB) specifically the Province of Maguindanao, Cotabato & parts of Sultan Kudarat & Cotabato City. ➢ It will prevent harmful degradation of riverbed. ➢ It will enhance economic activities of about 4 to 9 million people living within the geographic coverage of MRB.
Cost	39,219.68 million PhP (total)
Timeline	2020-2025
Project Status	(as of 31 July 2020) - Certificate on Non Coverage (CNC) for both Ambal-Simuay River and Rio Grande de Mindanao River were already issued by DENR. - Notice to Proceed was issued to Woodfield Consultants Inc. on August 7, 2019 for the Consulting Services for the Preparation of LAPRAP. - Approval of Conceptual Design for Contract Package 1 (CP1) and Contract Package 2 (CP2) on July 16, 2019 and August 9, 2019, respectively. - Meeting with Department of Finance (DOF) and China International Development Cooperation Agency (CIDCA) regarding Exchange of Notes on Cooperation Procedures for Award of Concessional Loans on September 06, 2019. - Shortlist of Chinese Contractors were issued by the Chinese Government on January 23, 2020. - Conceptual Designs Tender, Bid Documents, Terms of Reference (TOR) for Design and Build and Approval Budget for the Contract for CP 1 and CP 2 were already approved. - Ongoing procurement of Chinese Contractors (Civil Works) and Local Consultants (consultancy). - Target Schedules: Loan Signing August 2020 to October 2020, Land Acquisition August 2019 to May 2021, Design and Build October 2020 to February 2025.

**Source: The project description and cost are based on the infrastructure flagship projects as of April 30, 2019 approved by NEDA Board. The other information was collected by JICA Study Team.*



Source: DPWH Presentation entitled "Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects", 2018

Figure 18.5-2 Overview of the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects

18.5.3 Tamontaka River Flood Control Project

(1) Background

While the flood control project for Rio Grande de Mindanao is now underway, no specific flood control project for the Tamontaka River is being pursued. Since the Mindanao river bifurcates into Rio Grande de Mindanao and the Tamontaka River, the flood control plan and project for the Tamontaka River should be undertaken consistent with that of Rio Grande de Mindanao. The Tamontaka River also sometimes causes flooding in Cotabato City, just like Rio Grande de Mindanao. Therefore, finding solutions to flood problems in the City would necessarily consider also flood control projects for the Tamontaka River.

As described in the subsection 18.2.2(1) , the cut-off channel to divert excess flood waters from Rio Grande de Mindanao to Tamontaka River was proposed in the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP). This indicates that the flow capacity of the Tamontaka River has more room to prevent overflowing than that of Rio Grande de Mindanao. However, the flow capacity of both rivers was not clearly presented in the MRBIMDMP. Hence, supplemental detailed studies and planning are urgently needed for the Tamontaka River as bases for any appropriate structural measures that should be implemented.

(2) Objectives

The objectives of the project are:

(i) to conduct basic survey for the Tamontaka River including river cross-section and bathymetric survey and river-bed material survey;

(ii) to develop a flood control plan for the Tamontaka River;

(iii) to develop a river channel and course plan for the Tamontaka River based on consultations with DPWH, relevant LGUs and all stakeholders;

(iv) to implement priority structural measures for flood prevention and mitigation.

(3) Project Summary

Target Area	Tamontaka River
Implementing Agency	DPWH (National)
Project Component	➢ Basic survey (river cross section, bathymetry, river-bed material, etc.) ➢ River planning (flood control plan, river channel & course plan, etc.) ➢ Implementation of structural measures (the structural measures are selected in the developed flood control plan)
Timeline	➢ Master Plan and Feasibility Study (about 1.5 years in 2021-2022) ➢ Detailed Design Study (about 1 year in 2023-2025) ➢ Project Implementation (about 5 years in 2025-2032)

At first, a flood control plan should be developed through the review of the master plan of the Mindanao River (2012) and the feasibility study for the Ambal-Simuay and Rio Grande de Mindanao Flood Control Project (2017). As noted in subsection (1) , the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP, 2012) did not provide the basic information for planning structural measures, such as target safety level, design flood hydrograph, flood-water allocation plan, design high-water level, etc. On the other hand, in the feasibility study on the flood control plan for Rio Grande de Mindanao river and Ambal-Simuay River (hereinafter referred to as the FS) published in April 2017, the target safety level was set to 100-year return period including the climate change impact on rainfall by increasing the design hyetograph by 10 % based on the DPWH Design Guidelines, Criteria, and Standards (DGCS) Volume 3. The design hydrograph was also determined at the mouth of Rio Grande de Mindanao in the FS, however, the rainfall-runoff analysis for the Mindanao river seemed conducted with very limited hydrometeorological observation data and geological surveyed data. Accordingly, a flood control plan including target safety level, design of flood hydrograph, flood-water allocation plan, design of high-water level in the whole river-basin scale should have been developed.

To develop the flood control and river channel and course plan for the Tamontaka River, the plan should be consistent with the ongoing Ambal-Simuay and Rio Grande de Mindanao Flood Control Project whose strategy is to construct continuous dike along both left and right banks in the downstream of the Cotabato City East Diversion Road (CCEDR). In principle, the construction of ring dike along inside of Rio Grande de Mindanao as north, the Tamontaka River as south, the

CCEDR as east, and the proposed west diversion road (WDR) as west will be recommended considering the hydrological characteristic of the Mindanao river downstream and increasing flood risks in the future caused by climate change and watershed development at the upstream. On the other hand, flood control measures should be consistent with national policies, strategies, plans and technical ideas of concerned LGUs and local residents. Thus, the flood control and river channel and course plan should be carefully studied and developed.

In the development of the flood control plan for the Tamontaka River, priority structural measures are to be selected by comparing flood control options by their impact, feasibility, cost-benefit performance, etc. Then, the implementation plan for the priority structural measures identified shall be developed, and these proposed projects shall be implemented, accordingly.

(4) Expected outputs

The flood control plan and river channel and course plan for the Tamontaka River are expected to be developed. Along these developed plans, the priority structural measures for flood prevention and mitigation are then selected and implemented.

With the completion of the selected structural measures for the Tamontaka River and of the Ambal-Simuay river and Rio Grande de Mindanao flood control projects, the flood risk brought by the Mindanao river is expected to be reduced at the target safety level.

18.5.4 Flood Control and Drainage Improvement Project in Cotabato City

(1) Background

Due to high risk of floods from the Mindanao River downstream, most people of Cotabato City at present do not live in flood-prone areas but rather reside in relatively higher land, such as in PC hill or natural embankments. Thus, rivers and creeks in Cotabato City are almost still in their natural condition, and there is no existing flood control plan, river channel and course plan and rain-storm drainage plan.

However, due to pressure from population increase and economic development, Cotabato City is going to expand its residential and commercial areas to flood-prone areas. If urbanization expands without appropriate river planning, the exposure to natural hazards will dramatically increase in the near future. Occurrence of massive floods could cause disastrous damage to the community and hamper sustainable development of the City. Therefore, the flood control plan, river channel and course plan and rain-storm drainage plan should be urgently formulated consistent with the city development plan and the comprehensive land-use plan (CLUP) of Cotabato City before allowing the expansion of urban sites within identified flood-prone areas in the city. Effective and efficient structural and non-structural measures for flood prevention and mitigation should be implemented according to these formulated plans.

(2) Objectives

The objectives of the project are:

(i) to conduct basic survey for the natural rivers and creeks in Cotabato City;

(ii) to develop a flood control plan and a river course plan for the natural rivers and creeks;

(iii) to develop a rain-storm drainage plan for the planned development areas identified in the CLUP;

(iv) to implement priority structural measures for flood prevention and mitigation.

(3) Project Summary

Target Area	Cotabato City
Implementing Agency	DPWH (National/Regional), Cotabato City LGU
Project Component	➢ Basic survey (river cross section, bathymetry, river-bed material, etc.) ➢ River planning (flood control plan, river channel & course plan, rain-storm drainage plan, etc.) ➢ Implementation of structural measures (the structural measures are selected in the developed flood control plan)
Timeline	➢ Master Plan and Feasibility Study (about 1.5 years in 2021-2022) ➢ Detailed Design Study (about 1.5 years in 2023-2025) ➢ Project Implementation (about 3 years in 2026-2031)

The project consists of three stages: (i) master plan and feasibility study stage; (ii) detailed design stage; and (iii) project implementation stage. The first stage includes river cross-section survey for major natural creeks (Matampay, Tarbung, etc.), flood control and drainage improvement planning, prioritization of structural measures for flood prevention and mitigation, strategic environment assessment (SEA) implementation and feasibility study for the selected priority projects.

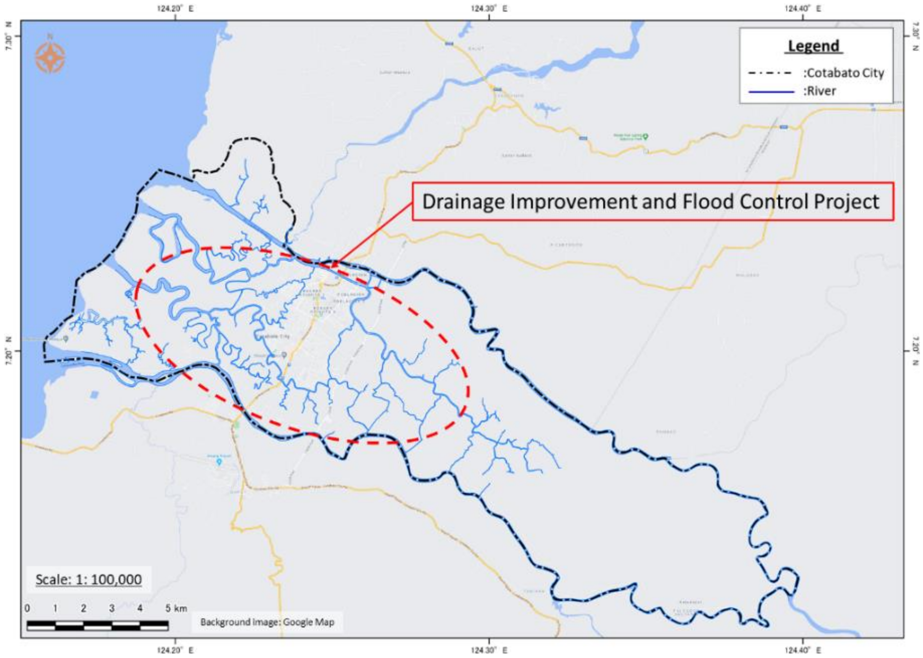
The second stage includes detailed design of the selected structural and non-structural measures and identification of support mechanism for land acquisition and resettlement action plan (LARAP).

The third stage includes implementing the selected structural and non-structural measures and monitoring the resettlement action plan (RAP). Throughout the project, special consideration shall be devoted for socially vulnerable people and natural environment conservation.

(4) Expected Outputs

A flood control plan, river channel and course plan and rain-storm drainage plan are targeted to be developed. Based on these developed plans, priority structural measures shall be selected by comparing flood control options by their impact, feasibility, cost-benefit performance, and others. Then, the implementation plans for the selected priority structural measures will be prepared, and the proposed projects will be implemented, accordingly.

The project is expected to contribute to building a safe and a disaster-resilient community in Cotabato City by controlling the exposure increase to floods and by implementing structural measures for flood prevention and mitigation. Such good practices for disaster risk reduction in Cotabato City can also be expected to be emulated by neighboring regions.



Source: JICA Study Team

Figure 18.5-3 Project Location Map (Project No.3)

18.5.5 Project for Developing Flood Forecasting and Warning System for the Lower Mindanao

(1) Background

Due to large capital investment requirements not able to provide substantially by the government in the past years, the implementation of structural measures for flood prevention and mitigation has not been given much priority in the Mindanao river basin. Accordingly, flood residual risk in the lower Mindanao almost remains in its natural condition at present.

The Ambal-Simuay River and Rio Grande de Mindanao Flood Control Projects are going to be implemented in the next 5 years. After the project completion, the flood risk in the target area is expected to decrease with the target safety level at 100-year return period including climate change impacts. However, even after the completion of all feasible structural measures, the occurrence of flood risks cannot be totally eliminated. Therefore, there remains a continuing need to develop or maintain preparedness, and response and recovery activities to minimize the damages and the negative impacts from the extreme floods over the target safety level.

In terms of minimizing casualties and affected people by floods, developing a flood forecasting and warning system (FFWS) and enhancing evacuation activity are the most effective solution and must form part of the residual risk management. FFWS is very important not only for evacuating people but also for government DRRM staff and volunteer groups to take proactive and quick actions against floods.

(2) Objectives

The objectives of the project are:

(i) to develop flood forecasting and warning system (FFWS) in the lower Mindanao;

(ii) to strengthen the capacity of PAGASA regional staffs and LGU relevant staffs.

(3) Project Summary

Target Area	Mindanao River downstream
Implementing Agency	PAGASA (National/Regional)
Project Component	➢ Establishment of flood forecasting and warning system (FFWS) ➢ Capacity development on the management of FFWS
Timeline	➢ Preparatory Survey (about 1 year in 2021-2022) ➢ Detailed Design and Procurement of FFWS (about 1.5 years in 2023-2024) ➢ Capacity Development (about 2.5 years in 2024-2026)

The project consists of three stages: (i) preparatory survey stage; (ii) detailed design and procurement stage; and (iii) capacity development stage. In the first stage, a plan for establishing FFWS in the lower Mindanao should be developed through the review of the master plan of the Mindanao River. As noted in subsection (4) , the development of early warning and flood forecasting system (EWFFS) was proposed as one of the 10 priority projects in the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP, 2012), and the pre-feasibility study was conducted by PAGASA. However, the system has not been established yet as of this time, hence, a plan for promoting FFWS establishment as soon as possible should be developed. The first stage also includes cost and impact analysis of the proposed FFWS.

The second stage focuses on the detailed design and procurement for the proposed FFWS.

The third stage involves capacity development on (a) operation and maintenance of FFWS; and (b) further development of FFWS. A set of guidelines or manual of operations pertaining to FFWS shall also be developed along the capacity development. The third stage also includes the evacuation drills based on the developed FFWS.

(4) Expected Outputs

Flood forecasting and warning system (FFWS) for the lower Mindanao will be established. Subsequently, the capacity enhancement of relevant staff of PAGASA on the operation and maintenance of the FFWS and on further development of the FFWS will be conducted. The establishment of FFWS and the capacity development of the operational staff will greatly enhance the evacuation activities of local people with proactive and quick response of government DRRM staff and other volunteer groups and individuals.

18.5.6 Project for Enhancing Flood Response Capacity

(1) Background

An emerging flood risk in the near future may occur because Cotabato City is expanding its residential and commercial areas within flood prone areas. This may happen due to limited available high ground areas in the City as presented in the CLUP. And the Ambal-Simuay River and Rio Grande de Mindanao Flood Control Project is going to construct new dikes along the most downstream of the Rio Grande River. Since there was no existing dike in the area, indigenous knowledge nor accumulated experiences on operation and maintenance of dikes are not yet available to local people. On the other hand, the flood hydrographs of the Mindanao downstream tend to have large discharge for long time. Hence, upon completion, the constructed dikes will be under the high risk of dike breach, and once a dike breach happens, it will cause disastrous damage to the community. Therefore, a system for flood fighting and responding to prevent or mitigate dike breach should be developed sooner than the completion of dike construction.

Japan has a long history of flood fighting activities. One of the developed solutions to combat the risk of flooding is to construct a flood fighting station to enhance flood fighting activities. The station is also utilized as venue for educating local people for better understanding of disaster risks and evacuation activities and for implementing evacuation drills. The image and role of flood fighting station is shown in Table 18.5-3. The construction of flood fighting station can work as a base not only for flood fighting during time of emergency but also for educational activities during normal condition.

As dike system is still not much widespread in the Philippines, the knowledge on monitoring and maintenance of dikes should also be technically transferred to the concerned staff of DPWH regional office and LGUs. Therefore, the technical assistance for the capacity development on dike management, to include (i) monitoring and maintenance; (ii) flood fighting; and (iii) evacuation activity, is hereby proposed in addition to the construction of a flood fighting station.

Table 18.5-3 An Example of Flood Fighting Station

Image	Role
	➢ Material Storage for Urgent Restoration Works ➢ Emergency Vehicle Base ➢ Working Space for Restoration Works ➢ Heliport ➢ Establish Local Headquarters in emergency ➢ Evacuation Place for Local People etc.
	➢ Community Space for Local People ➢ Education Facility for Better Understandings of Disaster Risks and of Evacuation Activity ➢ Implementation of Evacuation Drill etc.

Source: The pictures are cited from the river management office for the Tone river upstream of MLIT, Japan

(2) Objectives

The objectives of the project are:

(i) to study the feasibility of constructing a flood fighting station in Cotabato City;

(ii) to conduct the detailed design of flood fighting station;

(iii) to construct a flood fighting station;

(iv) to develop the guidelines or manual for monitoring and maintenance of dikes and for flood fighting;

(v) to strengthen the capacity of concerned offices and staff on dike management and flood fighting activities.

(3) Project Summary

Target Area	Cotabato City
Implementing Agency	DPWH (National/Regional), Cotabato City LGU
Project Component	➢ Construction of flood fighting station ➢ Capacity development on dike management and flood fighting activities
Timeline	➢ Preparatory Survey and Design (about 2 years in 2021-2023) ➢ Construction of flood fighting station (about 2 years in 2024-2025) ➢ Capacity Development (about 3.5 years in 2025-2028)

The project consists of three stages: (i) preparatory survey stage; (ii) detailed design and construction stage; and (iii) capacity development stage. The first stage includes planning for the construction of a flood fighting station (location, capacity, basic design, etc.) and the systematization in the legal and organizational structures. Cost and impact analysis is also included in the preparatory survey.

The second stage includes the detailed design, procurement and construction of the flood fighting station.

The third stage includes capacity development on (a) monitoring and maintenance of dikes in normal condition; and (b) flood fighting activities in flood condition. A set of guidelines or manual of operations shall also be developed along with the capacity development. The third stage also includes the conduct of drills for flood fighting and evacuation activities.

(4) Expected Outputs

In addition to the construction of a flood fighting station, the capacity of concerned offices and their staff on dike management, particularly on monitoring and maintenance under normal condition and flood fighting activities under flooding situation is expected to be greatly enhanced. The capacity development on dike management is vitally important because the construction of dikes is one of the priority structural measures being proposed for flood prevention and mitigation considering the natural condition in the lower Mindanao. At present, the knowledge and skills on dike management of concerned offices are still insufficient due to lack of experience in dike management.

18.5.7 Project for Building Tsunami Disaster Resilient Community

(1) Background

Earthquake and tsunami disasters are identified as the first priority hazards by the Cotabato City Disaster Risk Reduction Management Council (CCDRRMC) in 2016. Although earthquake and tsunami have less frequency of occurrence than floods in Cotabato City, nonetheless, earthquake and tsunami were ranked first among natural hazards because of their disastrous impact once experienced in a community. The 1976 Moro Gulf Earthquake (Magnitude 8.1) is often called as "the most destructive tsunami event in the Philippines"[11] and killed more than seven thousand people in the coastal areas of Southern Mindanao. It was reported that about 90% of the total number of casualties had perished due to tsunami[12].

Since the coastal area of Illana Bay lies in proximity to the Cotabato trench, the coastal area is highly exposed to tsunami impacts. Besides, tsunami waves will preferentially run-up rivers and expand damage along the rivers. Despite of this, there are no structural measures that had been

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[11] DOST-PHIVOLCS website

[12] The factor analysis on water-related disasters in the Philippines, the Public Work Research Institute (PWRI) of Japan, 2007

put up so far in the area against the risks of tsunami. One of the main reasons for this was that structural measures, such as coastal dike requires large investment, coupled with the lack of existing policies and plans by the government for tsunami defense.

Cotabato City as the regional center of BARMM plans to expand its urban area to accommodate its increasing population and fast-growing economy. It is therefore the perfect time to build road dikes as part of tsunami defense, along with a new road construction project. The concept of tsunami defense is to make the community resilient to tsunami disaster through the combination of structural and non-structural intervention on the premise that tsunami damage cannot be completely prevented alone by structural measures.

(2) Objectives

The objectives of the project are:

(i) to develop a master plan for tsunami defense;
(ii) to study the feasibility and conduct the detailed design of structural measures for Tsunami disaster risk reduction;
(iii) to construct road dikes, evacuation roads, and evacuation facility;
(iv) to enhance the disaster risk governance of the Office on Civil Defense (OCD) and LGUs against tsunamis.

(3) Project Summary

Target Area	Coastal Areas of the 4 LGUs (Sultan Mastura, Sultan Kudarat, Cotabato City, Datu Odin Sinsuat)
Implementing Agency	DPWH (National), OCD, LGUs
Project Component	➢ Construction of road dike, evacuation roads & facilities ➢ Capacity development on tsunami-disaster preparedness
Timeline	➢ Feasibility Study (about 1.5 years in 2021-2022) ➢ Detailed Design Study (about 2.5 years in 2023-2025) ➢ Project Implementation (about 5 years in 2026-2030) ➢ Capacity Development (about 2 years in 2029-2030)

The project consists of three stages: (i) feasibility study stage; (ii) detailed design stage; (iii) project implementation stage; and (iv) capacity development stage. The first stage includes planning for basic design of road dike (height, tsunami-resistant structure, etc.), evacuation roads, and evacuation facility (capacity, necessary disaster-aid equipment and goods, management plan, etc.). Cost and impact analysis is also included in the feasibility study.

The second stage includes studying detailed design of the selected structural measures and support for land acquisition and resettlement action plan (LARAP).

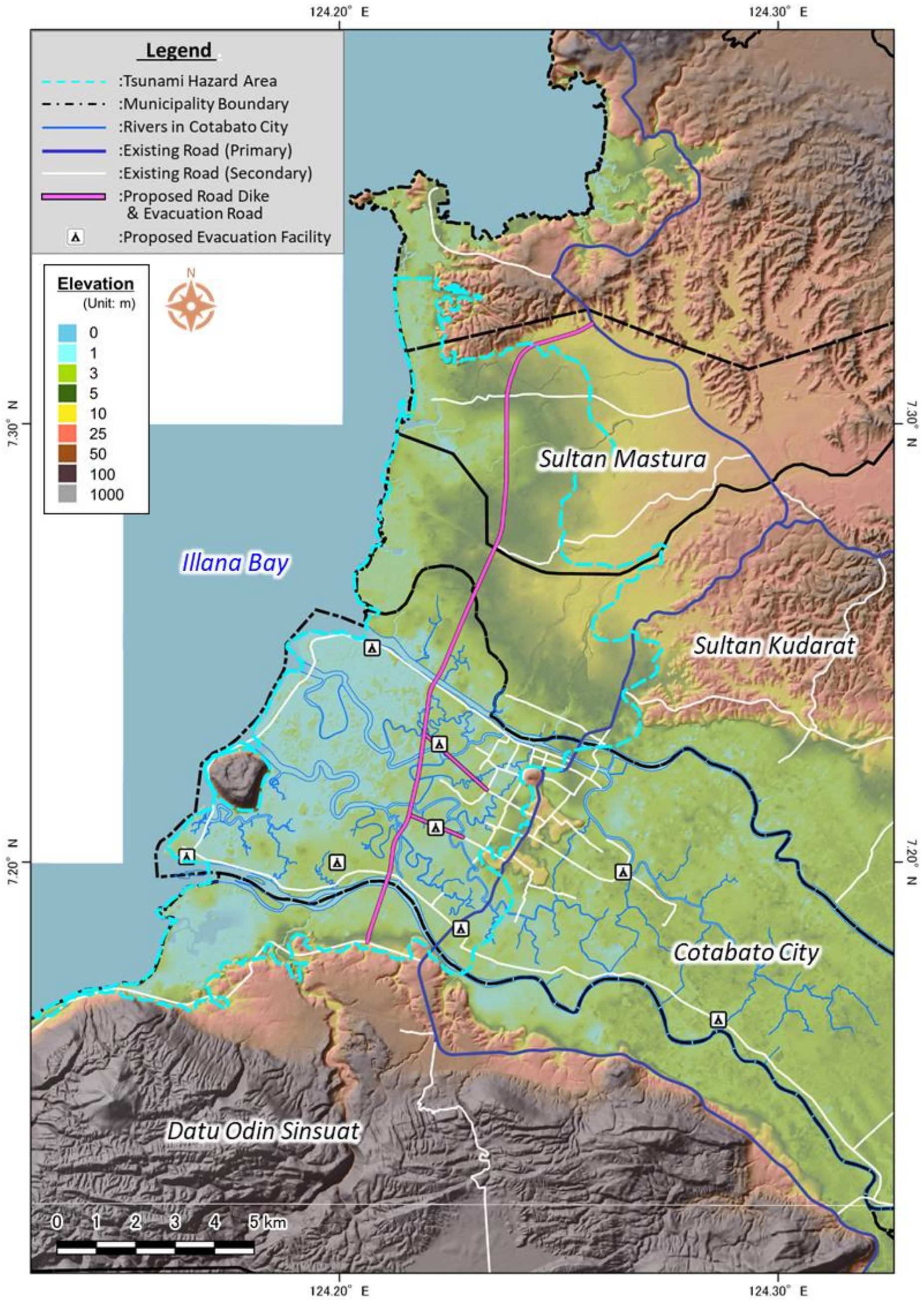
The third stage includes the implementation of the selected structural measures and monitoring the undertaking of the resettlement action plan (RAP). Throughout the project, special consideration shall be accorded for socially vulnerable people and natural environment conservation.

The fourth stage includes capacity development on (a) preparation of evacuation plans; and (b) developing the timelines during of emergency for quick response of OCD and LGUs. A set of guidelines or manual of operations which shall govern the implementation of the evacuation plans, as well as the conduct of evacuation drills shall also form part of the capacity development.

The following structural and non-structural measures are being proposed in this project: (a) construction of road dike, evacuation road and evacuation facility to decrease casualty, to mitigate tsunami damage and to enhance disaster response activity; and (b) capacity building for concerned staff of OCD and LGUs to strengthen disaster preparedness and response activity.

(4) Expected Outputs

Target for implementation are road dikes which will mitigate tsunami damage, as well as evacuation roads and facility which will greatly reduce tsunami-related casualties. Capacity building for concerned disaster staff of OCD and LGUs shall be provided. This is expected to contribute to reducing casualties and enhance disaster preparedness, response and recovery.



*The tsunami hazard area is based on the tsunami hazard map created by PHIVOLCS (see Figure 18.2-16)

Source: JICA Study Team

Figure 18.5-4 Project Location Map (Project No.6)

18.5.8 Project for Strengthening Capacity of Tsunami Early Warning System

(1) Background

The Moro Gulf tsunami of 17 August 1976 has been declared as the most disastrous tsunami ever experienced by the Philippines. It was also reported in a past study that the Moro Gulf area is the most prone to tsunami disaster in the country. Despite of these experience and findings, no tsunami countermeasure plan had been put in place, neither any structural measure to prevent or mitigate the risk of tsunamis has been constructed. Therefore, there is a strong need to develop a tsunami early warning system in the area to minimize the number of casualties caused by tsunamis.

Meanwhile, there is a global system that the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization's (IOC UNESCO) oversees the coordination of the global tsunami warning and mitigation system. There are currently 4 systems by region and the Philippines belongs to the Intergovernmental Coordination Groups of Pacific Tsunami Warning and Mitigation System (ICG/PTWS). Besides, event information services are provided by Tsunami Service Providers (TSP) in each region. The TSPs provide guidance to Country Tsunami Focal Warning Points (TWFP) and their National Tsunami Warning Centers (NTWC). Each country is solely responsible for determining the alert level (such as warning, advisory, watch) for their coasts using the international information and/or their own national assessment.

The west side of Mindanao island is under the responsibility of South China Sea Tsunami Advisory Center (SCSTAC) which is the newest addition to the ICG/PTWS and started the formal service from 5 November 2019. The DOST-PHIVOLCS, as the Country TWFP, receives tsunami advisory from the SCSTAC and provides tsunami early warning in the Philippines. PHIVOLCS has been developing the tsunami early warning system (TEWS) in the country, however, the system seems to be still not well coordinated with LGUs.

(2) Objectives

The objectives of the project are:

to develop a tsunami early warning system (TEWS) in the coastal area of Moro Gulf;

(i) to strengthen the capacity of regional staff of PHIVOLCS and relevant staff of LGUs

(3) Project Summary

Target Area	Coastal Area of the 4 LGUs (Sultan Mastura, Sultan Kudarat, Cotabato City, Datu Odin Sinsuat)
Implementing Agency	PHIVOLCS, LGUs
Project Component	➢ Development of tsunami early warning system (TEWS) ➢ Capacity development on the management of TEWS
Timeline	➢ Capacity Development (about 3.5 years in 2021-2024)

The project will be capacity development focusing on improving existing TEWS of PHIVOLCS. To enhance the existing TEWS, current issues and bottlenecks should be studied first. For example, it is expected that a system or capacity development to enhance information exchange between PHIVOLCS and the relevant staffs of LGUs is one factor in improving TEWS. After the problem analysis, the applicable measures will be proposed. The capacity development will include (a) operation and maintenance of TEWS; (b) further development of TEWS; and (c) conduct of evacuation drills based on TEWS. A set of guidelines or manual of operations will also be developed along with the capacity development component.

(4) Expected Outputs

The tsunami early warning system (TEWS) for the coastal area of Moro Gulf shall be improved. Subsequently, the capacity enhancement of relevant staff of PHIVOLCS and LGUs on operation and maintenance of the TEWS and on further development of the TEWS shall be conducted. Improvement of TEWS and the capacity development of the operational staff will greatly enhance the evacuation activities of local people and proactive and quick response of government DRRM staff.

18.5.9 Project for Building Earthquake Disaster Resilient Community in Cotabato City

(1) Background

Seismic activity in the vicinity of the Mindanao island is quite active. Statistically, most of large earthquakes concentrate along the Philippine Trench and the Cotabato Trench in the past 100 years. Even in 2019, 5 times of the large earthquakes (>Magnitude 5.5) were observed in Mindanao island. Accordingly, Cotabato City is highly exposed to seismic hazard.

To make things worse, the geological condition of Cotabato City where deltaic deposits are densely accumulated is likely to amplify seismic movements. A report for the Moro Gulf Earthquake in 1976 described that all concrete buildings collapsed caused by increased ground shaking due to soft foundation materials.

On the other hand, earthquake risk cannot be effectively reduced by structural means using a block-type approach. Earthquake risk has to be reduced by seismic reinforcement works or reconstruction for every individual structure. Important facilities such as government offices, schools, hospitals, malls, and other public and private structures should have seismic resistance intervention. Critical infrastructures such as the designated transportation roads and bridges in cases of emergency, water-power-gas supply utilities, transmission facilities, and other public facilities should also be seismically strengthened and be considered among the first priorities.

At present, there is no available data that can provide the number and types of existing earthquake-resistant structures located in different LGU areas. Hence, conducting a seismic capacity assessment of the priority facilities and come-up with a plan to enhance and improve these identified priority facilities into earthquake-resistant structures is necessary. The plan should also include designation of emergency roads and open spaces to enhance disaster-response activities and prevent the happening of any subsequent disaster, such as fire and others.

(2) Objectives

The objectives of the project are:

(i) to conduct seismic capacity assessment for public buildings with high priority and for critical infrastructures;

(ii) to develop a plan to enhance earthquake resistance for the priority buildings and infrastructures;

(iii) to implement seismic reinforcement works for the selected priority buildings or infrastructures.

(3) Project Summary

Target Area	Cotabato City
Implementing Agency	DPWH (National), Cotabato City LGU
Project Component	➢ Planning for seismic reinforcement of public buildings and critical infrastructure and for designated emergency roads ➢ Seismic strengthening for high-priority structures as a pilot project
Timeline	<For Public Buildings> ➢ Feasibility Study (about 1.5 years in 2021-2022) ➢ Project Implementation (about 2.5 years in 2023-2025) <For Critical Infrastructure> ➢ Feasibility Study (about 1.5 years in 2021-2022) ➢ Project Implementation (about 3.5 years in 2023-2026)

The project comprises of two parts: one is seismic strengthening for priority public buildings and the other is seismic strengthening for critical infrastructures.

The project consists of two stages in both parts: (i) feasibility study stage; and (ii) implementation stage of seismic reinforcement works. The first stage includes (a) study for current structural criteria such as building code, bridge-building standards, etc.; (b) planning for the designated emergency roads and open spaces; (c) selection of priority buildings or infrastructures; (d) survey for current condition of the selected structures; and (e) action plan with recommended seismic strengthening methods, time frame, and estimated costs.

In the second stage, seismic strengthening works shall be implemented for the selected buildings and infrastructures as pilot projects. After the completion of the pilot projects, lessons learned shall be shared with the stakeholders, and the action plan shall be improved.

(4) Expected Outputs

An action plan for seismic strengthening will be developed. In line with the plan, priority facilities will be selected for the implementation of seismic strengthening works as pilot projects. The results and lessons and learned will be shared with stakeholders, which will be reflected to the action plan.

Through the project, the important facilities in disaster response and the primary roads and bridges will be seismically reinforced first. Subsequently, utilizing the lessons learned and other skills derived from the implementation of the pilot projects, these shall form part of the technology transfer on seismic strengthening works to be shared with concerned technical personnel of concerned offices and LGU Cotabato City, along with the developed action plan.

By promoting earthquake-resistance works for public buildings and critical infrastructure, the number of casualties during earthquakes may substantially decrease. Further, planning for the designated emergency roads and open spaces could enhance the activities on disaster response and recovery.

18.6 Cost of DRR Plan

The cost of each proposed project is roughly estimated with an assumption of JICA support, as shown in Table 18.6-1.

Table 18.6-1 Cost Estimation of the Proposed Projects in the DRR Plan

Project/Programme	Implement Agency	Indicative Cost (PhP M)
1. Ambal-Simuay and Rio Grande de Mindanao River Flood Control Project ・ Feasibility Study was conducted (2017) ・ Land Acquisition and Resettlement Action Plan (LARAP) is ongoing (as of 2020) ・ River improvement and dike construction will be implemented for the Simuay River downstream and Rio Grande de Mindanao River downstream.	DPWH (National)	39,220 (approved value by NEDA Board)
2. Tamontaka River Flood Control Project **2-1. Study on Tamontaka River Improvement and Flood Control** ・ Review of relevant plans and projects ・ Basic survey (river cross section, etc.) for the Tamontaka River ・ Proposed priority structural measures ・ Feasibility study (FS) on the proposed priority structural measures	DPWH (National)	30
2-2. Detailed Design Study on Tamontaka River Improvement and Flood Control ・ Detailed design for the proposed structural measures in the above FS (Location, Structural Design, Cost, etc.) ・ Land Acquisition and Resettlement Action Plan (LARAP)	DPWH (National)	90
2-3. Implementation of Tamontaka River Improvement and Flood Control Works ・ Implementation of the proposed structural measures ・ Monitoring of Resettlement Action Plan	DPWH (National)	20,000
3. Project for Flood Control and Drainage Improvement in Cotabato City **3-1. Study on Flood Control and Drainage Improvement in Cotabato City** ・ Basic survey (river cross-section, etc.) for the major rivers (Matampay, Tarbung, etc.) in Cotabato City ・ River planning (flood control plan, river-course plan, rain-storm drainage plan) ・ Proposed priority structural measures ・ Feasibility study on the proposed priority structural measures	DPWH (Regional or National)	100

Project/Programme	Implement Agency	Indicative Cost (PhP M)
3-2. Detailed Design Study on Flood Control and Drainage Improvement in Cotabato City ・ D/D and S/V of the proposed structural measures	DPWH (Regional or National)	230
3-3. Project for Flood Control and Drainage Improvement in Cotabato City ・ Land Acquisition and Resettlement Action Plan (LARAP) ・ Implementation of the proposed structural measures	DPWH (Regional or National)	6,900
4. Project for Developing Flood Forecasting and Warning System for the Lower Mindanao		
4-1. Preparatory Survey for Developing Flood Forecasting and Warning System for the Lower Mindanao ・ Plan the contents and schedule of proposed FFWS ・ Evaluate costs and effectiveness of proposed FFWS	PAGASA (National)	50
4-2. Detailed Design and Procurement for Flood Forecasting and Warning System for the Lower Mindanao ・ Detailed design and procurement ・ Installation of necessary hydrometeorological observation equipment, radio communication equipment, operating system, etc. ・ Developing the guidelines and manuals of FFWS	PAGASA (National)	690
4-3. Project for Strengthening Capacity of Flood Forecasting and Warning System for the Lower Mindanao ・ Capacity development on O&M of FFWS and further development of FFWS ・ Improving the accuracy of FFWS	PAGASA (Regional)	70
5. Project for Enhancing Flood Response Capacity of Cotabato City		
5-1. Preparatory Survey for Construction of Flood Fighting Station ・ Planning the location, site area, basic design, necessary materials & equipment ・ Planning the role and the use in normal times and at the time of disaster ・ Evaluating costs and impacts	DPWH (National)	30
5-2. Project for Construction of Flood Fighting Station ・ Detailed design of flood fighting station ・ Construction of Flood Fighting Station ・ Procurement of the disaster-related materials and equipment	DPWH (National)	460
5-3. Project on Capacity Development for Flood Response and Dike Management ・ Capacity development on O&M of dikes and flood fighting activities ・ Conduct of evacuation drills ・ Develop education program for disaster risk reduction	DPWH, OCD (Regional), Cotabato City	50
6. Project for Building Tsunami Disaster Resilient Community		
6-1. Feasibility Study on Structural Measures for Tsunami Disaster Risk Reduction ・ Developing a master plan for tsunami defense ・ Feasibility study on structural measures for tsunami disaster risk reduction such as road dike as part of Cotabato City West Diversion Road (CCWDR), evacuation road (linking road between CCWDR and the center of Cotabato City), evacuation facility (tsunami evacuation tower), etc.	DPWH (National)	60

Project/Programme	Implement Agency	Indicative Cost (PhP M)
6-2. Detailed Design Study on Structural Measures for Tsunami Disaster Risk Reduction ・ Detailed design of the proposed structural measures in the above FS (Location, Structural Design, Cost, etc.) ・ Land Acquisition and Resettlement Action Plan (LARAP)	DPWH (National)	280
6-3. Construction of Structural Measures for Tsunami Disaster Risk Reduction ・ Construction of road dike, evacuation road, evacuation facility, etc. ・ Monitoring of Resettlement Action Plan	DPWH (National)	4,600
6-4. Project on Capacity Development for Tsunami Disaster Risk Reduction by Improving Local Disaster Risk Reduction and Management Plan (LDRRMP) ・ Capacity development for improving Local Disaster Risk Reduction and Management Plan (LDRRMP) and contingency plan ・ Evacuation planning and drills in official level and community level	OCD (Regional), Cotabato City	100
7. Project for Strengthening Capacity of Tsunami Early Warning System for Cotabato City ・ Enhance communication between PHIVOLCS and Cotabato City LGU ・ Capacity development for effective information dissemination on tsunami warning ・ Procurement of necessary equipment	PHIVOLCS	70
8. Project for Building Earthquake Disaster Resilient Community in Cotabato City **8-1. Feasibility Study on Seismic Strengthening for Public Buildings** ・ Study building codes and design criteria about seismic capacity ・ Survey the current ratio of public buildings with earthquake resistance such as public offices, schools, hospitals ・ Study effective methods of strengthening earthquake resistance work	DPWH, Cotabato City	30
8-2. Project of Seismic Strengthening for Public Buildings ・ Seismic strengthening for municipal buildings ・ Seismic strengthening for priority schools and hospitals as pilot project	DPWH, Cotabato City	1,000
8-3. Feasibility Study on Seismic Strengthening for Critical Infrastructure ・ Identify primary transportation road in disaster emergency ・ Survey weak points of identified primary transportation road in disaster emergency ・ Estimate benefit and cost of seismic strengthening works	DPWH (National)	30
8-4. Project of Improving Seismic Resilience for Critical Infrastructure ・ Seismic strengthening work for selected bridges, buildings along the primary transportation road	DPWH (National)	2,300

18.7 Selection of High Priority Projects

18.7.1 Project Prioritization Criteria

Prioritization for the proposed projects is conducted based on the following criteria:

(a) Importance and urgency

(b) Effectiveness and impact

(c) Feasibility

(d) Need for Japanese assistance

18.7.2 Prioritization of the proposed projects

Two (2) priority projects and six (6) second priority projects are selected based on the prioritization criteria as shown in Table 18.7-1.

<u>Priority Projects:</u>

- (No. 3) Project for Flood Control and Drainage Improvement in Cotabato City
- (No. 6) Project for Building Tsunami Disaster Resilient Community

<u>Second Priority Projects:</u>

- (No. 2) Tamontaka River Flood Control Project
- (No. 4) Project for Developing Flood Forecasting and Warning System for the Lower Mindanao
- (No. 5) Project for Enhancing Flood Response Capacity of Cotabato City
- (No. 7) Project for Strengthening Capacity of Tsunami Early Warning System for Cotabato City
- (No. 8) Project for Building Earthquake Disaster Resilient Community in Cotabato City

Table 18.7-1 Prioritization of the Proposed Projects

Project/ Programme	Importance/ Urgency	Effectiveness/ Impact	Feasibility	Needs of Japanese Assistance	Prioriti-zation
1. Ambal-Simuay and Rio Grande de Mindanao River Flood Control Project	- (Ongoing by DPWH National)				-
2. Tamontaka River Flood Control Project	◎	◎	△	◎	○
	While the flood control project for Rio Grande de Mindanao is ongoing, any specific flood control project for the Tamontaka River is not proceeding. Since the Mindanao river bifurcates into Rio Grande de Mindanao and the Tamontaka River, the flood control plan and project for the Tamontaka River should be proceeded in consistency with those for the Rio Grande de Mindanao.	Flood risks in the lower Mindanao will be reduced by increasing the flow capacity of the Tamontaka River and by lowering high water levels in floods.	The needs for the Tamontaka River flood control plan & project must be high. On the other hand, the Tamontaka flood control plan should be consistent with the ongoing 'Ambal-Simuay and Rio Grande de Mindanao Flood Control Project' and the MP of the Mindanao river, which have lots of uncertainties.	The river system of the lower Mindanao is very complicated, so that detailed hydraulic analysis should be conducted. In addition, there are many issues in river planning such as climate change impacts, management of natural retarding basins and upstream watersheds, etc. Japan can also support the construction of gates on weak ground along the Tamontaka River.	
3. Project for Flood Control and Drainage Improvement in Cotabato City	◎	◎	○	◎	◎
	At present, most of the urban area of Cotabato City locates on relatively higher area where the drainage system is only developed. However, Cotabato City is going to expand the residential and commercial areas to the lower, flood-prone area in line with the CLUP. Then, it is expected to emerge inland flooding in the newly developed lowlands due to the difficulty to make enough water head in drainage channels. In addition, there is no flood control plan nor river channel and course plan for the rivers in Cotabato City, so that their planning is urgently needed for the new development of the lowlands and to prevent new flood risks.	City development for roads, bridges, residential areas, etc. will be enhanced by developing flood control plan, river channel and course plan, and rain-storm drainage plan. Conversely, such city development cannot proceed smoothly or will result in increasing new flood risks and inefficient DRR investments without appropriate river planning.	The needs for the relevant planning for flood prevention and mitigation is considered high, hearing from Cotabato City that a drainage master plan should be developed. However, their planning has to be in consistency with the flood control plan of the Mindanao river because the rivers in Cotabato City include the bifurcated rivers from the Mindanao river. On the other hand, there remains many issues to develop flood control structural measures in the plan. Accordingly, it is also difficult to develop the river planning in Cotabato City.	Target rivers locate at the delta of the Mindanao river where braided channels are developed by the strong effect of sedimentation, which make the hydraulic condition of the rivers difficult. In addition, there are many issues to be considered for climate change impacts, for tsunami surging up the rivers, etc. Thus, river planning for the target rivers requires advanced methods.	

Project/ Programme	Importance/ Urgency	Effectiveness/ Impact	Feasibility	Needs of Japanese Assistance	Prioriti-zation
4. Project for Developing Flood Forecasting and Warning System (FFWS) for the Lower Mindanao	◎	○	◎	○	○
	Due to the unstable peace and order situation in the BARRM region, structural measures for flood prevention and mitigation have not much been proceeded in the Mindanao river basin. Accordingly, the people in the lower Mindanao suffer from frequent floods.	Flood forecasting and warning system (FFWS) will enhance evacuation activities of local people and proactive and quick response of government DRRM staffs.	The needs of FFWS are very high. In addition, it does not involve local people's resettlement which constitute a most limiting factor of implementing flood control projects.	Japan has supported PAGASA for long time, and PAGASA have developed their capacity on FFWS. In addition, Pre-FS for the FFWS in the Mindanao river basin was already conducted by PAGASA.	
5. Project for Enhancing Flood Response Capacity of Cotabato City	○	○	○	○	○
	Since there was no dike in the area, indigenous knowledge nor accumulated experiences on operation and maintenance of dikes have not been developed. On the other hand, the constructed dikes will be under the high risk of dike breach, and once a dike breach happens, it will cause disastrous damage on the society. Therefore, the system for flood fighting and responding to prevent or mitigate dike breach should be developed no sooner than the completion of dike construction.	The capacity on dike management such as monitoring and maintenance in normal condition and flood fighting activities in flood condition will be greatly enhanced in addition to the construction of a flood fighting station.	The needs of technical transfer on dike management should be high because the knowledge and skills on dike management are lacking due to few experiences in the area. In addition, there are enough space to construct a flood fighting station, so that involuntary resettlement will not be happened.	Japan has a long history of flood fighting activities. One of the developed solutions is to construct a flood fighting station to enhance flood fighting activities. The station is also utilized for educating local people for better understanding of disaster risks and evacuating activities and for implementing evacuation drills.	
6. Project for Building Tsunami Disaster Resilient Society	◎	◎	◎	◎	◎
	The Moro Gulf tsunami in 1976 is reported as the most destructive tsunami in the Philippines and caused more than 7,000 casualties. The earthquakes induced by the Cotabato Trench periodically generates, and the succeeding tsunami risk is increasing. Because the tsunami disaster has less frequency but results to significantly high impact, structural measures for tsunami risk reduction is important and urgently needed.	The number of casualties affected can be remarkably reduced by construction of road dikes, evacuation facilities and their access roads. It is also expected that the constructed road dike will prevent or mitigate tsunami damages especially for the tsunami with relatively high frequency and small scale.	The planned road dike is important not only for preventing or mitigating tsunami risks but also for enhancing the local transportation. Hence, the local needs for the project should be high. Besides, structural measures would be difficult to be feasible because they require large investments. Now that Cotabato City is expected to develop as the central city of BARRM and new road construction is planned, it is the	Japan can greatly contribute for tsunami disaster risk reduction based on the lots of studies and experiences. For example, after the East Japan Great Earthquake in 2011, a lot of studies were conducted for structural improvement not easily breached by tsunami overflowing. Therefore, Japan can provide effective solutions for building tsunami-resilient dike road.	

Project/ Programme	Importance/ Urgency	Effectiveness/ Impact	Feasibility	Needs of Japanese Assistance	Prioriti-zation
			perfect time to reduce tsunami risks by constructing a road dike as a part of new roads.		
7. Project for Strengthening Capacity of Tsunami Early Warning System (TEWS) for Cotabato City	○	○	○	◎	○
	Due to the significance in scale of tsunamis in the area, evacuation is vitally important to reduce tsunami risks. TEWS can enhance evacuation activities by providing tsunami information such as tsunami heights, travel time, etc.	Improvement of TEWS and the capacity development of the operational staffs will greatly enhance evacuation activities of local people and proactive and quick response of government DRRM staffs.	PHIVOLCS is developing a TEWS in cooperation with PTWC and SCSTAC. But the system is not well coordinated with LGUs, so that there should be a need for technical transfer and capacity development on the management of TEWS.	Japan Meteorological Agency (JMA) has lot of experiences on TEWS. Besides, JMA provided tsunami information to the whole Philippines till 2019, so that they also have knowledge and experiences in the target area.	
8. Project for Building Earthquake Disaster Resilient Community in Cotabato City	○	○	○	◎	○
	Cotabato City is highly exposed to seismic hazard and its geological condition (locates on dense deltaic deposits) makes the city vulnerable to seismicity. Accordingly, seismic risk has to be reduced by seismic reinforcement works or reconstruction for priority buildings and critical infrastructure.	By promoting earthquake-resistance works for public buildings and critical infrastructure, casualties are to be decreased and the activities of disaster response and recovery are greatly to be enhanced.	Cotabato City is going to add 'Resilient' in the city's vision, which implies that public buildings and critical infrastructure should have earthquake resistance to be resilient to seismic disasters.	Japan has lots of experiences on seismic reinforcement skills and works especially after Hanshin-Awaji Earthquake in 1995.	

18.8 Implementation Schedule

Considering the target year of the seven global targets of SFDRR 2015-2030, the implementation schedule of the proposed projects was planned as shown in Table 18.8-1. Because the proposed projects do not have a strict sequential order of implementation, each project can be implemented individually. Thus, the implementation schedule was planned with the assumption that all proposed projects will start from 2021.

Table 18.8-1 Implementation Schedule of the Proposed Projects

Project/Activities		Short Term		Middle Term						Long Term						
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1. Ambal-Simuay and Rio Grande de Mindanao River Flood Control Project (Ongoing DPWH National Project)																
1-1	ROW and Land Acquisition, Resettlement (Ongoing)	■	■													
1-2	Design and Build (D/B)	■	■	■	■	■	▨ (possibility of extention)	▨								
2. Tamontaka River Flood Control Project																
2-1	Study on Tamontaka River Improvement and Flood Control	■	■													
2-2	Detailed Design Study on Tamontaka River Improvement and Flood Control				■											
2-3	Implementation of Tamontaka River Improvement and Flood Control Works						■	■	■	■	■	▨ (possibility of extention)	▨			
3. Project for Flood Control and Drainage Improvement in Cotabato City																
3-1	Study on Flood Control and Drainage Improvement in Cotabato City	■	■													
3-2	Detailed Design Study on Flood Control and Drainage Improvement in Cotabato City				■	■										
3-3	Project for Flood Control and Drainage Improvement in Cotabato City						■	■	■	■ ▨ (possibility of extention)	▨	▨				
4. Project for Developing Flood Forecasting and Warning System for the Lower Mindanao																
4-1	Preparatory Survey for Developing Flood Forecasting and Warning System for the Lower Mindanao	■	■													
4-2	Detailed Design and Procurement for Flood Forecasting and Warning System for the Lower Mindanao			■	■											
4-3	Project for Strengthening Capacity of Flood Forecasting and Warning System for the Lower Mindanao				■	■	■									
5. Project for Enhancing Flood Response Capacity for Cotabato City																
5-1	Preparatory Survey and Design for Construction of Flood Fighting Station	■	■	■												
5-2	Project for Construction of Flood Fighting Station				■	■										
5-3	Project on Capacity Development for Flood Response and Dike Management					■	■	■	■							
6. Project for Building Tsunami Disaster Resilient Community																
6-1	Feasibility Study on Structural Measures for Tsunami Disaster Risk Reduction	■	■													
6-2	Detailed Design Study on Structural Measures for Tsunami Disaster Risk Reduction			■	■	■										
6-3	Construction of Structural Measures for Tsunami Disaster Risk Reduction						■	■	■	■	■					
6-4	Project on Capacity Development for Tsunami Disaseter Risk Reduction									■	■					
7. Project for Strengthening Capacity of Tsunami Early Warning System																
7	Capacity Development on Tsunami Early Warning System	■	■	■	■											
8. Project for Building Earthquake Disaster Resilient Community in Cotabato City																
8-1	Feasibility Study on Seismic Strengthening for Public Buildings	■	■													
8-2	Project of Seismic Strengthening for Public Buildings			■	■	■										
8-3	Feasibility Study on Seismic Strengthening for Critical Infrastructure	■	■													
8-4	Project of Improving Seismic Resilience for Critical Infrastructure			■	■	■	■									

*The 6 of 7 global targets of SFDRR target 2030.

18.9 Initial Environmental and Social Assessment of DRR Plan

Initial environmental and social assessment for each project on DRR Plan was conducted based on the JICA guideline for environmental and social considerations in initial environmental examination (IEE) level. Environmental impact assessment (EIA) will be required for the following proposed projects which have large-scale construction works:

- ➢ (No.2) Tamontaka River Flood Control Project
- ➢ (No.3) Project for Flood Control and Drainage Improvement in Cotabato City
- ➢ (No.6) Project for Building Tsunami Disaster Resilient Community

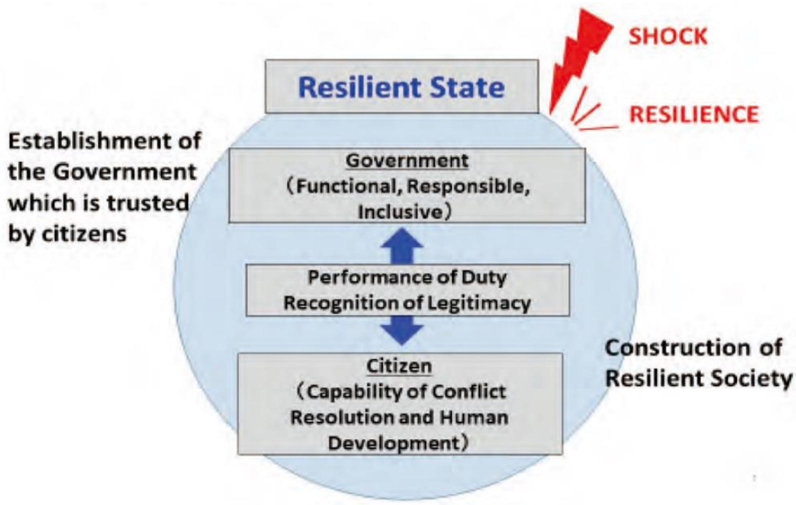
Table 18.9-1 Initial Environmental and Social Assessment of DRR Plan

	Pollution Control								Natural Environment					Social Environment						Others		
	1	2	3	4	5	6	7	8	1	2	3	4	5	1	2	3	4	5	6	1	2	3
Project/ Program	Air Quality	Water Quality	Wastes	Soil Contamination	Noise and Vibration	Subsidence	Odor	Sediment	Protected Areas	Ecosystem	Hydrology	Topography and Geology	Management of Abandoned Sites	Involuntary Resettlement	Living and Livelihood	Heritage	Landscape	Ethnic Minorities and Indigenous Peoples	Working Conditions	Impact during construction	Accident Prevention Measures	Monitoring
1. Ambal-Simuay and Rio Grande de Mindanao River Flood Control Projects	Ongoing by DPWH National																					
2. Tamontaka River Flood Control Project	C	B	C	C	B	C	C	C	A	A	B	C	C	A	C	C	A	A	C	C	C	C
3. Project for Flood Control and Drainage Improvement in Cotabato City	C	B	C	C	B	C	C	C	A	A	B	C	C	A	C	C	A	A	C	C	C	C
4. Project for Developing Flood Forecasting and Warning System for the Lower Mindanao	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
5. Project for Enhancing Flood Response Capacity for Cotabato City	C	C	C	C	B	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
6. Project for Building Tsunami Disaster Resilient Society	C	C	C	C	B	C	C	C	A	A	C	C	C	A	C	C	A	A	C	C	C	C
7. Project for Strengthening Capacity of Tsunami Early Warning System	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
8. Project for Building Earthquake Disaster Resilient Society in Cotabato City	C	C	C	C	B	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Notes:
A: Projects that may have significant adverse impacts on the environment and society impacts
(including the projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible)
B: Projects whose potential adverse impacts on the environment and society are less adverse than those of Category A projects
C: Projects that may have minimal or little adverse impact on the environment and society
FI: Projects that satisfy all of the following requirements:
- JICA's funding of projects is provided to a financial intermediary or executing agency;
- the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and
- those sub-projects are expected to have a potential impact on the environment.

18.10 Peacebuilding

In the field of "ensuring peace, stability, and safety", JICA conducts; (1) Building a resilient state where conflict does not occur/recur, and (2) Establishing just and robust governance. In JICA's peacebuilding support to Mindanao, JICA has adopted two approaches; the top-down approach of "establishing a functional, comprehensive, and responsive government trusted by its people" and the bottom-up approach of "forming a resilient society capable of self-development and conflict resolution" as illustrated in Figure 18.10-1. Disaster risk reduction and management (DRRM) can greatly contribute for both approaches. Since natural disasters harm people's safety and stability, the government must have proper DRRM to be trusted by citizens. On the other hand, economic disparities and unequal opportunities in a society will create a new friction that leads to conflict. Since it is often the case that socially vulnerable people live in the vulnerable area to natural hazards, DRRM activities will protect them and enhance their livelihoods, which contributes to decrease economic disparities and unequal opportunities.



Source: "Peace and Development in Mindanao", Naoyuki O. 2020. JICA Ogata Sadako Research Institute13

Figure 18.10-1 Conceptual diagram of building a resilience state

Enhancing DRRM activities basically contributes for peacebuilding in the society, however, DRR investments and its project implementation might trigger a new conflict if not properly handled in a comprehensive, transparent, and fair manner. The following issues must be well considered when implementing DRR projects.

1) Consideration for various stakeholders
   Society in the target area is diverse one, made up of Muslims, Christians, and indigenous groups. Known as the Mindanao conflict, there is a long history of conflicts not only between Muslims and Christians but also between elite families (clans). The structure of conflicts is very complicated. Therefore, special care should be paid for consensus building among

[13] "Peace and Development in Mindanao, Republic of the Philippines -The Long Road to Peace through Trust", Naoyuki Ochiai. 2020. JICA Ogata Sadako Research Institute for Peace and Development

stakeholders, and project benefits and negative impacts should be shared equally as much as possible.

2) Consideration for land ownership

There are national land registration system and local traditional management system for land ownership. Therefore, if land acquisition is required to implement DRR project, landowners should be identified not only from the land registration system but also the traditional management system. In addition, if involuntary resettlement is inevitable, the following aids must be supported: 1) compensation for loss of assets, loss of income sources and livelihood means; 2) assistance for relocation including provision of relocation sites with appropriate facilities and services, and; 3) assistance for rehabilitation to achieve at least the same level of well-being.

3) Consideration for the socially vulnerable

There are socially vulnerable people such as female-headed household and handicapped people due to the conflicts and indigenous people in the target area. If DRR project might give negative impacts to them, the project should be reconsidered.

CHAPTER 19
PEACEBUILDING

19.1 Peacebuilding Survey and Plan

19.1.1 Historical Review of the Mindanao Conflict and Cotabato City

(1) Cause and the Peace Process of the Mindanao Conflict

The beginning of the Mindanao conflict is generally known as the 1969 founding of the Moro National Liberation Front (MNLF) by Nur Misuari, a University of the Philippines (UP) professor, to condemn the killing of the 11 Muslim military trainees by the Armed Forces of the Philippines (AFP) and establish a Bangsamoro nation by force. After fierce battles, the Philippine government and the MNLF signed the Tripoli Agreement for peace in 1976. The agreement provided that Mindanao would remain a part of the Philippines, but an autonomous government for the Bangsamoro people would govern 13 provinces in Mindanao. However, violence continued because President Marcos later reneged on the agreement. Taking a more aggressive stance than the MNLF and seeking to establish an Islamic state, Sheikh Salamat Hashim separated from the MNLF and formed the Moro Islamic Liberation Front (MILF) in 1984. President Corazon Aquino initiated peace with the MNLF. As a result, the Autonomous Region in Muslim Mindanao (ARMM) was created under Republic Act No. 6734 or the ARMM Organic Act, pursuant to the 1987 Constitution. Nevertheless, as the fighting between the MILF and the AFP steadily escalated, President Estrada declared in March 2000 an "all-out war" on the MILF. The fighting between the MILF and the AFP was so severe that the physical damage to communities and the loss of lives in Mindanao were unprecedented. Despite a victory claim by President Estrada over the MILF, the armed conflict persisted. After President Macapagal Arroyo took office in 2001, negotiations resumed between the Government of the Republic of the Philippines (GRP) and the MILF. In 2003, Murad Ebrahim became the MILF chairman succeeding Salamat, the MILF founder who died in the same year. After intense negotiations, on July 28, 2008, the GRP announced a preliminary autonomy agreement with the MILF named the “Memorandum of Agreement on the Ancestral Domain Aspect of the GRP-MILF Tripoli Agreement on Peace of 2001.” Nevertheless, in a ruling issued on August 4, 2008, the Philippines Supreme Court blocked the formal signing of the agreement. While fighting continued in Mindanao, the Malaysian government mediated the GRP-MILF peace negotiations in Kuala Lumpur. President Benigno Aquino, who took office in 2010, supported the peace process. On October 15, 2012 in Manila, the GRP and the MILF signed the Framework Agreement on the Bangsamoro. The agreement provided for the establishment of an autonomous Bangsamoro replacing the ARMM. Furthermore, on March 27, 2014 in Manila, the GRP and the MILF signed the Comprehensive Agreement on the Bangsamoro including the power- and wealth-sharing agreements. Based on this agreement, many attempts were made in Congress to pass the “Bangsamoro Basic Law” as the organic law for establishment of a new autonomous regional government but failed. Then, Rodrigo Duterte was elected in 2016 with overwhelming support from the electorate as the first Philippine President from Mindanao.

President Duterte successfully initiated the passage of the Bangsamoro Basic Law in Congress. On July 26, 2018, President Duterte signed the law whose official name is the "Organic Law for the Bangsamoro Autonomous Region in Muslim Mindanao." Based on the law, a two-part plebiscite was held on January 21, 2019 for ARMM areas, and February 6, 2019 for Cotabato and the six municipalities of Lanao del Norte, including areas that petitioned to join the Bangsamoro, to create the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) that would formally replace the ARMM. After the positive results of these two plebiscites, the BARMM currently consists of 3 cities, 116 municipalities, and 2,590 barangays. The city of Isabela, despite being part of Basilan Province, is not under the administrative jurisdiction of the BARMM. Likewise, 63 barangays in North Cotabato joined in the BARMM despite their belonging to North Cotabato Province and their respective parent municipalities are not under the administrative jurisdiction of the BARMM.

(2) "Human-induced Disasters" in Cotabato City

Although Cotabato City proper has not been a main battlefield in the Mindanao conflict since 1969, political disputes, easy resort to violence, economic stagnation, and social confusion have jeopardized the security conditions of the city. These phenomena brought overall instability and increased various types of crime in the city.

For example, murders and homicides such as assassinations, "rido" or vengeance killings between rival families or clans, and drug-related killings have been frequent. Under such conditions, the residents of Cotabato City have feared that they might become targets of those killings or become victims by accident. Such fear has discouraged businesspeople from initiating new business activities or expanding existing ones., particularly due to incidence kidnappings and extortion that they experienced. This has led to reduced economic activities and fewer employment opportunities, especially among poor and handicapped people. Reduced job opportunities and lower income have increased poverty, crimes and instability in the communities. It is noted, however, that the problem of kidnapping is no longer a concern at least for the last five (5) years.

Thus, the cumulative number of lost lives in the Mindanao conflict, the fear for safety among the city's residents, and delays or termination of social and economic development are the core components of "human-induced disasters" in Cotabato City.

To further reduce incidences of "human-induced disasters," the city should sustain its concrete actions to continue the reduction of serious crimes, prevalence of pessimistic mindsets among the residents, and stagnation of social and economic development. Concerted effort by the security authorities should continue to reduce serious crimes, namely murders and homicides. Table 19.1-1 summarizes recent annual crime records in Cotabato City.

Table 19.1-1 Summary of Recent Annual Crime Records in Cotabato City

	PEACE AND ORDER INDEX						
Year	**Murder**	**Homicide**	**Physical injury**	**Rape**	**Robbery**	**Theft**	**Car napping**
2018	24	37	22	13	65	66	0
2019	46	11	21	9	62	64	2
2020	32	5	7	7	30	35	2
Sub-Total	102	53	50	29	157	165	4
	PEACE AND ORDER INDEX			**PUBLIC SAFETY INDEX**			
	Mortor napping	**Special Law**	**Other mon-index crimes**	**RIR's homicides**	**RIR's physical injury**	**RIR's damage to property**	**TOTAL**
2018	57	274	119	5	16	8	706
2019	14	229	90	3	25	18	594
2020	6	205	84	7	28	21	469
Sub-Total	77	708	293	15	69	47	1769

Notes:
Peace and Order Index: includes the major crimes and are classified into I & II
I. Index Crimes (8 focus crimes) – involves the following major crimes, such as a) Murder, b) Homicide, c) Physical Injury, d) Rape, e) Robbery, f) Theft, g) Carnapping of vehicles, h) Motor napping (carnapping of motorcycles)
II. Non-Index Crimes- this usually include the violation of Revised Penal Codes which usually includes complex crimes like grave threat, estafa, driving under the influence, liquor laws, etc.
Public Safety Index: usually involves traffic accidents and other quasi accidents. This is also used in presenting/coordinating with the LGU what needs to be fixed (e.g. Lack of streetlights in the area which caused high level of traffic accidents, rough road that should be repaired, etc.)
Motor napping: napping of motorcycles, tricycles, payong-payong, and like.
Special Laws: covers the Republic Acts. The most applicable ones are Republic Acts 9165 (Comprehensive Dangerous Drugs Act), 10591 (An Act Providing for a Comprehensive Law on Firearms and Ammunition and Providing Penalties for Violations Thereof), 9262 (Violence Against Women and Children), and 9287 (Illegal Gambling). These four Republic Acts covers the majority of the crimes classified under the "Special Laws" category.
RIR: Reckless Imprudence Resulting to…
The number of crimes in 2020 only covers 11 months from January to November 2020. The 2018 and 2019 data cover 12 months of each year.
Source: Modified by the JICA Study Team from the crime records of Cotabato Police

Table 19.1-1 indicates that the numbers of robberies and thefts are relatively high in the years 2018 and 2019 but had gone down significantly in 2020. In a local governmental unit that is not directly affected by any armed conflict, it may be appropriate for the police and security authorities to put priority on preventing and solving these crimes. However, these crimes do not pose a clear and present danger to residents in a conflict-affected area. From the peacebuilding perspective, this survey proposes that the security authorities mobilize extra human, financial, and technical resources to address serious crimes such as murders and homicides to save lives and mitigate the fear in the city's residents.

To achieve the purpose above, the police and other security authorities must have a sustained commitment to enhance the peace and security of the city. This survey expects that a substantial reduction in serious crimes will alleviate the city residents' fear, help business activities recover, and lead to the much faster social and economic development in the city. Furthermore, social and economic development will increase job opportunities, raise income among the poor, reduce number of petty crimes, make barangays stable, and enhance overall peace and prosperity in the city. To the public authorities concerned, city residents, and prospective international donors, Table 19.1-2 presents proposals to reduce serious crimes in the city as the starting point of the peacebuilding endeavors against the "Human induced disasters".

Table 19.1-2 Proposals for Reducing Serious Crimes in Cotabato City

No	Subject	Proposed content
1	**Capacity development of police officers and investigators**	・ Training for police officers and investigators for capacity development, such as better knowledge of criminal law and related legal procedures, physical exercises for police activities, firearms control, how to use scientific crime investigation technology, and domestic and foreign study tours to the places of good practice
2	**Provision of advanced police equipment and introduction of an advanced security information system**	・ Increased budget for police operations against serious crimes ・ Procurement of new police cars equipped with advanced portable communication devices ・ Procurement of advanced firearms and protection gear ・ Establishment of a fast and wide communication network for major natural disasters and urgent police operations ・ Establishment of an efficient security information system for collecting, analyzing, and processing information with advanced computers and software ・ Additional police stations in strategic areas with sufficient personnel complement.
3	**Community activities for better security**	・ Establishment of a new cooperation system or strengthening of the existing coordination system among the city police, responsible offices in the city, and barangay captains/representatives on peace and security in the city ・ Planning and implementation of barangay activities for preventing and solving serious crimes quickly through the activation of the system above. For example, support to “kagawad for peace and order” and “Lupon Tagapamahaya” (barangay justice system) is recommended.

Source: JICA Study Team

19.1.2 Purpose of the Peacebuilding Survey

(1) Compliance with the DILG-OPAPP Joint Memorandum Circular No.1 series of 2020

On October 16, 2020, the Department of Interior and Local Government (DILG) and the Office of the Presidential Adviser on the Peace Process (OPAPP) jointly issued the “DILG-OPAPP Joint Memorandum Circular No.1 series of 2020” (hereinafter the “Circular”) to the local government authorities in conflict-affected and conflict-vulnerable areas. The subject of the Circular is “Guidance on Mainstreaming Conflict Sensitivity and Peace Promotion (CSPP) and Sectoral Concerns in the Comprehensive Development Plan (CDP) of Local Government Units (LGUs) in conflict- affected and conflict-vulnerable areas.” The Circular also specifies the “Actions Required” to promote peacebuilding. Although this peacebuilding survey had been planned and executed before the issuance of the Circular, it complies with the Circular on mainstreaming Conflict Sensitivity and Peace Promotion (CSPP) and the Actions Required. The following are five concrete examples of the survey’s compliance with the Circular.

First, because the JICA definition of peacebuilding is essentially identical to that of the Circular, the purposes and subjects of this survey and those of the Circular are the same.

Second, the survey area of this peacebuilding survey is Cotabato City, which is qualified as either a conflict-affected or conflict-vulnerable area.

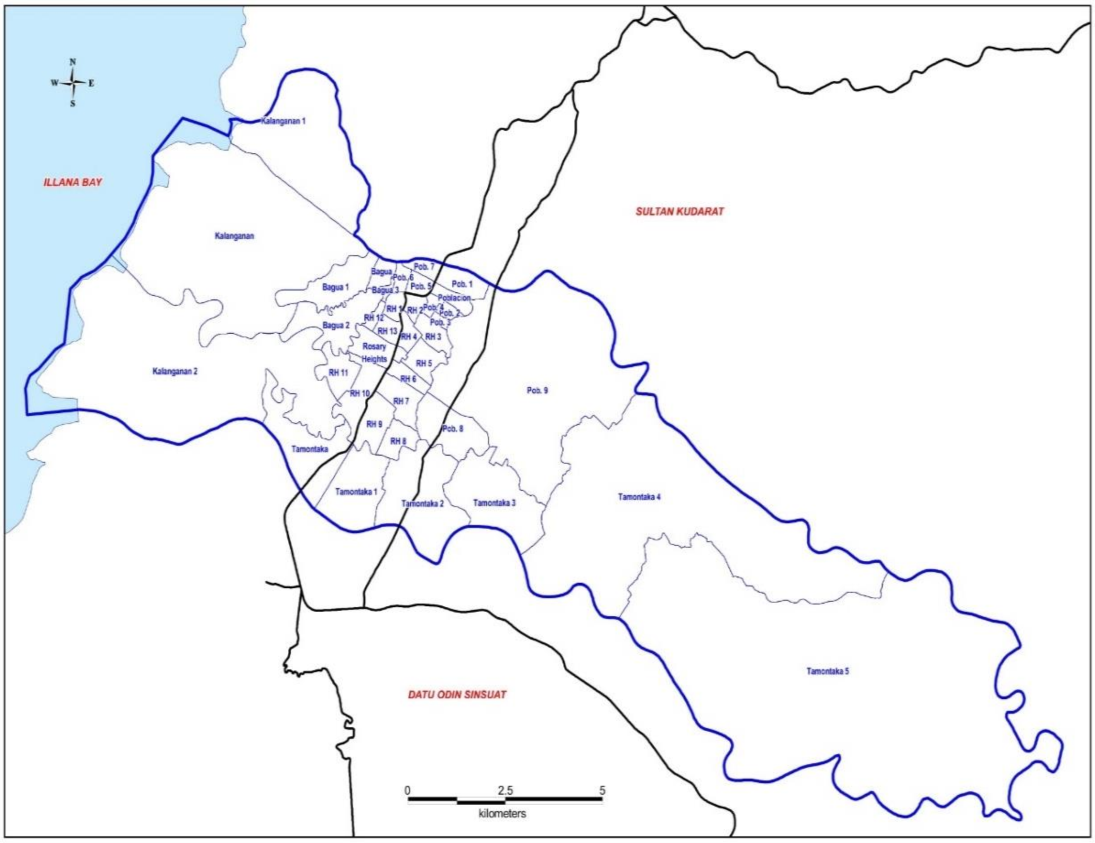
Third, the survey implemented questionnaire and interview surveys in all the barangays of Cotabato City through direct contact with barangay representatives and residents. This is an appropriate survey methodology to pursue the main themes of the Circular that emphasizes barangay development.

Fourth, although this survey focused on the socially vulnerable people by following JICA's terms of reference, the JICA categories of socially vulnerable people and those in the Circular are the same.

Fifth, this peacebuilding survey prepared relevant project concepts in Cotabato City based on its outcomes. These project concepts match the actions required by the Circular.

(2) Survey Sites

Cotabato City consists of 37 barangays that are divided into 5 barangay groups. The names of and numbers of barangays in the groups are as follows: Poblacion (10); Rosary Heights (14); Bagua (4); Kalanganan (3); and Tamontaka (6). Some of the Poblacion and Bagua barangays are in densely populated business districts. The Kalangan barangays stretch northwest to the coastline of the Illana Bay, which is part of the Moro Gulf. The Rosary Heights barangays are a mixed area of small shops, residences, and public offices around the business districts. The outskirts of the Rosary Heights and Tomontaka barangays developed inland to the southeast. Most of the areas are sparsely populated agricultural lands. Figure 19.1-1 shows the locations of the barangays in Cotabato City.



Source: JICA Study Team

Figure 19.1-1 Barangays in Cotabato City

(3) Survey Methodology

Based on the JICA terms of reference, the Study Team prepared the questionnaire on peacebuilding. The questionnaire's priority subjects are (1) general peace and security conditions, (2) land disputes, (3) IPs, and (4) any type of social discrimination against minorities. Local consultants of the Study Team visited the representatives of the 37 barangays who agreed to answer the questionnaire. The Study Team also executed in-person interviews. To secure objectivity and validity of the answers, the number of respondents per barangay was set as two so that the total number of respondents was 74. The positions of the respondents are barangay captains, barangay secretaries, barangay treasurers, and members of barangay offices such as "kagawad for peace and order" and "Lupon Tagapamahaya" (barangay justice system). In addition, the Study Team interviewed senior officials of the five adjacent municipalities[1] to collect their assessment on any impact of the four subjects above in their own municipality's relationship with Cotabato City. Furthermore, the Study Team consulted several people in Cotabato City who were familiar with the subjects and used their comments for analysis.

This peacebuilding survey had two main characteristics. First, it implemented an in-person interview with each respondent and collected their responses on sensitive matters despite the COVID-19-induced lockdown in Cotabato City. The respondents were generally cooperative to the survey and expressed candid views. Majority of them seemed to believe that the survey was a rare opportunity to make their issues known. They also hoped to have their needs met so that peace and prosperity in the barangays would advance. Second, by requesting respondents to explain the degree of impact on each subject numerically, the survey tried to analyze the situation in a quantitative way. Because the number of respondents per barangay is two, the collected data may not be sufficient to measure the degree of impact precisely. However, the Study Team hopes that the survey's analysis, based on the responses from 74 people in 37 barangays, will enhance the understanding of the general trend of impact on the barangays.

19.1.3 General Social Conditions in Cotabato City and Five Adjacent Municipalities

(1) Peace and Security Conditions

From July to September 2020, the JICA Study Team interviewed many senior Cotabato City police officers, a senior officer of the 6th Infantry Division, and residents. The interviewees believed that the peace and security conditions in Cotabato City were generally stable and did not see any indication of major violence or armed attacks by politically or ideologically motivated extremists and other unlawful elements. Moreover, all the officials of the five adjacent municipalities interviewed by the Study Team reported no serious security threat in the municipalities that would threaten the peace and security in Cotabato City.

The barangay survey revealed that the number of security-related incidents was limited, and the threat score was low. Although a few shooting incidents in Rosary Heights and a conflict between

[1] The municipalities of Sultan Kudarat, Sultan Mastura, Parang, Pigawayan, and Datu Odin Sinsuat

political parties in Bagua were reported, the survey indicated that residents felt no imminent danger from extremist groups. Table 19.1-3 indicates the data from the survey.

Table 19.1-3 Report of Security-related Incidents and Threat Scores of Barangays

No.	Subjects on general peace and security	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalang anan	Tamonta ka	
1	No. of incidents caused by political extremists and radical groups	**5% (1/20)[2]**	**7.1% (2/28)**	**12.5% (1/8)**	**0% (0/6)**	**0% (0/12)**	**5.4% (4/74)**
	Threat score of the barangay groups	**2.5% (1/40)[3]**	**8.9% (5/56)**	**12.5% (5/56)**	**0% (0/12)**	**0% (0/24)**	**7.4% (11/148)**

Source: JICA Study Team

Similarly, in the inquiry on the existence of "rido" or violent crashes between rival clans in barangays, the number of reported cases is limited as shown in Table 19.1-4. This shows that "rido" may exist in one of the Kalanganan barangays. Nevertheless, the overall threat score is relatively low at 6.8%. Thus, the situation of the barangays as a whole is calm.

Table 19.1-4 Report of "rido" -related Incidents and Threat Scores of Barangays

No.	Subjects on general peace and security	Barangay Groups					Total score and percentage
		Poblacio n	Rosary Heights	Bagua	Kalanga nan	Tamont aka	
2	No. of "rido" or violent crashes	**5% (1/20)**	**3.6% (1/28)**	**12.5% (1/8)**	**33.3% (2/6)**	**0% (0/12)**	**6.8% (5/74)**
	Threat score of the barangay groups	**2.5% (1/40)**	**3.6% (2/56)**	**0% (0/16)**	**58.3% (7/12)**	**0% (0/24)**	**6.8% (10/148)**

Source: JICA Study Team

However, a few responses indicated the presence of gangs and common criminal groups. The main concern of the barangay officials was the presence of so-called Out of School Youth (OSY) gangs and other criminals. The reported incidents were shooting, snatching, theft and drug related crimes. Table 19.1-5 shows the survey data on this aspect.

Table 19.1-5 Report on Gangs and Common Criminals and Threat Scores of Barangays

No.	Subjects on general peace and security	Barangay Groups					Total score and percentage
		Poblacio n	Rosary Heights	Bagua	Kalang anan	Tamonta ka	
3	Presence of gangs and common criminals	**40% (8/20)**	**57.1% (16/28)**	**75% (6/8)**	**0% (0/6)**	**8.3% (1/12)**	**41.9% (31/74)**
	Threat score of the barangay groups	**17.5% (7/40)**	**32.1% (18/56)**	**37.5% (6/16)**	**0% (0/12)**	**4.2% (1/24)**	**21.6% (32/148)**

Source: JICA Study Team

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2 (number of incidents reported by respondents/total number of respondents in each barangay groups)

333 The threat score is calculated as follows: each respondent scores 0 point for no threat or minimum, 1 point for potential threat, and 2 points for the most serious situation or imminent threat. The score for maximum threat is 148 = 2 points X 74 respondents.

All the barangays seemed to take this issue very seriously. Many of the respondents reported that barangay captains, barangay officials in charge, and other leading residents are taking active roles to maintain peace and security. Their activities included regular patrolling (Ronda), implementation of curfew hours, awareness campaign to drug users, setting a hotline, house-to-house dialogue, regular barangay consultation and orientation, community monitoring, and sport activities for mobilization of youths.

Barangay officers such as "kagawad for peace and order" reportedly performed leading roles in organizing and implementing the activities above. The surveyors reported that they received many requests from the respondents and other residents in the barangays to support these activities to prevent crime and disorder in the barangays. Table 19.1-6 shows the extent of measures implemented for peace and security in the barangays.

Table 19.1-6 Existence of Measures Implemented for Peace and Security in Barangays

No.	Subject on general peace and security	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
4	Existence of measures implemented for peace and security in barangays	90% (18/20)	100% (28/28)	90% (8/8)	100% (6/6)	91.7% (11/12)	82.4% (61/74)

Source: JICA Study Team

(2) Consideration on Social Problems in Barangays

1) Indigenous Peoples (IPs)

The barangay survey interviewed several groups of IPs who reside in Cotabato City. The survey results reveal that the IPs have 7,000 households and around 5,000 registered voters in the city. The main tribe is Téduray. Many of the IPs live in the barangays of RH (Rosary Heights) Mother, RH 1, RH 2, RH 4, RH 5, RH11, and the Poblacion 5 area. These IPs had migrated to the city over the years from South Upi, Upi, Datu Blah Sinsuat, and other municipalities of Maguindanao. The main reasons for the migration were to flee from persecution in rural areas and pursue job and business opportunities. The following is an outline of the main issues of IPs in Cotabato City. Mainly because of the discrimination that they faced, most of the IPs received neither proper education nor technical training. As a result, many of them work as manual laborers such as nanny, domestic helper, construction worker, sales lady, cook, gasoline boy, hospital worker, carpenter, subsistence farmer or fisherman, or remain jobless. It is hard for them to break away from serious poverty because their daily wages are at the subsistence level. Moreover, some of the IPs settled in government-owned or private properties, became squatters, and have no land titles to their residences.

Only two respondents in the Bagua barangay group reported a lack of discipline among the children of IPs. Respondents from other barangays made no report on IPs-related problems. The threat score is low as shown in Table 19.1-7. The surveyors were also informed by barangay officials that the latter were dealing with issues of IPs under the leadership of barangay captains or through intermediaries.

Table 19.1-7 Existence of Problems with Indigenous Peoples in Barangays

No.	Consideration to the social problems	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
5	Existence of problems with indigenous peoples in the barangay	**0% (0/20)**	**0% (0/28)**	**25% (2/8)**	**0% (0/6)**	**0% (0/12)**	**2.7% (2/74)**
	Threat score of the barangay groups	**0% (0/40)**	**0% (0/56)**	**12.5% (2/16)**	**0% (0/12)**	**0% (0/24)**	**1.4% (2/148)**

Source: JICA Study Team

2) Different Religions

In 2015, among Cotabato City's total population of 299,438, the Muslim population was 228,036 (76.2%), the non-Muslim population was 66,113 (22.1%), and the population of other faiths or those who did not disclose their religion was 5,289 (1.7%).[4] Although religious problems seemed possible, no respondent to the barangay survey reported any incident or conflict due to religious differences. Table 19.1-8 shows the outcome of this survey.

Table 19.1-8 Existence of Problems Among People of Different Religions in Barangays

No.	Consideration on social problems	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
6	Existence of problems among people of different religions in the barangay	**0% (0/20)**	**0% (0/28)**	**0% (0/8)**	**0% (0/6)**	**0% (0/12)**	**0% (0/74)**
	Threat score of the barangay groups	**0% (0/40)**	**0% (0/56)**	**0% (0/16)**	**0% (0/12)**	**0% (0/24)**	**% (0/148)**

Source: JICA Study Team

3) Poverty

In 2018, the estimate (%) of poverty incidence among families in Cotabato City was 35.5% while the national average was 12.2%.[5] Thus, it is logical that the respondents showed a keen interest in and concern on serious poverty in their barangays. As shown in Table 19.1-9, 93.2% of the respondents expressed a grave concern on this subject. However, the threat score is relatively low at 25.7%. According to the reports of the surveyors on their talks with the respondents and other residents, poverty was not regarded as an immediate threat to the peace and security of their barangays. Nevertheless, many of them pointed out that the situation was steadily getting worse over the years. In addition, some of the residents stated that poverty might become a major cause of large-scale social confusion and unrest soon.

[4] Philippine national population census in 2015
[5] Source: Philippine Statistics Authority, 2018

Table 19.1-9 Existence of Serious Poverty Problem in Barangays

No.	Consideration on social problems	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanga nan	Tamon taka	
7	Existence of serious poverty problem in the barangay	**90% (18/20)**	**89.3% (25/28)**	**100% (8/8)**	**100% (6/6)**	**100% (12/12)**	**93.2% (69/74)**
	Threat score of the barangay groups	**22.5% (9/40)**	**25% (14/56)**	**25% (4/16)**	**16.7% (2/12)**	**37.5% (9/24)**	**25.7% (38/148)**

Source: JICA Study Team

(3) Land Issues: Existence of Serious Land Disputes in Barangays and Their Impact

As Table 19.1-10 below shows, Cotabato City had 40 land disputes. The number of disputes is relatively high in the Rosary Heights, Poblacion, and Kalangan barangay groups. However, the overall threat score is relatively low. No major land dispute was reported that may jeopardize the peace and security in Cotabato City. The common feature of the land disputes is illegal settlements by squatters in publicly or privately owned lands. There are also a few land disputes between two rival families or clans. A long-term resident who is familiar with land issues states that land disputes are often due to an inheritance issue in a large family. The surveyors were also informed by the respondents and other barangay residents that land disputes are difficult to solve at the barangay level because of the complexity of each case.

Although land disputes pose no immediate danger to the peace and security of Cotabato City, they may pose an obstacle to the possible expansion of the infrastructure network in the barangays. Even if the city's infrastructure is developed, such disputes may prevent the improvement of the lives of barangay residents.

Table 19.1-10 Existence of Serious Land Disputes in Barangays

No.	Consideration on social problems	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanga nan	Tamont aka	
8	Existence of serious land disputes in the barangay	**35% (7/20)**	**75% (21/28)**	**50% (4/8)**	**50% (3/6)**	**41.7% (5/12)**	**54.1% (40/74)**
	Threat score of the barangay groups	**7.5% (3/40)**	**25% (16/56)**	**6.25% (1/16)**	**0% (0/12)**	**0% (0/24)**	**13.5% (20/148)**

Source: JICA Study Team

(4) Social Discrimination and Persecution Against Socially Vulnerable people

The survey tried to confirm the existence of socially vulnerable people in each barangay. Then, the survey asked the respondents if there was any discrimination against IPs, persons with disability (PWDs), religious minority, and internally displaced persons (IDPs). Although the existence of socially vulnerable people in the barangays was identified, all the 74 respondents flatly denied that there was any discrimination in their barangays against those socially vulnerable people, as indicated in Table 19.1-11.

In the inquiries to the authorities of the five adjacent municipalities, all the officials stated that there was no discrimination issue in their municipality that would have any negative impact on the peace and security in Cotabato City.

Table 19.1-11 Existence of Socially Vulnerable People in Barangays and Discrimination Against These People

No.	Consideration to socially vulnerable people	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
1	Existence of indigenous peoples (IPs) in the barangay	**40% (8/20)**	**35.7% (10/28)**	**25% (2/8)**	**16.7% (1/6)**	**25% (3/12)**	**32.4% (24/74)**
	Existence of discrimination against IPs	**0% (0/20)**	**0% (0/28)**	**0% (0/8)**	**0% (0/6)**	**0% (0/12)**	**0% (0/74)**
2	Existence of persons with disability (PWDs) in the barangay	**55% (11/20)**	**50% (14/28)**	**87.5% (7/8)**	**83.3% (5/6)**	**66.7% (8/12)**	**60.8% (45/74)**
	Existence of discrimination against PWDs	**0% (0/20)**	**0% (0/28)**	**0% (0/8)**	**0% (0/6)**	**0% (0/12)**	**0% (0/74)**
3	Existence of religious minorities in the barangay	**5% (1/20)**	**10.7% (3/28)**	**0% (0/8)**	**0% (0/6)**	**0% (0/12)**	**5.4% (4/74)**
	Existence of discrimination against religious minorities	**0% (0/20)**	**0% (0/28)**	**0% (0/8)**	**0% (0/6)**	**0% (0/12)**	**0% (0/74)**
4	Existence of internally displaced persons (IDPs) in the barangay	**0% (0/20)**	**3.6% (1/28)**	**12.5% (1/8)**	**0% (0/6)**	**0% (0/12)**	**2.7% (2/74)**
	Existence of discrimination against IDPs	**0% (0/20)**	**0% (0/28)**	**0% (0/8)**	**0% (0/6)**	**0% (0/12)**	**0% (0/74)**

Source: JICA Study Team

19.1.4 Infrastructure Development and Technical Project for Peacebuilding

(1) Needs for Community Infrastructure Development for Peacebuilding

In response to the inquiry on community infrastructure development for peacebuilding, the 74 respondents identified the facilities as shown in Table 19.1-12.

Table 19.1-12 List of Needed Infrastructures in Barangays

No.	Infrastructure development	Barangay Groups					No. of respondents
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
1	Access road	**3**	**7**	**0**	**1**	**4**	**15**
2	Sports/recreation facility	**1**	**9**	**2**	**0**	**2**	**14**
3	Sewerage system	**3**	**4**	**4**	**0**	**0**	**11**
4	Community marketplace	**2**	**2**	**0**	**2**	**2**	**8**
5	Storage house with emergency food, medicine, water, and rescue gear	**1**	**0**	**0**	**1**	**3**	**5**
6	Public park (evacuation site)	**3**	**1**	**1**	**0**	**0**	**5**
7	Potable water supply	**1**	**0**	**0**	**2**	**1**	**4**
8	Health post	**0**	**2**	**1**	**0**	**0**	**3**
9	Farm to Market road	**0**	**0**	**0**	**0**	**2**	**2**
10	School building (elementary, high school, etc.)	**1**	**1**	**0**	**0**	**0**	**2**

Source: JICA Study Team

Among the ten infrastructure facilities, the largest number of respondents indicated that the construction, repair, and reinforcement of access roads is the most important infrastructure development. The surveyors also reported that they received many requests from barangay residents for the construction of new access roads and the repair of the existing access roads. Although many respondents, especially those from the Rosary Heights barangays, suggested sport or recreation facilities, constructing such facilities is not urgent from the peacebuilding viewpoint. In addition, the respondents from business district and residential barangays cited a sewerage system. Such barangays have been flood-prone, and the construction, repair, and reinforcement of a sewerage system was an urgent infrastructure need for the residents there. A limited number of respondents requested potable water supply, but potable water is one of the major basic human needs. The need must be examined more in detail and this survey recommends that a comprehensive potable water supply system be constructed soon. On Farm to Market Roads (FMRs), only the respondents from the suburban barangays cited the need for them; there was no response from the respondents from downtown and residential-area barangays on this matter. Nevertheless, it is well known from similar FMR projects in Mindanao that the construction and extension of FMRs has produced a variety of social and economic benefits to the communities along the roads.[6] Given the potential benefits, this need should be examined for future planning and construction.

(2) Needs on Technical Projects for Capacity Development

In response to an inquiry on related technology transfer and capacity development, the 74 respondents identified the technical projects as shown in Table 19.1-13.

Table 19.1-13 List of Needed Technical Projects for Capacity Development in Barangays

No.	Technical project	Barangay Groups					No. of respon dents
		Poblacion	Rosary Heights	Bagua	Kalanga nan	Tamont aka	
1	Community livelihood project with an income generation scheme	**13**	**20**	**4**	**8**	**5**	**50**
2	Vocational training project	**3**	**5**	**2**	**0**	**5**	**15**
3	Free distribution of essential foods for people in abject poverty	**2**	**1**	**2**	**0**	**2**	**7**
4	Community monitoring and maintenance training project for access road and FMR	**1**	**2**	**0**	**0**	**0**	**3**
5	One Town One Product promotion project	**0**	**0**	**0**	**0**	**0**	**0**
6	"Peace Education" against violence and discrimination	**1**	**0**	**1**	**0**	**0**	**2**
7	Community evacuation practice	**0**	**0**	**0**	**0**	**0**	**0**

Source: JICA Study Team

[6] The project sites are at Bumbaran municipality in Lanao del Sur Province, Alamada municipality in Cotabato province, and Datu Paglas municipality in Maguindanao province.

Regarding the needs for a technical project for capacity development, the preference of the respondents was clear. As shown in Table 19.1-13, 50 out of the 74 respondents, or 67.6%, answered that "community livelihood project with an income generation scheme" is the most desirable project. Because the vast majority of the respondents already pointed out that "serious poverty" is a crucial issue that threatens the peace and security in their barangays, such technical project would be a proper means to solve the poverty issue. The selection of "vocational training project" seems to be based on the same reason. In contrast, the respondents are less interested in the maintenance of access roads and FMR. Because the condition and sustainability of roads depend on good repair and maintenance, technical capacity development on road repair and maintenance at the barangay level is necessary. Such technical training opportunities are also likely to convince barangay residents of the importance of regular repair and maintenance of the roads. The respondents are not interested much in "peace education" and "evacuation practice" as preventive measures against disruption of peace and order and for minimization of damage from natural disasters. Such indifference must be addressed. Possible solutions would be a public awareness campaign or the inclusion of an awareness program in technical projects.

(3) Other Related Infrastructure and Technical Projects

Other facilities and technical projects were also mentioned in this survey. Although the number of respondents was small, the listed infrastructure and technical projects may reflect the different concerns on peacebuilding in the barangays. The 74 respondents specified the facilities and technical projects as shown in Table 19.1-14.

Table 19.1-14 List of Other Related Infrastructure and Technical Projects in Barangays

No.	Other infrastructure and technical project	Barangay Groups					No. of respondents
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
[Infrastructure]							
1	Footbridge		**2**				**2**
2	Road concreting		**1**				**1**
3	Mega market building	**1**					**1**
3	Evacuation center	**3**					**3**
4	Barangay hall	**3**		**1**			**4**
5	Cell phone transmits tower		**1**				**1**
6	Garbage treatment facility	**1**					**1**
7	Covered court	**1**					**1**
8	Hall for meeting	**1**					**1**
9	Mini library				**1**		**1**
10	Dryer for farmers				**1**		**1**
11	Day care center					**1**	**1**
[Equipment and Materials]							
12	Agricultural materials				**2**	**1**	**3**
13	Fishery equipment				**1**		**1**
14	Solar streetlight				**1**		**1**
15	Fire truck			**1**			**1**
16	Septic tank	**1**					**1**
17	Car for patrolling		**3**				**3**
18	Equipment for patrolling		**3**				**3**
19	Cell phone for barangay officials		**1**				**1**
[Technical Program]							
20	Education and Training to IPs	**1**	**2**				**3**

Source: JICA Study Team

19.1.5 COVID-19 and Peacebuilding

(1) Rationale

As stated above, in the JICA basic principle on “establishment of resilience,” “(1) reconstruction of social capital” is one of the four main themes in the peacebuilding support mechanism. In this theme, JICA lists “ii) strengthening of community health and medical service” as the possible priority sector for realization of social capital as well as “i) reconstruction of community infrastructure.” Therefore, it is appropriate to discuss the strengthening of community health and medical service for enhancing peacebuilding in a conflict-affected area.

(2) COVID-19 Damages to the Barangays

Since March 2020, Cotabato City has faced the pandemic of coronavirus disease 2019 (COVID-19). The lockdown measures to prevent further spread of COVID-19 in the city led to a sudden halt of social and economic activities there.

In response to the inquiry on COVID-19’s most serious damage to their barangays, the vast majority of the respondents (59 out of 74, or 79.7%) stated that barangay residents were affected severely from the lack of income as shown in Table 19.1-15. Because many barangay residents were poor and working as manual laborers with low cash income and no job security, the negative impact on their daily life was devastating. Other damages cited by the respondents include fight among barangays on distribution of relief goods, lack of access to food due to strict lockdown measures, and lack of respect to protocols in distribution of relief goods. However, the number of respondents who reported other damages is small.

Table 19.1-15 Most Serious Damages to Barangays from COVID-19

No.	Most serious damage	Barangay Groups					Total score and percentage
		Poblacion	Rosary Heights	Bagua	Kalanganan	Tamontaka	
1	Lack of income	**90% (18/20)**	**60.7% (17/28)**	**100% (8/8)**	**83.3% (5/6)**	**91.7% (11/12)**	**79.7% (59/74)**

Source: JICA Study Team

(3) Needs for Infrastructure and Technical Projects Against COVID-19 Damages

Table 19.1-16 presents a summary of the responses on the necessary community infrastructure and technical projects to recover from the COVID-19 damages.

Table 19.1-16 Needs for Infrastructure and Technical Projects Against COVID-19 Damages

No.	Barangay Groups	Infrastructure and technical project against the COVID-19 damages
1	**Poblacion**	● Storage house with emergency food, medicine, water, and rescue gear ● Community livelihood program with income generation scheme ● Vocational training ● Free distribution of essential foodstuffs ● Dissemination seminar/meeting about what is COVID-19
2	**Rosary Heights**	● Storage house with emergency food, medicine, water, and rescue gear ● Community marketplace, health post and isolation rooms ● Community livelihood project
3	**Bagua**	● Isolation rooms ● Storage house ● Sports facility for evacuation center ● Mobile ambulance ● First aid training for health workers and barangay officials
4	**Kalanganan**	● Storage house ● Community marketplace ● Vocational training on agriculture and fishery technology ● Specially designed vocational training for out-of-school youth (OSY)
5	**Tamontaka**	● Storage house ● Potable water supply ● Covered court ● Public park and evacuation center ● Small banka/boat ● Community livelihood program ● Vocational training

Source: JICA Study Team

(4) Requests for Medical Supplies from Doctors Dealing with COVID-19

In September and October 2020, this peacebuilding survey implemented a quick interview survey on the medical practitioners in Cotabato City who were treating COVID-19 patients every day. Two medical doctors in charge of COVID-19 treatment replied on the needs of immediate supply of medical equipment and materials. Their recommended priorities are as follows:

a. Sanitation/hygiene kit to be distributed in barangays (soap, alcohol, and face masks)

b. Setting up a clean toilet in every household

d. Provision of communication equipment to barangay-level health workers

e. Public health and hygiene education including how to deal with COVID-19

f. Establishment of isolation/quarantine facilities, but they should not be at the community level. It should be at least at the municipal level if the provincial level is difficult. This will help to carry out concentrated monitoring and caring for COVID-19 patients.

While the COVID-19 pandemic is continuing, the medical examination and treatment capacity of the Cotabato Regional Medical Center is very limited. Under such circumstances, the two doctors made the following requests to strengthening the medical treatment capacity against COVID-19 and other prevailing infectious diseases.

a. Construction of a new isolation ward with an Intensive Care Unit (ICU) to accept and treat patients of COVID-19 in serious conditions and other infectious diseases

b. Provision of advanced medical equipment to use against COVID-19 and other infectious diseases (e.g., CT scanner, MRT, PET, blood analyzer, ECMO (Extra Corporeal Membrane Oxygenation), and ventilators)

c. Formulation of a technical cooperation project to deal with the COVID-19 pandemic, develop the capacity development of this institution and its staff

(i) Dispatch of specialist doctors on COVID-19 and infectious diseases to train Philippine medical doctors and nurses on how to conduct PCR tests and treat patients of COVID-19 and other infectious diseases

(ii) Dispatch of medical equipment experts to train Philippine medical engineers on how to use and maintain the advanced medical equipment

(iii) Short-term and intensive technical training for Philippine medical doctors and nurses who have worked on COVID-19 patients

19.2 Peacebuilding Development Plan

19.2.1 Factors That Affect the Peacebuilding Conditions in Cotabato City

Prior to the barangay survey, in "19.1.1 Historical review of the Mindanao conflict and Cotabato City," it is indicated that political conflict, easy resort to violence, economic stagnation and social confusion in the conflict-affected area for decades have substantially jeopardized the security conditions of the city. Specifically, the negative spiral consisting of the number of the lost lives, the fear in the residents, and the delays or termination of social and economic development in Cotabato City are the main components of the "human-induced disasters" in Cotabato City.

Then, the fact finding on and analysis of the social conditions of the 37 barangays and related community needs in the categories of infrastructure, technical projects, and emergency medical assistance against COVID-19 reveal the following.

The peace and security conditions in Cotabato City and the adjacent five municipalities are generally stable and present no immediate danger to the barangays.

A small number of land disputes among traditional families and clans were reported. Such land disputes are not a threat to peace in the barangays.

Regarding consideration on socially vulnerable people, all the 74 respondents replied that there is no discrimination against IPs, handicapped people, religious minorities, and unreturned internally displaced people. Therefore, the phenomena above are not considered as substantial factors that affect the peacebuilding conditions in Cotabato City.

In contrast, the following issues are identified as factors that affect the peacebuilding conditions in Cotabato City.

a) Lack or insufficiency of community infrastructure was pointed out in many barangays. The barangay residents are not satisfied with the current conditions of their community infrastructure facilities.

b) Serious poverty exists in all the barangays and has led to the highest threat scores. A majority of the respondents regard this as an urgent issue. Furthermore, poverty among IPs is dire because of their loss of jobs and income, which were caused by COVID-19.

c) Respondents from a few barangay groups cited land disputes related to IPs.

d) The need to strengthen the administrative capacity of barangay officials and add facilities and equipment for barangay activities was identified.

e) Medical practitioners in Cotabato City reported the limited public health and medical capacity in the COVID-19 pandemic. They requested emergency assistance on medical equipment and technical expertise of infectious diseases.

19.2.2 Guidelines of the Community Peacebuilding Development Plan

The basic component of this development plan is formulation of priority infrastructure and technical projects to strengthen the resilience of barangays in Cotabato City with respect to peacebuilding principles. For realization of these objectives, this survey set up the following four operational guidelines:The first is to make the purpose and contents of this plan compatible with the overall design of the "Urban Infrastructure Development in Greater Cotabato City Plan."

The second is to follow the basic principles of peacebuilding. The principles are that development projects should "do no harm" to the current fragile social conditions and should "do maximum good" for promotion of peace and prosperity of the barangays in Cotabato City.

The third is that the purpose and contents must be designed to address the factors that affect the peacebuilding conditions in Cotabato City.

The fourth is to find a means to respond immediately to the urgent requests from medical practitioners who are treating COVID-19 patients every day in Cotabato City.

19.2.3 Priority Community Infrastructure Development and Technical Projects

By following the above operational guidelines to enhance the resilience of Cotabato City for peace and security, this survey proposes the following priority community infrastructure development and technical projects in Table 19.2-1. For details, please see the attached "Project Profile" for peacebuilding.

Table 19.2-1 Priority Community Infrastructure and Technical Projects

No.	Title
【Community infrastructure development】	
1	**Comprehensive community infrastructure development project** (Construction/repair/reinforcement of community access roads, sewerage system, potable water supply system, etc.)
2	**Comprehensive community service facility development project** (Community marketplace, storage with emergency gear, barangay hall with public meeting space, public park=evacuation site, covered court, etc.)
3	**Construction of a new Farm to Market Road (FMR)** (Construction of a new FMR to connect a major road network to inland farmlands)
【Community technical project】	
1	**Community livelihood project with income generation scheme** (Production, processing, and sale of high-value vegetables, goats, chickens, tilapia, etc., through formulation of industry clusters)
2	**Special occupation training project for out of school youth (OSY) and women of IPs** (Occupation training for OSY and women of IPs, with specially designed subjects. · A sample program for OSY is one on computer usage. · A sample program for women of IPs is one on cooking with knowledge of nutrition and hygiene.)
3	**Administrative capacity development project** (Capacity development of city government and barangay officials for management of infrastructure development and barangay institution building)
【Priority infrastructure and technical project against COVID-19】	
1	**Emergency medical project against COVID-19** (Immediate supply of medical equipment and consumables for treatment of COVID-19 patients and others)

Source: JICA Study Team

Project Profile for Peacebuilding

1. PROJECT TITLE	**Comprehensive community infrastructure development project**
2. LOCATION	All the barangays in Cotabato City
3. IMPLEMENTING AGENCIES	City Government of Cotabato, DPWH Cotabato City District Engineering Office, MPW-BARMM
4. OBJECTIVES	Identify the most serious community infrastructure problem and solve the problem through construction or repair of the selected infrastructure.
5. EXPECTED EFFECTS	Reduction of inconvenience, physical burden, and social costs. Improvement of social service delivery. Enhancement of the barangay resilience against social and natural disasters. Stimulus to strengthen community unity and business activities.
6. PROJECT COSTS	Philippine Peso (PhP) 240 million (M)- (Barangay project formulation=10 M; detailed design and cost estimate=10 M; construction=200 M; and technical training=20 M)
7. IMPLEMENTATION SCHEDULE	2021-2025

8. PROJECT DESCRIPTION

Community infrastructure was affected and left without public intervention for a long time through the period of Mindanao conflict. Many barangays identified the needs for construction and repair of community infrastructure. This project is the response to their infrastructure needs in all the 37 barangays.
Sample contents of this project include the construction, repair, and reinforcement of community access roads, sewerage system, potable water supply system, and foot bridges.
In its first stage, the project will conduct a needs survey to confirm the top barangay infrastructure priority and build a consensus. The positive impact to socially vulnerable people must be counted in the selection and design process. In the second stage, detailed design and a cost estimate study will take place for the identified priority barangay infrastructure. The third stage is the actual construction of these infrastructure facilities. This project will consist of a number of small community infrastructure sub-projects. It will also include organization of maintenance group and technical training for them on repair and maintenance capacity at the barangay level. It is important to actively recruit socially vulnerable people as the members of the maintenance group. The tentative maximum budget of each sub-project is about PhP 10 million. The total budget will depend on the number and scale of sub-projects and maintenance training.

9. Strategic Environment Assessment (SEA) CONSIDERATIONS

Some of the undertaking may need small but extra land space. Although amicable settlement in barangays is likely, land acquisition remains a subject for clearance.

1. PROJECT TITLE	**Comprehensive community service facility development project**
2. LOCATION	All the barangays in Cotabato City
3. IMPLEMENTING AGENCIES	City Government of Cotabato, DPWH Cotabato City District Engineering Office, MPW-BARMM
4. OBJECTIVES	Immediate solution for the shortage of community facilities, which are to be used for promotion of regular barangay activities, preparation against natural and social disasters, and improvement of social service delivery for socially vulnerable people
5. EXPECTED EFFECTS	Improvement of overall "Quality of Life" among the barangay residents, including the socially vulnerable people. Enhancement of the barangay resilience against possible social problems and natural disasters. Stimulus to strengthen community unity. Help to activate peace and security related activities in the barangays.
6. PROJECT COSTS	PhP 230 million (Barangay project formulation=10 M; detailed design and cost estimate = 20 M; and construction = 200 M)
7. IMPLEMENTATION SCHEDULE	2021-2025

8. PROJECT DESCRIPTION

Community facilities were affected and left without public intervention for a long time through the period of Mindanao conflict. Many barangays identified the needs for construction/repair of community facilities. Sample contents of this project are the construction and repair of storage with emergency gear, barangay hall with public meeting space, public park (evacuation site), and covered court.

In its first stage, the project will implement a needs survey to confirm top barangay facility priorities and build a consensus. The needs include for the socially vulnerable people. In the second stage, detailed design and a cost estimate study will take place for each identified facility. The design must reflect the needs of socially vulnerable people. The third stage is actual construction of these facilities. The project will consist of sub-projects on small community facilities and management capacity training at the barangay level. Representatives of socially vulnerable people must be included in the management of these facilities. These people are expected to propose special activities to overcome their handicaps. The tentative maximum budget of each sub-project is PhP 10 million. The total project budget will depend on the number and scale of each sub-project.

9. SEA CONSIDERATIONS

Some of the project activities may need small but extra land space. Although amicable settlement in the barangays is likely, land acquisition remains a subject for clearance.

1. PROJECT TITLE	**Construction project of a Farm to Market Road (FMR)**
2. LOCATION	Connect an appropriate point of a major national road network with an inland area (Tamontaka barangays) of Cotabato City.
3. IMPLEMENTING AGENCIES	City Government of Cotabato, DPWH Cotabato City District Engineering Office, MPW-BARMM
4. OBJECTIVES	To address the inland barangays' limited access to social services such as school, medical treatment, peace and security protection, and other government welfare services. To eliminate the physical difficulties and reduce economic costs for farmers' agribusiness activities in downtown markets.
5. EXPECTED EFFECTS	Improvement of the overall quality of life among the barangay residents along the road. Enhancement of the barangays' resilience against social and natural disasters and threats to peace and security. Stimulus to expand local business activities.
6. PROJECT COSTS	PhP 250 million Barangay project formulation (route selection and technical specification of roads) =10 M; detailed design and cost estimate =40 M; and construction of 10-km concrete road and bridges=200 M
7. IMPLEMENTATION SCHEDULE	2021-2025

8. PROJECT DESCRIPTION

The main task is to construct a new FMR that connects an appropriate point of a major national or town road network with an inland area (Tamontaka barangays). The construction will partially use the existing town road network.

Among the technical specifications of the road are a concrete road with reinforcing bar, U-shaped grooves, and concrete bridges, to be resilient against natural disasters. As the construction workers, local youth which include Out of School Youth (OSY) are encouraged to be hired. Through these experiences, they are expected to obtain road construction skills, save some cash income and learn basic social discipline. There were similar JICA FMR projects for peacebuilding in Maguindanao, Lanao del Sur, and Cotabato provinces, which brought significant expansion of agribusiness activities, improvement of access to schools, hospitals and markets, and more active commerce along the roads. This project can make a similar social and economic development impact. In addition, the new FMR may become the starting point of social and economic development of the inland area of Cotabato City. The total budget will depend on the length of the FMR.

9. SEA CONSIDERATIONS

Because most of the road sections are new roads, land acquisition is needed for the Road Right-of-Way (ROW).

1. **PROJECT TITLE**	**Community livelihood project with an income generation scheme**
2. **LOCATION**	Barangays in the coastal and inland areas
3. **IMPLEMENTING AGENCIES**	City Government of Cotabato
4. **OBJECTIVES**	To establish a community livelihood project, which is tentatively named “Halal Food Village.” The main purpose is to have participants from low-income families gain income through sales of the products made through this project.
5. **EXPECTED EFFECTS**	Generation of income among the socially vulnerable people who are not capable of skilled work or lost jobs. This project can provide them a way out of poverty and create social stability in the barangays. Then, the stability will strengthen the barangays’ resilience against social and natural disasters and threats to peace and security. The project can also be a stimulus to expand business activities among the participants.
6. **PROJECT COSTS**	PhP 150 million Barangay project formulation (site and participant selection) =10 M; preparation of teaching materials and technical training on production and marketing=100 M; and technical training = 40 M)
7. **IMPLEMENTATION SCHEDULE**	2021-2024

8. PROJECT DESCRIPTION

The main task is the introduction of an integrated farming system of high-value vegetables, goats, native chickens, tilapia, and processed foods made of them. The CD-CAAM project by JICA was a prototype of this project. The achievements of the CD-CAAM project are the sustainability of an income generation scheme and the development of entrepreneurship among its participants. This project will be implemented in a number of poor barangays The participants will be selected from socially vulnerable people. The tentative maximum budget for establishing each project site is PhP 5 million. The total budget will depend on the number of project sites and the scale of each project site.

9. SEA CONSIDERATIONS

Land acquisition is necessary for establishing the project site. No serious issue is assumed for SEA considerations.

1. **PROJECT TITLE**	**Special occupation training project for Out of School Youths and Women of IPs**
2. **LOCATION**	In a barangay that are easily accessible from the rest of Cotabato City
3. **IMPLEMENTING AGENCIES**	City Government of Cotabato
4. **OBJECTIVES**	To establish an occupation training project that is specially designed for Out of School Youths (OSY) and women of IPs, who are regarded as either troublesome or vulnerable people in the community. The main purpose is to have them become capable of earning income after this occupation training.
5. **EXPECTED EFFECTS**	OSY are regarded as troublesome in the barangays. Women of IPs are some of the most vulnerable people in the city. If both groups learn to earn income and become capable of work, a few major causes of social instability will be addressed.
6. **PROJECT COSTS**	PhP 100 million Barangay project formulation (site and participant selection) =10 M; preparation of teaching materials = 10 M; acquisition of teaching equipment =10 M; and planning, execution, and evaluation of technical training = 70 M)
7. **IMPLEMENTATION SCHEDULE**	2021-2025

8. PROJECT DESCRIPTION

The major activity of the project is to establish a training facility and a training program to address the limited occupational capacity of the two groups mentioned above. The program components for both groups will include basic literacy of English and Tagalog, basic mathematics and calculation, and counseling for mental health. In addition, introduction of on-the-job training (OJT) methodology, which is helpful for cash earning, will be an important component of the program. For OSY, training subjects will focus on practical skills and techniques on such matters as electronics, computer science, operation of automobiles, and heavy machinery. For women of IPs, cooking with knowledge of nutrition and hygiene, dress making with a sewing machine, and bookkeeping for micro business management may be beneficial. After successful technology transfer, this project intends to help the participants look for jobs and set up small businesses. The total budget of the project will depend on the numbers of participants and sites.

9. SEA CONSIDERATIONS

No need for consideration.

1. PROJECT TITLE	**Administrative capacity development project**
2. LOCATION	City hall and barangays of Cotabato City
3. IMPLEMENTING AGENCIES	City Government of Cotabato
4. OBJECTIVES	Enhancement of administrative capacity of city government and barangay officials for managing new infrastructure development and technical projects.
5. EXPECTED EFFECTS	Officials of both the city and the barangays will be more administratively and technically capable of planning, implementing, maintaining and assessing infrastructure development. In addition, barangay officials are expected to manage peacebuilding related social problems among socially vulnerable people in the barangays and strengthen barangay organizations and their activities.
6. PROJECT COSTS	PhP 50 million Project formulation (participant selection and preparation of teaching materials, arrangement of study tours) =10 M; and execution of training = 40 M
7. IMPLEMENTATION SCHEDULE	2021-2023

8. PROJECT DESCRIPTION

This will be a technical training project for both city and barangay officials in charge of the planning, implementation, maintenance, and assessment processes of infrastructure development. The project will implement lectures, workshops, and study tours on national laws, administrative rules and regulations, environmental guidelines and advanced civil engineering technology. For barangay officials, a special training program must be added to enhance their capacity to manage peacebuilding related social problems and build pertinent barangay institutions, especially with regard to socially vulnerable people related matters and the role of the barangay peace council. Because project participants have professional experience, on-the-job training (OJT) and study tours to the barangays with good practices should be included. In response to potential natural disasters, it is important for the barangay officials to formulate an information dissemination network in cooperation with relevant city government officials through this project as well as their own initiative.

9. SEA CONSIDERATIONS

No need for consideration.

1. PROJECT TITLE	**Emergency medical project against COVID-19**
2. LOCATION	Cotabato Regional Medical Center
3. IMPLEMENTING AGENCIES	DOH-12, DOH-BARMM, City Government of Cotabato, Cotabato Regional Medical Center
4. OBJECTIVES	Urgent enhancement of the overall medical treatment capacity of Cotabato Regional Medical Center, especially for the emergency treatment of COVID-19 and other infectious diseases.
5. EXPECTED EFFECTS	Medical professionals will be able to care for COVID-19 patients better. The medical center can provide more effective life-saving medical service against COVID-19 and other infectious diseases by using more advanced medical equipment and materials.
6. PROJECT COSTS	PhP 400 million a) construction of a hospital ward = 250 M b) provision of equipment and materials = 100 M c) training of doctors and nurses = 50 M
7. IMPLEMENTATION SCHEDULE	2021-2025

8. PROJECT DESCRIPTION

This project consists of the following components:

a) Construction of an independent hospital ward that is specifically designed for treatment of COVID-19 and other infectious diseases.
b) Provision of advanced medical equipment and materials for emergency treatment of COVID-19 patients.
c) Technical training for medical doctors, nurses and other medical professionals such as medical engineers, all of whom are dealing with COVID-19 patients, on how to treat COVID-19 patients with advanced expertise and good practice.

The components above should be implemented as soon as possible. The total budget will depend on the scale of each component.

9. SEA CONSIDERATIONS

No need for consideration.