



**THE INITIAL ENVIRONMENTAL EXAMINATION (IEE)  
RECONSTRUCTION AND REHABILITATION  
PALU COASTAL PROTECTION  
November 2019**

**FOR  
CONSULTING SERVICES FOR FLOOD RISK MANAGEMENT  
AND ENGINEERING SERVICES**

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**IEE**

**Reconstruction and Rehabilitation**

**Palu Coastal Protection**

## Glossary

ADB	Asian Development Bank
AH	Affected Household
AMDAL	Environmental Impact Assessment, EIA
AP	Affected Person
ASEAN	Association of South East Asian Nations
Bapedal	Environmental Management Agency, established in Ambon Province
Bappeda	Local Development Planning Agency
Bappenas	National Development Planning Agency
BBWS	Major River Basin Organization
BLH	District Environmental Management, established in Kabupaten Serang
BPBD	Local Disaster Mitigation Agency
BPDAS	Watershed Management Organization, under Ministry of Forestry
BPLH	Local Provincial Environmental Agency, established in Banten Province
BWS	River Basin Organization
CPMU	Central Project Management Unit
DED	Detailed Engineering Design
DGWR	Directorate General of Water Resources
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FMSRB	Flood Management in Selected River Basins
GERHAN	National Movement for Forest and Land Rehabilitation
GOI	Government of Indonesia
GR	Government Regulation
IA	Implementing Agency
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
KECC	Korea Engineering Consulting Corp
LARAP	Land Acquisition and Resettlements Action Plan
LG	Local Government
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOF	Ministry of Forestry
MOHA	Ministry of Home Affairs
NGO	Non-government organizations
O&M	Operation and Maintenance
PMU	Project Management Unit
POLA	Indonesian full name then "Water Resource Strategic Plan"
PP	Government Regulation
PU	Public Works
REA	Rapid Environmental Assessment
RENCANA	Indonesian full name then "Water Resource Detail Plan"
RKL/RPL	Environmental Management & Monitoring Plan, Complementary of AMDAL
SPS 2009	Safeguard Policy Statement 2009

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## Executive Summary

The earthquake and tsunami disaster of 28 September 2018 damaged the facilities and infrastructure of the Palu City coastal area. The destructive force of the tsunami was such, that the coastal protection infrastructure and the physical infrastructure behind it got damaged until 200 m land inwards. Currently the coastline of Palu Bay is left unprotected against sea abrasion and tidal waves. With assistance from ADB, the local River Basin Organization (Balai Wilayah Sungai Sulawesi III) in association with the Directorate General of Water Resources (DGWR), Ministry of Public Works has prepared a strategic plan and emergency program for the preparation and implementation of the Reconstruction and Rehabilitation of Palu Coastal Protection.

- Under ADB's Safeguard Policy Statement (SPS) 2009, this Emergency Assistance for Rehabilitation and Reconstruction (EARR 2019) Project for Construction of Palu Coastal Protection is categorized as Category B and requires an IEE.
- Under Indonesia regulation, the BWS Sulawesi III have determined to proceed with an Environmental Impact Assessment (AMDAL).
- Screening of environmental impact for the Palu Coastal Protection Project has been carried out by the Central Sulawesi Provincial Environment Agency (DLH). The result of the screening is that the project must prepare a full AMDAL (letter: 660/362 / BID.I / DISLH).

### Palu Coastal Redevelopment Program

The Palu Coastal Protection Project is part of the Palu Coastal Redevelopment Program. Other elements of this program are: (i) an Elevated Road, (ii) Palu Bridge IV, (iii) mangrove development, and (iv) salt production plots. The Elevated Road, and Palu Bridge IV projects will be financed by JICA. These projects may be constructed together or after the Palu Coastal Protection Project. The objective of the Palu Coastal Protection Project is to restore the coastal protection against sea abrasion and tidal waves as soon as possible. Protection against tsunamis and sea level rise will be provided on longer term by the elevated road and mangrove development.

### The Palu Coastal Protection Project

The project location covers four villages, i.e. Silae (Palu Barat Sub-district), Lere (Ulujadi Sub-district), Besusu Barat (Palu Tiur Sub-district), and Talise (Mantikulore Sub-district).

The project consists of construction of a coastal embankment along Palu beach, including four boat mooring facilities and land acquisition. The total length of embankment will be 7.0 km, where the length along the west coastline is 2.375 km, and the length along the east coastline is 4.625 km. The crest elevation of the structure will be 3.0 m, and the width of the coastal protection varies, depending on the local elevation with a minimum of 17.15 m.

Materials required for the construction are: Polypropylene (PP): 146,928 m<sup>2</sup>; Woven geotextile: 131,240 m<sup>2</sup>; Demolition of existing embankment material: 742.51 m<sup>3</sup>; Soil excavation: 299,172 m<sup>3</sup>; Cobble stones (50-150 kg/piece: 140,578 m<sup>3</sup>); Armor stones (800 kg/piece: 255,507 m<sup>3</sup>).

The quarry location for cobble and armor stones is at Watusampu. For transportation of all the material 190 trucks trips / day will be needed during 1 year, based on an average truck capacity of 10 tons. The manpower involved will be 200 people.

The four boat mooring facilities will be constructed perpendicular to the coastal embankment. They will consist of standing piles with driving piles and pontoons. The boat moorings will have the following dimensions: width: 3 m, length: 30 m. Foundation length will be: 12 and 18 m.



## **Anticipated Environmental Impacts and Mitigation Measures**

Assessment of potential impacts has been carried out considering proposed project activities and their effect on the existing environment. Based on this assessment, mitigation measures have been formulated to ensure that environmental impact can be minimized to acceptable levels. During the pre-construction phase, the main concern generally related to potential impact: community unrest. Potential impact at the construction phase includes: increased employment, decreased aquatic biota diversity, soil erosion and sedimentation, noise and vibration, air pollution, water pollution, increased traffic density, road damage and occupational health. Potential impact at the operation phase: drainage disturbance and sediment accumulation at boat moorings.

## **Information Disclosure, Consultation and Participation**

The public consultation was carried out in advance by announcing the proposed Coastal Protection project plan in the local newspaper Radar Sulteng on April 12, 2019. This has made the public become aware about the project plan. Public consultation and FGDs (Focus Group Discussion) were held with stakeholders in Palu on 25 May 2019 as part of the environmental assessment process. Some of the issues raised by the public consultation participants include:

1. Concerns about the problem of fishing activity caused by the dykes
2. The origin of the cobble stone (batu gajah) used for construction of embankments
3. Problems of land acquisition

## **Grievance Redress Mechanism**

Grievance Redress Mechanism (GRM) process has been formulated in accordance with EARF 2019 where it consists of several stages, as follows: (i) Stage 1: Submission of Complaint & Informal Resolution, (ii) Stage 2: Formal Submission of Complaint, (iii) Stage 3: Multi-stakeholder Meeting, (iv) Stage 4: ADB Special Mission, (v) Stage 5: Judicial Proceedings; and Reporting.

## **Environmental Management Plan**

Environmental assessment has been carried out on the proposed project. The assessment has been undertaken on all relevant environmental components including physical, biological, and socio-cultural aspects. Environmental mitigations have been formulated to address adverse environmental impacts. Environmental management and monitoring for the Coastal Protection project is formulated based on the predicted environmental impacts of project intervention on the existing environment. Environmental management will be implemented by the Project, under the supervision of BWS Sulawesi III as a PIU. Environmental management has been prepared considering the following aspects:

- A. Environmental Mitigation has been formulated for each potential environmental impacts considering the following: Project Activity, Potential Environmental Impact, Proposed Mitigation Measure or Enhancement Measure, Location, Mitigation Cost, Responsibility Implementation/Supervision, Implementation Schedule
- B. Environmental Monitoring, consist of: Aspects/ Parameters to be monitored, Location
- C. Means of Monitoring, Monitoring Frequency, Mitigation Responsibility, Compliance Monitoring Responsibility, and Monitoring Cost

## **Conclusions and Recommendations**

Based on the IEE of the proposed Palu Coastal Protection subproject, there are no significant adverse impacts that cannot be mitigated. With proper mitigation measures, the subproject can be implemented in an environmentally acceptable manner. There is no need for further environmental assessment study.

Mitigation measures and recommendation presented in this IEE should be implemented to minimize environmental impacts caused by the subproject. The subproject will conduct regular monitoring on project implementation supervised by DPIU (BWS Sulawesi III), and environmental monitoring report will be prepared every 6 months to be submitted to ADB.

## I. Introduction

Sulawesi Island is often hit by earthquakes due to the complicated interaction among tectonic plates that constitute this island, including Australian, Philippine and Sunda plates. On 24 January 2005 an earthquake with a magnitude of 6.2 occurred in the city. According to the local meteorological office (BMKG), the epicenter of the earthquake was around 1.249° S, 119.922° E, about 16 kilometers southeast of Palu at a depth of 30 kilometers of Bora Village's hot spring, Biromaru Sub-district, Donggala District. This earthquake killed one person, injured four others, and destroyed 177 buildings.

Recently, on 28 September 2018, the city suffered a large number of casualties due to an earthquake with a magnitude of 7.5, which occurred 80 km north of the city and the induced a tsunami. Here at least 2,256 people lost their lives as reported by the Indonesian National Board for Disaster Management (BNPB), while a large unknown number is still buried under the rubble and presumed dead.

The coastal area of Palu Bay was heavily damaged. Damage occurred at seawalls, reclamation areas, school buildings, houses, and shop houses on the coast. Impacts of damage occurred up to 200 m inland. The coastline retreated inland, which reduced the land and changed the slope along the coastline. The retreated coastline and the damaged seawalls left Palu City unprotected against coastal abrasion and tidal influences. To resolve this issue, an emergency project was proposed for 'Reconstruction and Rehabilitation of Palu Coastal Protection' by provision of a 7 km sea embankment along the coastline of Palu City.

This IEE for the Coastal Protection works has been prepared based on available information, including design, as of mid-August 2019. These works are part of the Priority Flood Management Activities intended for urgent implementation proposed under ADB sector loan.

With assistance from ADB, the local River Basin Organization (Balai Besar Wilayah Sungai) Sulawesi III in association with the Directorate General of Water Resources (DGWR), Ministry of Public Works has prepared a strategic plan and program for the preparation of the design and construction of a coastal protection project. It identifies a comprehensive list of possible structural and non-structural interventions throughout the coastal protection plan. An initial structural core sub-project is proposed for initial loan funding. The policy and legal framework for environmental management for the overall project has been established in the EARF (Environmental Assessment and Review Framework), which is the umbrella for further environmental documentation.

This Initial Environmental Examination is mainly based on information available from the Regional Environmental Impacts Analyses (AMDAL) for Coastal Rehabilitation of Palu City. Screening of environmental documents that must be compiled for the Palu Coastal Rehabilitation is carried out by the Central Sulawesi Provincial Environment Agency (the DLH). The results of screening by the DLH of Central Sulawesi Province is presented in letter: 660/362 / BID.I / DISLH, which states that Construction of Coastal Protection for Palu City is included in projects that require AMDAL studies.

During the AMDAL public consultation on 25 May 2019, the community and stakeholders requested the Palu District Council to include fishing boat moorings in the coastal protection plan (see Appendix 4). The AMDAL study is also expected to include:

1. Elevated Road;
2. Construction of Palu Bridge IV
3. Mangrove planting and development

Besides Sulawesi III BWS, the project will involve the following agencies:

1. PJJN XIV (Dinas Bina Marga) with YACHIYO Engineering Co. Ltd for road elevation and Palu IV Bridge projects.
2. Marine and Fisheries Agency (Dinas Kelautan dan Perikanan) for fishing boat mooring area and development mangrove.

The AMDAL document drafter will coordinate with the agency, to be able to complete the explanation of other planned activities in the vicinity of the Palu coastal protection project plan.

**Table 1: History of AMDAL Reconstruction and Rehabilitation Palu Coastal Protection**

<b>Date</b>	<b>Description</b>	<b>Reference</b>
28 September 2018	Palu city suffered a large number of casualties due to a 7.5 magnitude earthquake, which occurred 80 km north of the city and induced a tsunami where at least 2,256 people lost their lives.	
4 October 2018	PPK Subdit Sungai Pantai PUPR asked FMSRB CS.01 consultants to help prepare an emergency response proposal for Palu	PPT Presentation - 4 October 2018
18 December 2018	Coordination meeting on Palu Coastal Protection attended by PUPR, CS.01 consultant and JICA	MOM 18 December 2018
3 January 2019	Coordination meeting on Palu Coastal Protection attended by PUPR, CS.01 consultant, JICA, ADB. The design of the Palu Coastal Protection was completed by a joint team consisting of Sulawesi BBWS III, CS01 Consultant FMSRB and JICA, and was approved by the PUPR Kasatgas Palu.	MOM 3 January 2019
18 January 2019	Coordination meeting on Palu Coastal Protection, attended by PUPR, resource persons, JICA, ADB, and CS.01 Consultant. It was decided that the CS.01 Procurement Specialist would immediately prepare the required tender document for Palu.	
12 February 2019	Coordination meeting on Palu Coastal Protection, attended by Sulawesi BWS III, ADB, CS.01 Consultant	
21 March 2019	Direction from the Central Sulawesi Provincial Environment Office (DLH) for Preparation of Environmental Documents: Palu City Coastal Rehabilitation Plan must be completed with AMDAL	

<b>Date</b>	<b>Description</b>	<b>Reference</b>
28 March 2019	RTRWP (Rencana Tata Ruang Wilayah Propinsi) Spatial Suitability Coordination Meeting on the Palu City Coastal Development Plan	Dinas Bina Marga and Penataan Ruang Provinsi Sulawesi Tengah.
25 May 2019	Public Consultation on the AMDAL for Palu Coastal Protection	
26 June 2019	First Community Meeting (PKM) on LARP	
17 October 2019	Second Community Meeting (PKM) on LARP	

## **1.1. Policy Legal and Administrative Framework**

### **1.1.1 ADB Safeguard Policy Statement (SPS), 2009**

ADB requires that its environmental safeguard measures are adhered in all aspects of ADB operations. The Policy states that all projects supported by ADB must comply with ADB's Safeguard Policy Statement (SPS) 2009. It sets out the policy objectives, scope and triggers, and principles for environmental safeguard areas for all aspects of its operations. ADB adopts a set of specific safeguard requirements that borrowers/clients are required to meet in addressing environmental impacts and risks. Borrowers/clients must comply with these requirements during the project preparation and implementation phases. ADB's environmental safeguard requirements are defined in ADB's SPS, Appendix 1 (Safeguard Requirements 1: Environment. Pages 30-40).

The type of environmental assessment required depends on the nature, magnitude, significance, and sensitivity of environmental impact of the project. ADB uses the following categorization to screen expected environmental impacts of a project:

- Category A: Projects that can have significant and adverse environmental impacts that are irreversible, diverse, or unprecedented. An Environmental Impact Assessment (EIA) is required for category A projects;
- Category B: Projects that can have some adverse environmental impacts, but of less degree or significance than those of category A. These impacts are site-specific and can be readily addressed through common mitigation measures. An Initial Environmental Examination (IEE) is required for category B projects;
- Category C: Projects that are likely to have minimal or no adverse environmental impacts. No environmental assessment is required.

Besides, there is Category Financial Intermediary (FI) which includes projects that involve a credit line through financial intermediary or involve an equity investment.

The Palu City Coastal Protection will include the reconstruction of the coastal dyke to anticipate adverse impact of abrasion and tidal floods. The subproject is expected to generate some environmental impacts typically associated with relatively small-scale and short duration construction activities. These impacts are neither adverse nor significance, and can be readily mitigated with available mitigation measures. Therefore, the IEE of the Palu Coastal Dike is classified as environmental Category B which needs an IEE.

## International good practice

ADB's SPS requires that the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards, particularly the World Bank Group's *Environment, Health and Safety Guidelines (EHS)*, which is derived from the IFC environmental guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. The following table (Table 2) presents a list of IFC guidelines applicable to all activities supported under the Emergency Assistance for Rehabilitation and Reconstruction (EARR) and should be used and referred to in environmental safeguard documents, i.e. Initial Environmental Examination (IEE) and Environmental Management Plan (EMP).

The EARF of EARR also mentions the need for the subprojects under EARR to use IFC guidelines which is also followed by ADB.

**Table 2: IFC guidelines applicable to this project**

EHS Guideline	Description, Relevance to EARR
General EHS Guidelines (2007)	<p>Define general and GIIP that must be applied for facilities and activities to be supported under the EARR. Key sections of the General Guidelines of relevance to EARR include:</p> <ul style="list-style-type: none"> <li>• Environmental Guidelines (covering air emissions, wastewater and ambient water quality, hazardous materials management, waste management, noise)</li> <li>• Occupational health and safety</li> <li>• Community health and safety</li> <li>• Construction and decommissioning (including debris removal and clearance).</li> </ul> <p>The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors (see below).</p>
EHS Guidelines for Health Care Facilities (2007)	<p>Provide guidance relevant to the management of EHS issues associated with the operation of HCF. Most importantly, the guidelines cover the following aspects that should be considered in the design and operation of HCF to be supported by the EARR:</p> <ul style="list-style-type: none"> <li>• HCF design considerations</li> <li>• HCF waste management, including need to establish HWMS</li> <li>• Air emission control, especially if medical waste incineration is practiced (including air emission benchmarks).</li> <li>• HCF wastewater management (including effluent quality benchmarks)</li> <li>• Occupational health and safety</li> </ul>
EHS Guidelines for Water and Sanitation (2007)	<p>Provide guidance on operation and maintenance of (i) potable water treatment and distribution systems, and (ii) collection of sewage in centralized systems (such as piped sewer collection networks) or decentralized systems (such as septic tanks subsequently serviced by pump trucks) and treatment of collected sewage at centralized facilities. Most importantly, the guidelines cover the following aspects that should be considered in the design</p>

EHS Guideline	Description, Relevance to EARR
	<p>and operation of water supply and sanitation activities to be supported by the EARR:</p> <ul style="list-style-type: none"> <li>• Water supply (including water abstraction, water treatment, and water distribution)</li> <li>• Sanitation (including fecal sludge and septage collection, sewerage, wastewater and sludge treatment and discharge)</li> <li>• Occupational health and safety</li> <li>• Community health and safety</li> </ul>
<p>EHS Guidelines for Water Management Facilities (2007)</p>	<p>Provide guidance for facilities or projects dedicated to the management of municipal solid waste and industrial waste, including waste collection and transport; waste receipt, unloading, processing, and storage; landfill disposal; physical-, chemical- and biological treatment; and incineration projects. Most importantly, the guidelines cover the following aspects that should be considered in the design and operation of solid waste management activities to be supported by the EARR:</p> <ul style="list-style-type: none"> <li>• Municipal solid waste management (collection and transport, processing and storage, treatment, disposal)</li> <li>• Industrial non-hazardous waste management (such as sludge from water supply treatment plant, wastewater treatment plant, inert construction/demolition waste)</li> <li>• Occupational health and safety</li> <li>• Community health and safety</li> </ul>
<p>EHS Guidelines for Ports, Harbors, Terminals (2017)</p>	<p>Provide guidance on EHS issues primarily associated with port and terminal construction and operations. Most importantly, the guidelines cover the following aspects that should be considered in the design, reconstruction and operation of ports to be supported by the EARR:</p> <ul style="list-style-type: none"> <li>• Terrestrial and aquatic habitat alteration and biodiversity</li> <li>• Climate change resilience</li> <li>• Water quality</li> <li>• Air emissions</li> <li>• Waste management</li> <li>• Hazardous materials and oil management</li> <li>• Noise and vibration (including underwater)</li> </ul>

EHS: Environmental, Health, and Safety; GIIP: Good International Industry Practice; HCF: health care facilities; HWMS: health care waste management system.



### 1.1.2 Government of Indonesia's Environmental Policy and Regulatory Framework

Besides, ADB's SPS (2009), the EARR's subprojects shall also comply with the Government of Indonesia's environmental laws, standards, rules, and requirements which impose restrictions on activities to avoid, minimize, or mitigate likely impact on the environment.

#### National environmental regulatory framework

**Law No 32 of 2009.** The main Indonesian law on environmental management is Law No 32 of 2009 on Environmental Protection and Management. Article 22 of the Law stated that any business and activity that has significant impact on the environment shall have an environmental impact assessment (AMDAL), and article 34 specifies that any business and activity that does not require an AMDAL, shall undertake *Upaya Pengelolaan Lingkungan Hidup dan Upaya Pemantauan Lingkungan Hidup* (UKL-UPL), whereas for small activities that do not require an UKL-UPL, a statement of ability to undertake environmental management and monitoring of their activity, *Surat Pernyataan Pengelolaan Lingkungan* (SPPL), is required. These documents are subject to approval by the Ministry of Environment and Forestry or local governments (i.e. provincial and District/city) depending on the nature, scope, and administrative location of the business and/or activity. Based on the AMDAL or UKL-UPL approval, the mentioned Government Regulation 27/2012 requires that the business and/or activity apply for the Environmental Permit (Izin Lingkungan) to the same government authority granting the AMDAL and UKL-UPL approval.

Other key regulations related to the environmental assessment that are adhered to by the Palu Coastal Dike Project are as follows:

- Minister of Environment Regulation No. 5/2012 on Type of Business and/or Activity Requiring AMDAL.
- Minister of Environment Regulation No. 16/2012 on Guidelines for the Preparation of Environmental Documents.
- Minister of Public Works Regulation No. 10/PRT/M/2008 on Types of Business and/or Activity in Public Works Sector Requiring UKL-UPL.

#### Environmental assessment procedures.

The environmental assessment procedure is described in Indonesia's environment law and regulations. All project or business proposals will undergo screening to classify whether a project proposal would need AMDAL, or UKL/UPL (equal to category B that needs IEE), or SPPL (equal to category C). Indonesian environmental assessment procedure and requirements are presented in several laws and regulations related to Environmental Impact Assessment, among others:

- Law No. 26/2007 on Spatial Planning;
- Law No. 14/2008 on Public Information Disclosure;
- Law No 32 of 2009 on Protection and Management of the Environment;
- Minister of Environment Decree 5 of 2012 on Types of Business Plans and/or Activities Subject to Environmental Impact Analysis;
- Minister of Environment Decree 16 of 2012 on Guidelines for Preparation of Environmental Documentation;
- Government Regulation 12 of 2010 on Living Environment Management and Monitoring Efforts and Statement of Capability to Manage and Monitor the Living Environment;



- Government Regulation 17 of 2012 on Guidelines for Community Participation and Environment Disclosure in Environmental Impact Assessment and Environmental Permitting;
- Government Regulation 27 of 2012 on Environment License/Permit;
- Decree of Minister of Environmental Affairs 45 of 2005 on Guidelines for the Formulation of Reports on the Realization of Environmental Management Plans (RKL) and Environmental Monitoring Plans (RPL); and
- Minister of Environment Decree 9 of 2010 on Guidelines on Community Grievances and Handling of Grievances Caused by Pollution and/or Degradation.

### **Minister of Environment Decree No. 5 of 2012.**

The Government's screening procedure is presented in the Minister of Environment Decree No. 5 of 2012 on Types of Business Plans and/or Activities Subject to Environmental Impact Analysis. The screening considers potential significant impacts as well as magnitude or size of business plan or activities. Decree No. 5 of 2012 indicates that potential significant impacts for each type of business and/or activity are determined based on the following aspects:

- amount of the population who will be affected by the planned business and/or activity;
- area of spread of impact;
- intensity and duration of the impact;
- number of other environmental components that will be affected;
- cumulative nature of the impact;
- reversal or irreversibility of the impact; and
- other criteria in accordance with the development of science and technology; and / or
- international references applied by several countries as a basis for AMDAL policy.

According to GOI's Law No. 32 of 2009 on protection and Management of Environment, Article 22 stated that any business and activity that has significant impact on the environment shall have environmental impact assessment (AMDAL).

Screening of environmental impact for the Palu Coastal Protection Project is carried out by the Central Sulawesi Provincial Environment Agency (DLH). The results of the screening of the DLH of Central Sulawesi Province which is presented through a letter: 660/362 / BID.I / DISLH, specifies that the project has been classified as project that needs to prepare AMDAL. In the latest development, Palu protection coastal project together with several other activities (Elevated Road, Construction of Palu IV Bridge, and surrounding buildings), included in the Disaster Resilient Area (Kawasan Tangguh Bencana), accordance with the Decree of the Governor of Central Sulawesi No. 650/374 / DBMPR-G.ST / 2019.

## 1.2. Purpose of the Initial Environmental Examination (IEE)

Though the Project aims to improve the environmental condition of coastal area and reduce coastal abrasion, the proposed improvements of coastal protection facilities, may have certain adverse impacts on the natural environment. The process of building the project may cause environmental impacts, starting from the pre-construction, construction and operation stages.

This IEE report covers the general environmental profile of Palu Coastal Protection and includes an overview of the potential environmental impacts from construction management activities and their magnitude on physical, ecological, economic, social, and cultural resources within the subproject's influence area during design, construction, and operation stages. An indicative Environmental Management Plan (EMP), which includes mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program, and the responsible entities for mitigation and monitoring.

This purpose of the IEE report as follows:

- Describes the proposed subproject interventions;
- Presents the baseline of environmental and socioeconomic conditions in the Project area;
- Identify proposed subproject intervention that may result in significant environmental impacts;
- Predicts and assesses significance and magnitude of impacts for those interventions identified in the screening that may result in negative potential impacts;
- Recommends appropriate mitigation measures to minimize negative potential impacts, and predict and assess residual impacts
- Presents an environmental management plan that facilitates mitigation implementation, monitoring and reporting; and In accordance with the EARF of Emergency Assistance for Rehabilitation and Reconstruction (EARR), identify aspects that will require detailed consideration in the AMDAL to be prepared by BBWS Sulawesi Tengah III commencing in August 2019.

## II. Description of the Project

### 2.1. Project Location Plan

The planned coastal embankment will restore the coastal protection of Palu City, Central Sulawesi Province from sea abrasion and tidal waves, which has been damaged by the Tsunami. The plan for the construction along 8 km of coastline is in Palu Bay, which covers Silae, Lere, Besusu Barat and Talise Villages (Table 3, and Figure 1). The location is geographically located between 119°16'29.8" East Longitude and 02°23'5.2" South Latitude.

**Table 3: Administrative area of coastal protection plan**

No	Village	Sub-District
1	Silae	Palu Barat
2	Lere	Ulujadi
3	Besusu Barat	Palu Timur
4	Talise	Mantikulore

**Figure 1: Administrative Area of Palu Coastal Protection Project**



## 2.2. The Palu Coastal Protection Design

### The Project

The project design consists of Palu Coastal Dike Development which is constructed along the Palu coastal area as long as about 7 km. The project consists of construction of coastal dike (embankment) along Palu beach. Total length of embankments will be about 7 km, where the length of West dike 2.375 Km, length of east dike 4.625 km. The crest elevation of the structure will be 3.0 m, and the width of the coastal protection varies, depending on the local elevation with a minimum of 17.15 m.

Quarry location is at Watusampu. The quantity of cobble stone material and armor stone: 396,084 m<sup>3</sup> and excavation of earth and unloading of the existing embankment: 299,914 m<sup>3</sup>. Transportation of material will use trucks with 10 ton capacity. Therefore, 190 truck trips / day are needed during 1 year. The involved manpower will be 200 people.

During public consultation, the fishery community of the area requested the construction of a boat mooring facility. The Project responded to the request by adding four boat mooring facilities attached to the coastal dike. It will consist of standing piles, driving piles and pontoons. The boat moorings will have the following dimensions: width: 3 m, length: 30 m. Foundation length will be: 12 (standing piles) and 18 m (driving piles). Brief information on these activities is presented in Table 4 below.

**Table 4: IEE objectives for each sub project**

Description	IEE Objectives for each Sub Project	
	Coastal Protection Embankment	Boat Mooring
Project Location	The plan for the construction of 7 km of coastline is in Palu City (from Kelurahan Silae to Talise)	There are 4 locations for planned boats mooring which lies in: STA 01+650 STA 01+750 STA 04+100 STA 04+200
Type Activities	Structural intervention with length 7 km	Structural intervention with boat mooring construction and non-structural interventions with improving the lives of fishermen.
Category	Category B that requires an IEE	Category B that requires an IEE
Need	It is necessary to study the impact of construction activities such as the impact of land preparation, material transportation, drainage flow disturbance	It is necessary to study the impact of change location of sedimentation,

### 2.2.1. Coastal Protection Embankment

#### 2.2.1.1. Coastal Protection Construction

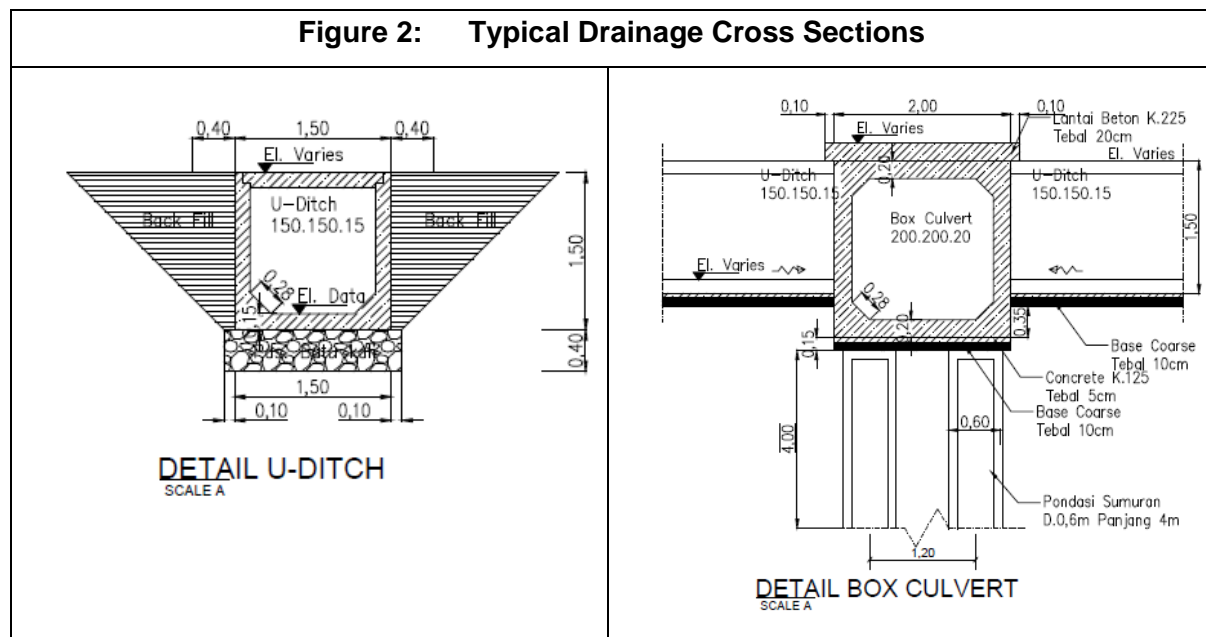
The project design consists of Palu Coastal Dike Development which is constructed along the Palu coastal area as long as about 7 km. The project consists of construction of coastal dike (embankment) along Palu beach. Total length of embankments will be about 7 km, where the length of the west dike is 2.375 Km, and the length of the east dike is 4.625 km. The crest

elevation of the structure will be 3.0 m, and the width of the coastal protection varies, depending on the local elevation with a minimum of 17.15 m.

Storm water drainage channels will be constructed along the embankment. These drainage channels will discharge to Palu Bay through the existing outlets, which still are intact (**Error! Reference source not found.**, Figure 4 and Figure 5).

Integrated coastal protection details with supporting infrastructure as follows:

Type I Width	: Minimal 17.15 m
Type II Width	: 18.52 m
Structure Height	: 5.5 m
Crest height above MSL	: 3.0 m
Length West embankment	: 2.375 km
Length East embankment	: 4.625 km
Total length of embankment	: 7.000 km
Width of Drainage area	: 3.5 m
Drainage type	: U-Ditch
Height of U Ditch	: 1.5 m
Width of U-Ditch	: 1.5 m
Height of Box Culvert	: 2 m
Width of Box Culvert	: 1.85



Estimated required construction materials:

Polypropylene (PP)	: 146,927.60 m <sup>2</sup>
Geotextile Woven	: 131,240.43 m <sup>2</sup>
Demolition of existing embankment material	: 742.51 m <sup>3</sup>
Soil excavation	: 299,172.42 m <sup>3</sup>
Cobble stones (50-150 kg/piece)	: 140,577.90 m <sup>3</sup>
Armor stone (800 kg/piece)	: 255,507.16 m <sup>3</sup>

The quarry location for 396,084 m<sup>3</sup> cobble stone and armor stone material is at Watusampu (Figure 6), which is located along the west coast at 5 km north of Palu. Based on an average truck capacity of 10 tons, 190 trucks trips / day will be needed during 1 year. Transport will mainly go over the main road along the coast. To avoid heavy burden on Palu river bridge, water transport can be used for the east coast. The involved manpower is estimated at 200 people/day.



### 2.2.1.2. Types of Coastal Protection structures

The type of coastal structure that will be developed is a sea dike. The main objectives and functions, principles and important features of this coastal structure in the form of a sea dike are as follows: The beach structure is used in coastal defense schemes, with the main objective of preventing and protecting from erosion of coastlines and floods that enter residential settlements in Kelurahan Lere caused by tidal waves. Whereas the protection of water intake and drainage systems is an additional goal of all types of coastal structures.

### 2.2.1.3. Geometrical Shape

The coastal protection is a trapezoidal geometric shape, which is built to maintain the desired slope and limit erosion. The geometric shape in its structural cross section can be very flexible in size. The surface of the embankment is a stone Armor and Cobble to prevent abrasion that is mounded to build a sea dike. The typical cross section of a sea dike is shown in Figure 4 and Figure 5. For example, mean sea level is indicated at 0.00 m, and high tide at 1.53 m. Armor stone is placed along the entire length of the sea side and where there is no existing protection anymore on the land side

In general, beach structures are used as infrastructure that functions as a beach protector. Due to the influence of several factors such as tides, it will be easy to move sediments around the coastline, so that erosion will often occur on the coast. Coastal buildings are used to protect the beach against damage due to wave and current attacks. There are several ways you can do to protect Talise Beach in Palu Bay, one of which is to be able to withstand damage by building coastal structures in the form of a sea dike or embankment, which is a kind of artificial sloping wall used to regulate the water level. According to the Minister of Public Works Letter No. 07 / SE / M / 2010 concerning the Imposition of Guidelines for the Implementation of Construction of Coastal Safety Buildings, it is explained that Sea Dike is a coastal security structure built along the coast with the aim of protecting the coastal lowlands from inundation caused by tides, waves and storms. Man-made structures designed to protect low-lying areas such as Lere Village from sea floods / tides. Dikes are usually designed with several components including a sand core, waterproof outer protective coating, toe protectors and drainage channels.

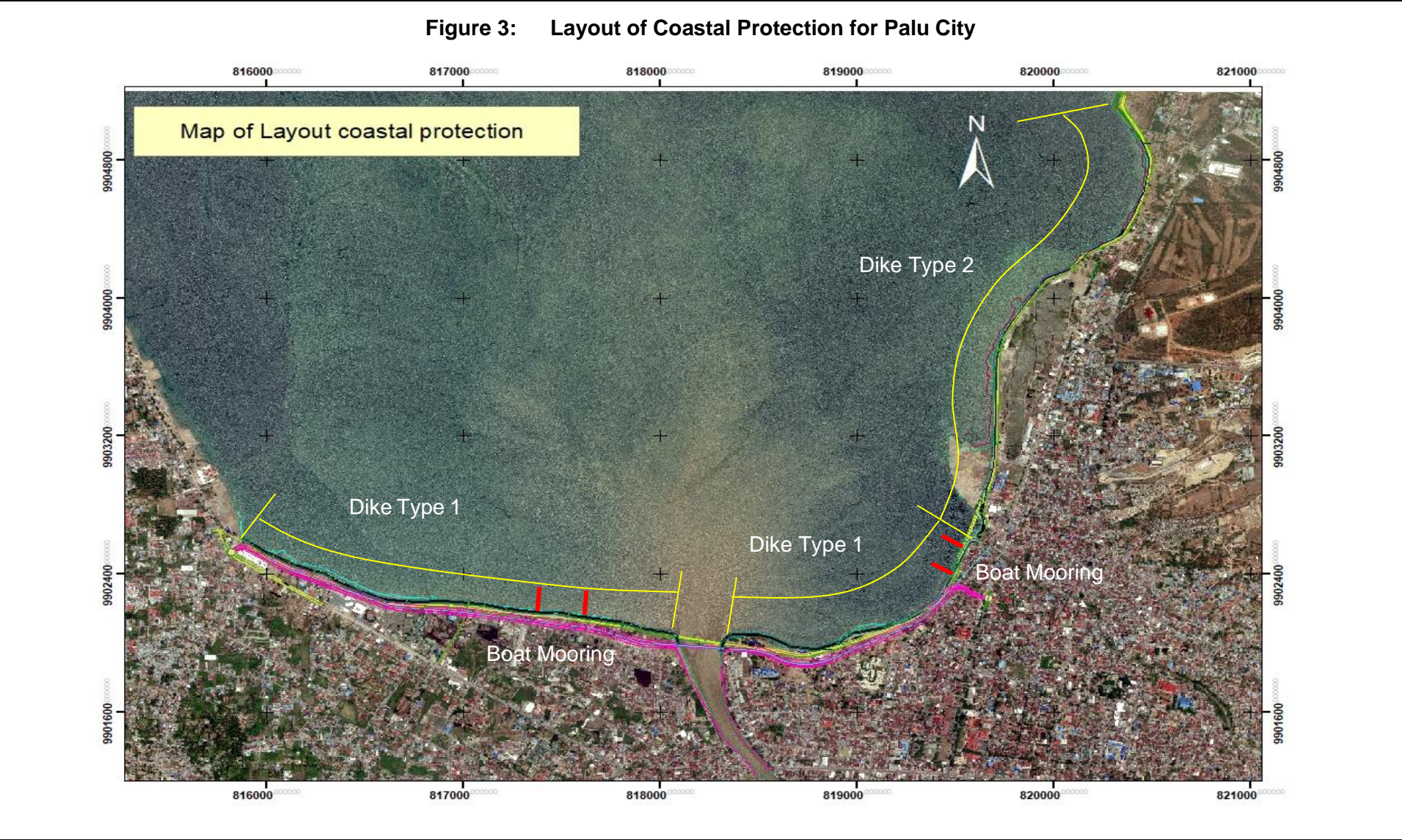
For coastal protection, by installing revetment layers of bare stones / armor on the outer slopes of the sea dike. The installation of cobble stones of size 50-150 kg / stone ( 140,577 m<sup>3</sup>), is proceed by the placement of armor stones weighing 800 kg / stone (255,507 m<sup>3</sup>).

There are 2 types of shoreline design plans, Type I for the retaining wall which is still good while Type II for existing beach embankments that have been damaged. Pictur 4 is a planned coastal safety design drawing. The details of integrated coastal protection with supporting infrastructure are as follows: Type I width: 17.15 meters and Type II width: 18.52 meters, each structure height is 5.5 meters. The planned installation of the West Bank is 2,375 kilometers while the East Bank is: 4,625 kilometers so that the total length of the embankment is 7 kilometers.

**Table 5: Type and Length of Sea Dike**

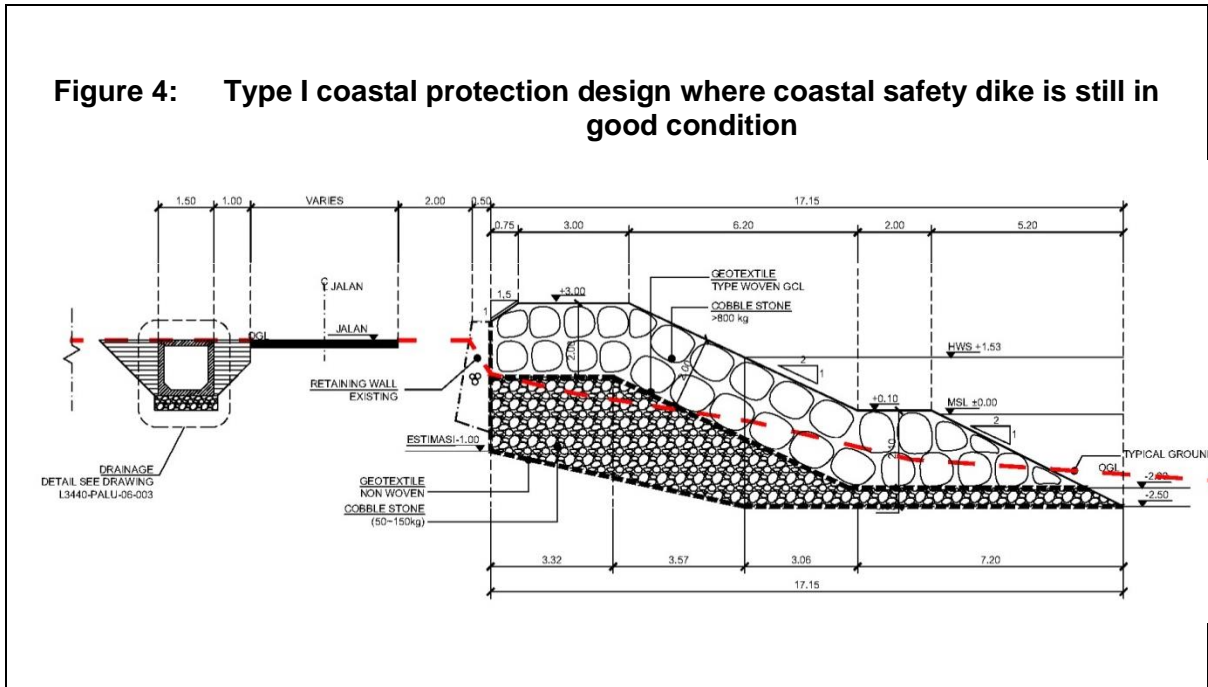
Section	Length (km)	Type of Structure	Remarks
1. Sea Dike - West		Stone Dike	
Type 1	2.375		Sta 0 +00 00Sta 02+300
2. Sea Dike - East		Stone Dike	
Type 1	1.600		Sta 02 + 750 50Sta 04 + 250
Type 2	3.025		Sta 04 + 250 50Sta 07 +250
<b>Total</b>	<b>7.000</b>		

Figure 3: Layout of Coastal Protection for Palu City

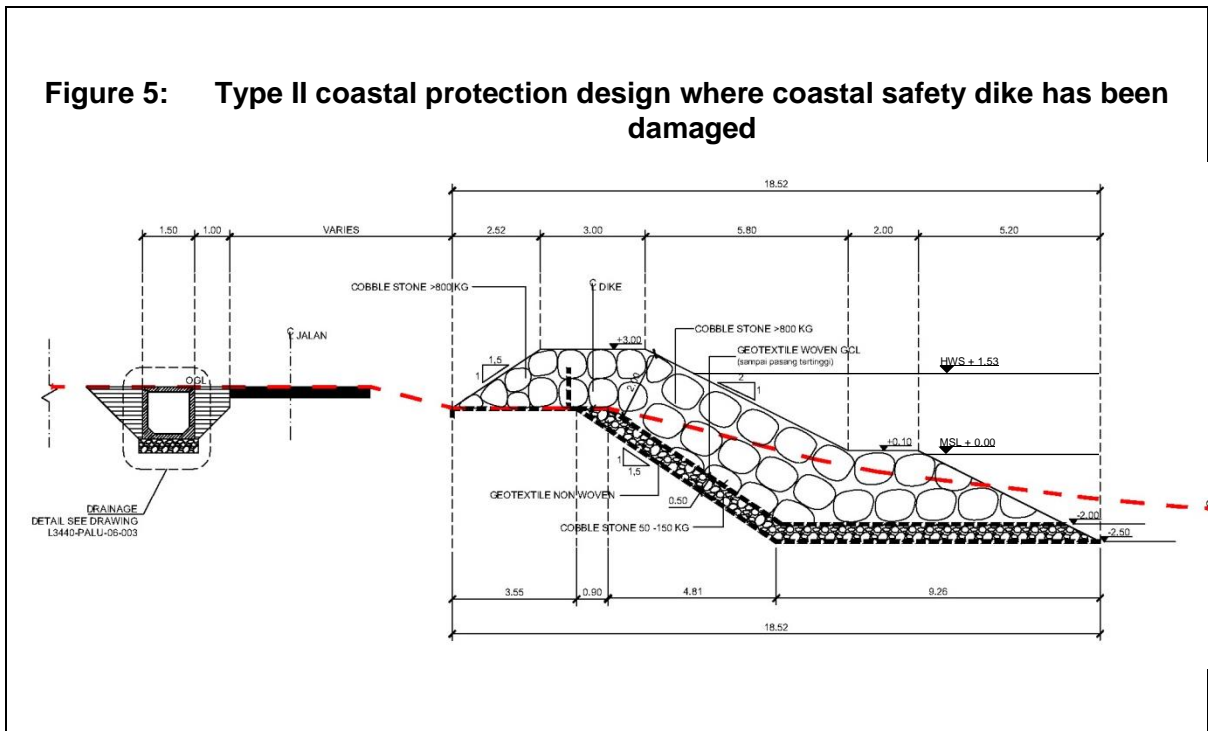




**Figure 4: Type I coastal protection design where coastal safety dike is still in good condition**



**Figure 5: Type II coastal protection design where coastal safety dike has been damaged**



#### 2.2.1.4. Equipment needed

At the construction stage equipment will be used such as Compactors, Concrete Mixers, Roller Vibrators, Formwork, Cutting Machines and other construction equipment. The equipment will be used in land clearing activities up to the construction of Palu City Coastal Dike Protection. In addition, construction vehicles such as Mobile Crane, Tower Crane, Excavators and Dump Trucks will be used. Some of the equipment and materials and materials are planned to be brought from the closest location in the city of Palu.



#### 2.2.1.5. Materials

Polypropylene (PP)	: 146,927.60 m <sup>2</sup>
Geotextile Woven	: 131,240.43 m <sup>2</sup>
Demolition of existing embankment material	: 742.51 m <sup>3</sup>
Soil excavation	: 299,172.42 m <sup>3</sup>
Cobble stone (50-150 kg/piece)	: 140,577.90 m <sup>3</sup>
Armor stone (800 kg/piece)	: 255,507.16 m <sup>3</sup>

From the transportation of cobble stone material and armor stone: 396,084 m<sup>3</sup> and excavation of earth and unloading of the existing embankment: 299,914 m<sup>3</sup>, then by transporting a truck volume of 10 tons, trips of 190 trucks / day is needed for 1 year.

#### 2.2.1.6. Manpower involved

Mobilization of workers needed at the time of the implementation of the main construction of approximately 200 people consisting of 120 skill workers and 80 non-skill workers. This workforce needs prioritize local workforce that is adjusted to the required qualifications. Workers at this stage are contract workers who are employed during the construction phase only. The solid waste generated from 200 construction workers is 0,15 m<sup>3</sup> / day with assumption 0,75 liter/man-day (SNI 3242-2008). The BWS Sulawesi III will apply the concept of waste management using 2 types of trash, namely organic and inorganic waste which will be placed scattered at the project site. Waste is then collected at a temporary shelter and then transported to the landfill by Dinas Kebersihan Palu City.

Assumption of water needs of each worker based on SNI 19-6728.1-2002 is 150 liters / person / day, clean water needs are estimated for 200 workers/day: 30 m<sup>3</sup>/day. Liquid waste generated from 200 workers is 80% of the need for clean water: 9m<sup>3</sup>/day

#### 2.2.1.7. Transportation Material

Transporting material for both Coastal Protection projects and others (Elevated road, Bridge IV Palu, Boat Mooring, etc.) in two ways, namely land and sea routes. Quarry location on Watusampu. From Watusampu the transportation of material is divided into 2 sides, namely the East and West sides. This distribution is done to avoid congestion that occurs on the bridge which is on the Gajah Mada road. On the west side, transportation is done by land by route: from Watusampu - Trans Palu Donggala axis - Malonda Street – Jalan Cumi-cumi. As for existing projects along the Rajamoili road, the Penggaraman road, the material will be supplied by sea by barges

**Figure 6: Material path from the quarry to the project site and disposal site**



### 2.2.2. Boat Mooring Facility

During public consultation, the fishery community of the area requested to construct Boat Mooring facility. The Project responded the request by adding four units of Boat Mooring facility to be constructed attached to the coastal dike. It will be a standing piles with piles Palu driver + Pontoon. This Boat Mooring will have the following dimension: width: 3 m, length: 30 m. Foundation length will be: 12 and 18 m. There are 4 locations for the planned berths, i.e.: STA 01 + 600, STA 01 + 850, STA 4+100 and STA 4 + 250. Procurement of concrete piles will include K.600 d.30 cm L. 6 m totaling 216.00 units stacking piles with Palu + Pontoon pile drivers. The specification of the Boat Mooring as follows:

#### Boat Mooring Facility Characteristics:

Width of Boat Moorings	: 3 m
Length of Boat Moorings	: 30 m
Foundation	: Concrete Spun Pile
Length of foundation	: 12 and 18 m
Length spun pile 12 m	: 10 units
Length spun pile 18 m	: 12 units
Type Harbor	: Bollard
Floor	: Concrete Floor K225

Procurement of concrete piles K.600 d.30 cm L. 6 m totaling 216.00 units Stacking piles with Palu + Pontoon pile drivers at the following locations: There are 4 locations for planned berths: STA 01 + 600, STA 01 + 850, STA 4+100 and STA 4 + 250. Standing piles with piles Palu driver + Pontoon. Boat Mooring Width: 3 m Length of Boat Mooring: 30 m Foundation length: 12 and 18 m (Figure 7 and Figure 8).

Figure 7: Design Boat Mooring

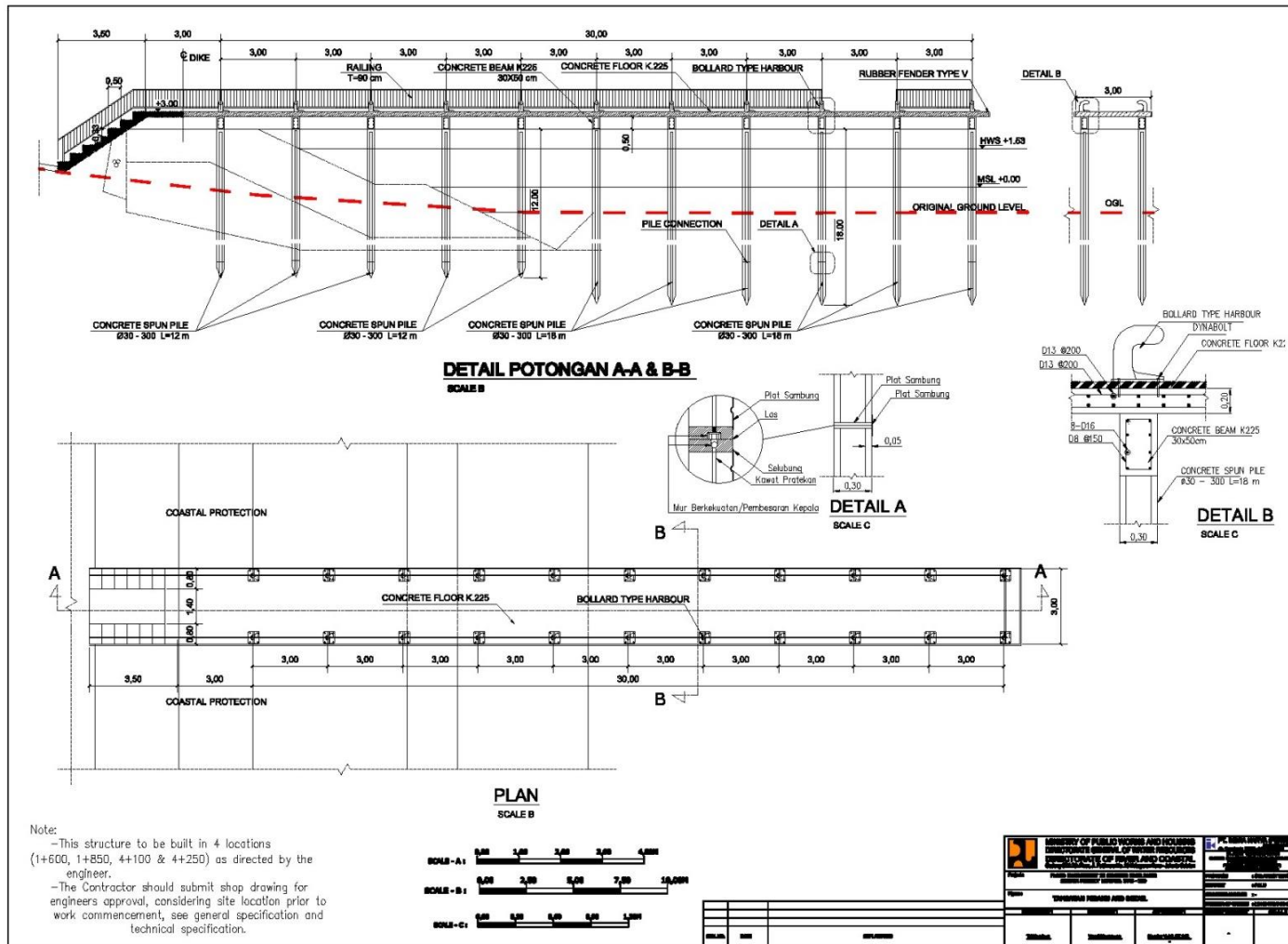
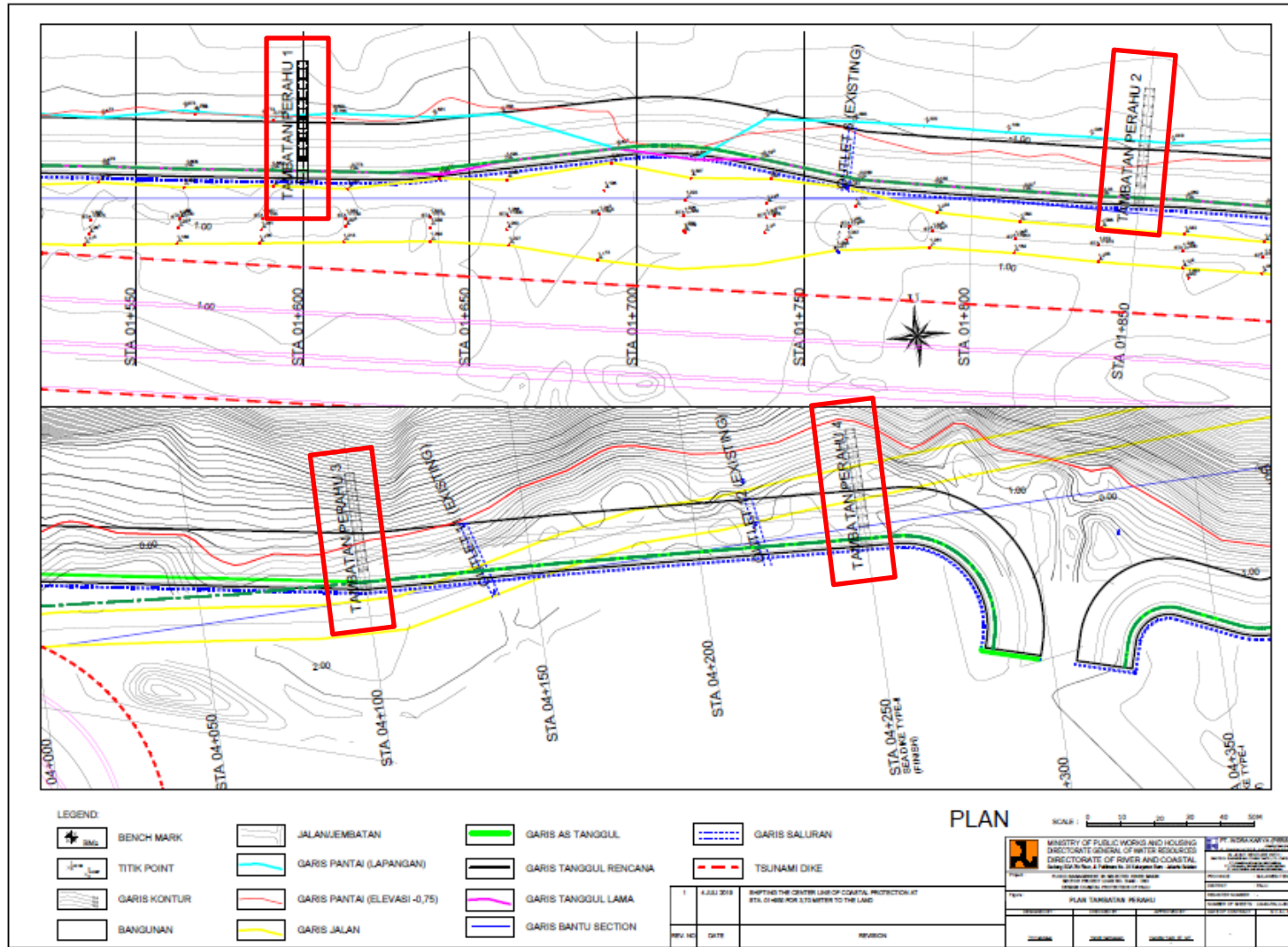




Figure 8: Fishing Boat Mooring location



### 2.2.3. Non-civil Work

Also based on the conclusion of above mentioned meeting, alignment of coastal protection passes through some buildings, in which most of the buildings are almost entirely destroyed by the tsunami; however, land acquisition is required for those buildings and the total area is estimated at 4,457 m<sup>2</sup> as listed in Table 6 **Error! Reference source not found.**

**Table 6: List of names of landowners in the project location**

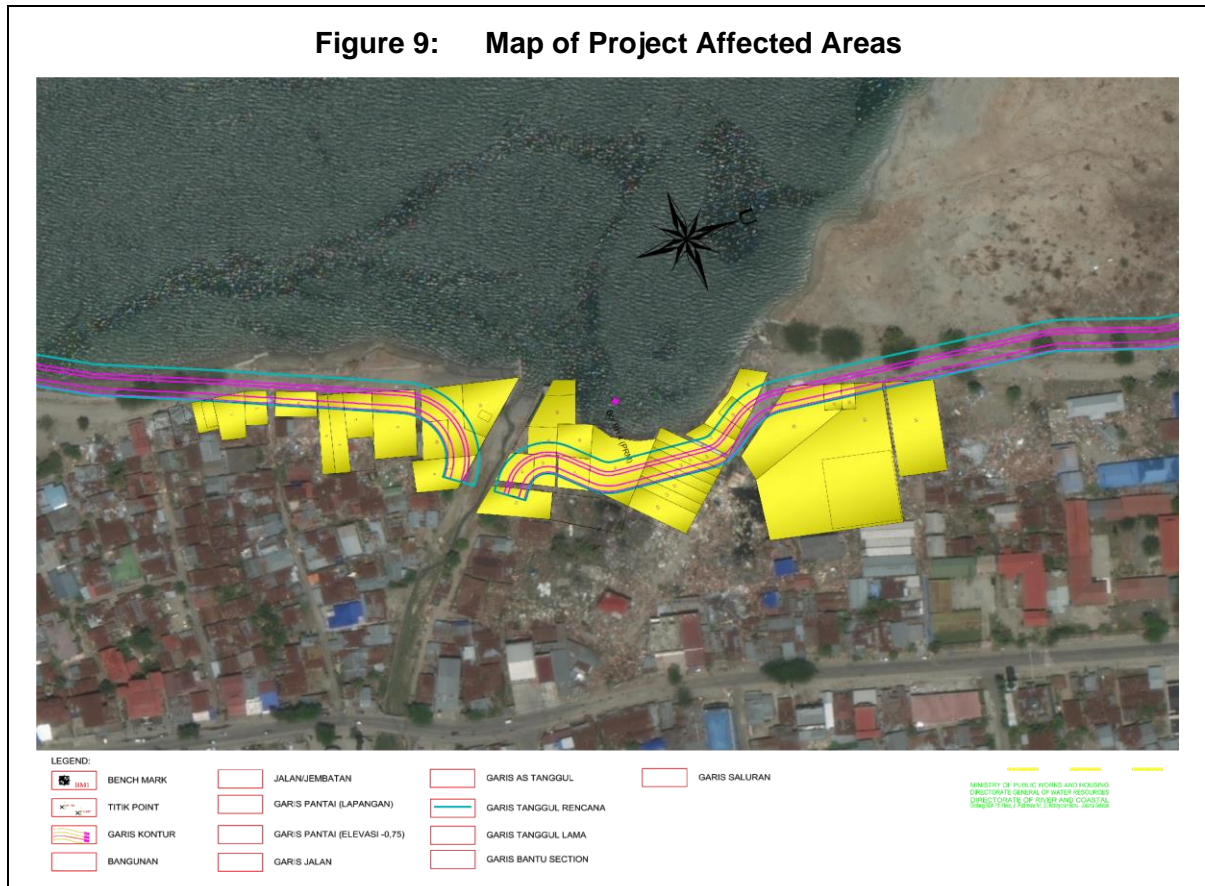
No	Field No	Owner	Age	Addresses			Land area affected (m <sup>2</sup> )
				Kelurahan	Sub-district	City	
1	19	Sawiyah / Septin / Singke	73	Talise	Mantikulare	Palu	73,45
2	23	Sawiyah / Septin / Singke	73	Talise	Mantikulare	Palu	219,88
3	13	Sukono	55	Talise	Mantikulare	Palu	142,14
4	15	Saikun	62	Talise	Mantikulare	Palu	140,06
5	21	Saat Tanturitu	63	Talise	Mantikulare	Palu	125,01
6	24	Sudin Gantria / Suprpto	34	Talise	Mantikulare	Palu	79,59
7	32	Ahmad Yunan Sembiring	52	Talise	Mantikulare	Palu	131,07
8	37	Abd. Sahid / Arfiah	51	Talise	Mantikulare	Palu	168,83
9	29	Baso Bara	47	Talise	Mantikulare	Palu	29,15
10	31	Suyatno	52	Talise	Mantikulare	Palu	95,77
11	33	Yunan Budiman	51	Talise	Mantikulare	Palu	115,73
12	11	Kaharuddin A. Bikoe	59	Besusu Barat	Palu Timur	Palu	65,25
13	6	Abidin Baso	60	Talise	Mantikulare	Palu	79,25
14	30	M. Basri R	53	Talise	Mantikulare	Palu	80,77
15	8	Maman Usman	51	Kamonji	Palu Barat	Palu	171,65
16	10	Maman Usman	51	Kamonji	Palu Barat	Palu	36,19
17	22	Maman Usman	51	Kamonji	Palu Barat	Palu	89,20
18	4	H. Tampang	58	Talise	Mantikulare	Palu	3,71
19	41	Rudi Wongkar	62	Tatura Selatan	Palu Selatan	Palu	71,21
20	39	H. Syafrudin/Irfan	40	Donggala Kodi	Ulujadi	Palu	77,17
21	38	Burhan	46	Lolu Utara	Palu Selatan	Palu	273,53
22	14	Chairil Anwar	62	Talise	Mantikulare	Palu	264,99
23	42	Awong Chandra Alfa	58	Ujuna	Palu Barat	Palu	31,30
24	34	Sidik	52	Pasangkayu	Pasangkayu	Pasangkayu	159,48
25	36	Jamaludin (Alm) / Indra	34	Talise	Mantikulare	Palu	117,99
26	28	Ikhwani	54	Talise	Mantikulare	Palu	1,00
27	17	Safwan Ariady Labudu	41	Talise	Mantikulare	Palu	536,84
28	35	Indar Parawansa/Syarir (Wakil)	54	Talise	Mantikulare	Palu	135,75
29	18	Fahrul	64	Layana Indah	Mantikulare	Palu	23,10
30	5	Sarinah / Junaedin	-	-	-	-	64,14
31	16	Hj. Ratna	-	-	-	-	85,66
32	20	Assyafah	-	-	-	-	238,16
33	26	Junaedin	-	-	-	-	480,94
34	40	Galon	-	-	-	-	48,96
<b>Total</b>							<b>4.456,90</b>

**Keterangan:**

	Cannot be interviewed
	Not yet identified

Sources: Processed from Data on Inventory of Impacted Assets and Socio-Economic Surveys, 2019

**Figure 9: Map of Project Affected Areas**



## 2.3. Indicative Project Activities

### 2.3.1 Pre-construction Phase

Activities completed in 2019. The following activities have already been undertaken by the Project Executing Agency as part of the project:

- The screening of the project has been carried out by ADB with the result: Environmental category B; (b) screening by DELH Central Sulawesi is presented in letter: 660/362 / BID.I / DISLH, which stated that Construction of Coastal Protection Palu City is included in projects that require AMDAL studies.
- A community consultation meeting was held on May 25 2019 at the Hotel Jazz Meeting room Palu City The meeting was attended by: government agencies, public is affected, Non-governmental organizations, etc. The meeting was aimed for disseminating information about proposed project. The meeting was attended by 48 people, 6. (six) of the participants are women. At the meeting, the potential impacts of the construction activities, labor recruitment including mitigation measures to be undertaken were generally discussed. The response of the personnel attending this event was supportive community with planned activities. There were some issues raised by the participants: problems of land acquisition, clarity of activity plans, concerns about the problem of fishing activity caused by the dykes.
- The minute of this meeting and is included in Appendix 5 The list of participants attending the meeting is included in Appendix 5.

### **2.3.2 Construction Phase.**

Land Clearing. A minor land clearing of approximately 4.4 Ha is needed (source: Data Inventory of Impacted Assets and Socio-economic Survey 2019).

#### *Recruitment of construction labors.*

The construction of facilities and infrastructure of the Palu Coastal Protection will require skilled and unskilled labors, consisting of drivers, heavy equipment operators, project supervisor/foremen, stone men, carpenters, electricians, and daily labors. It is expected that most of the labor needs will be recruited from the community around the project site from Silae, Lere, Besusu Barat and Talise Villages (Silebeta). Skilled labors that cannot be supplied from these villages will be recruited from elsewhere. It is estimated that the total number of labors required for the construction activity is up to 200 people, but this number will be reduced as the works are gradually completed. The labors from outside Silebeta will be accommodated in a temporary labor basecamp to be constructed within the Silebeta area.

#### *Mobilization of equipment and construction materials*

The mobilization of equipment will include small to medium-sized excavators for earthworks and small tonnage of dump trucks for transportation of construction materials, etc.. Construction materials to be mobilized are soils, rock/stones, sand, cement, bricks, steels, etc..

#### *Construction of public facility and infrastructure*

The infrastructure built public activities related to the construction of coastal safeguards are only the planning and construction of drainage canals along the coast guard structures. In addition to the drainage channel, a floodgate is built. This drainage serves to drain water from the mainland into the sea.

### **2.3.3 Post-construction Phase**

Post-construction activities include construction maintenance activities that are built up from siltation due to sedimentation especially at fishing boat mooring locations. Also carried out monitoring of the condition of damaged coastal protection.

The project construction will be scheduled for implementation in 2019 as shown in Table 18.

## **2.4 Related Activities in the Area**

The Palu Coastal Protection Sub-Project is part of a Palu Coastal Rehabilitation Program. Besides the coastal protection activities of this rehabilitation program include:

- (i) Elevated Road,
- (ii) Palu Bridge IV,
- (iii) Mangrove Development, and
- (iv) Salt Ponds/Harvesting ('Pengaraman').

The Elevated Road and the Palu Bridge IV will be financed by JICA, whereas mangrove development will be implemented as a continuation of the Coastal Protection Project. Location and implementation schedule of these projects may overlap, hence an overall spatial plan, and coordination will be needed (Appendix VII).

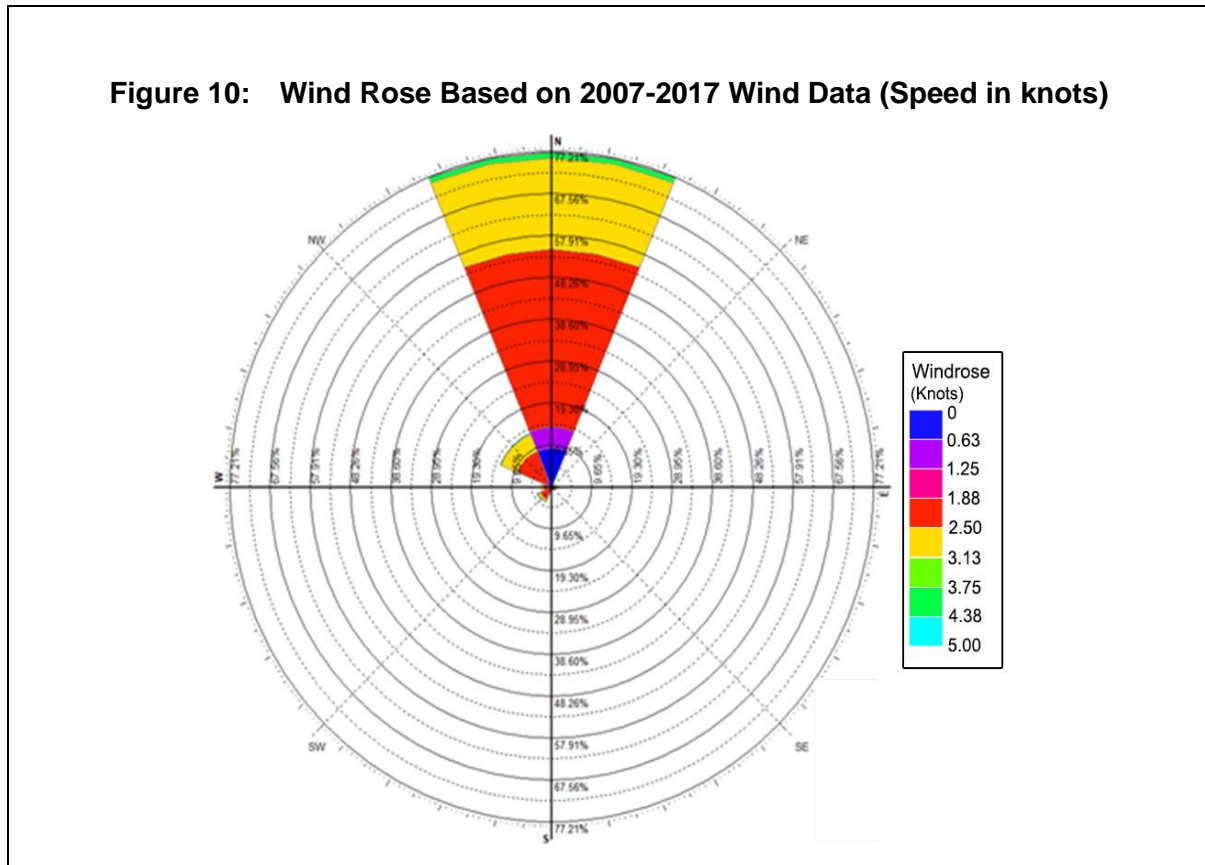


### III. Description of the Existing Environment

#### 3.1. Physical Resources

##### 3.1.1. Wind

Wind data is used to predict the magnitude of the wave height, wave period, and direction of the wave. The daily wind data used are wind speed and daily direction data for the 10 year period 2007-2017. Analysis of wind data is done by grouping recording data into intervals of wind speed and direction. Distribution of wind data based on speed and direction is intended to determine the direction of the dominant wind. The percentage of wind events with a certain speed from various directions in the recording period for 10 years (2007 - 2017) presented in the form of wind rose can be seen in Figure 10.



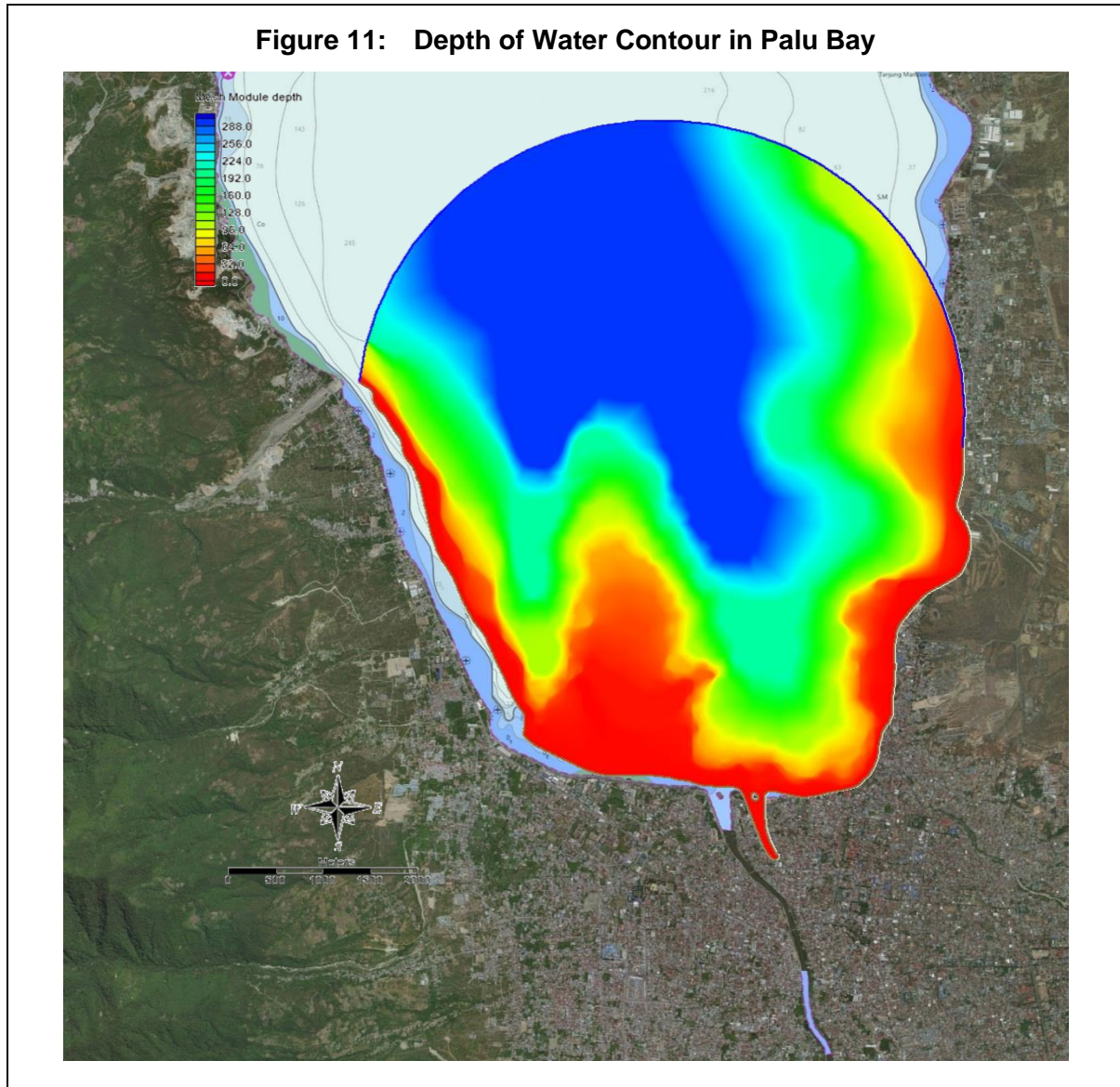
The wind rose shows a dominant wind direction from the North with a wind speed mainly ranging between 0 - 3.13 knots.

### 3.1.2. Hydro-Oceanography

#### Wave modeling

Input Parameters:

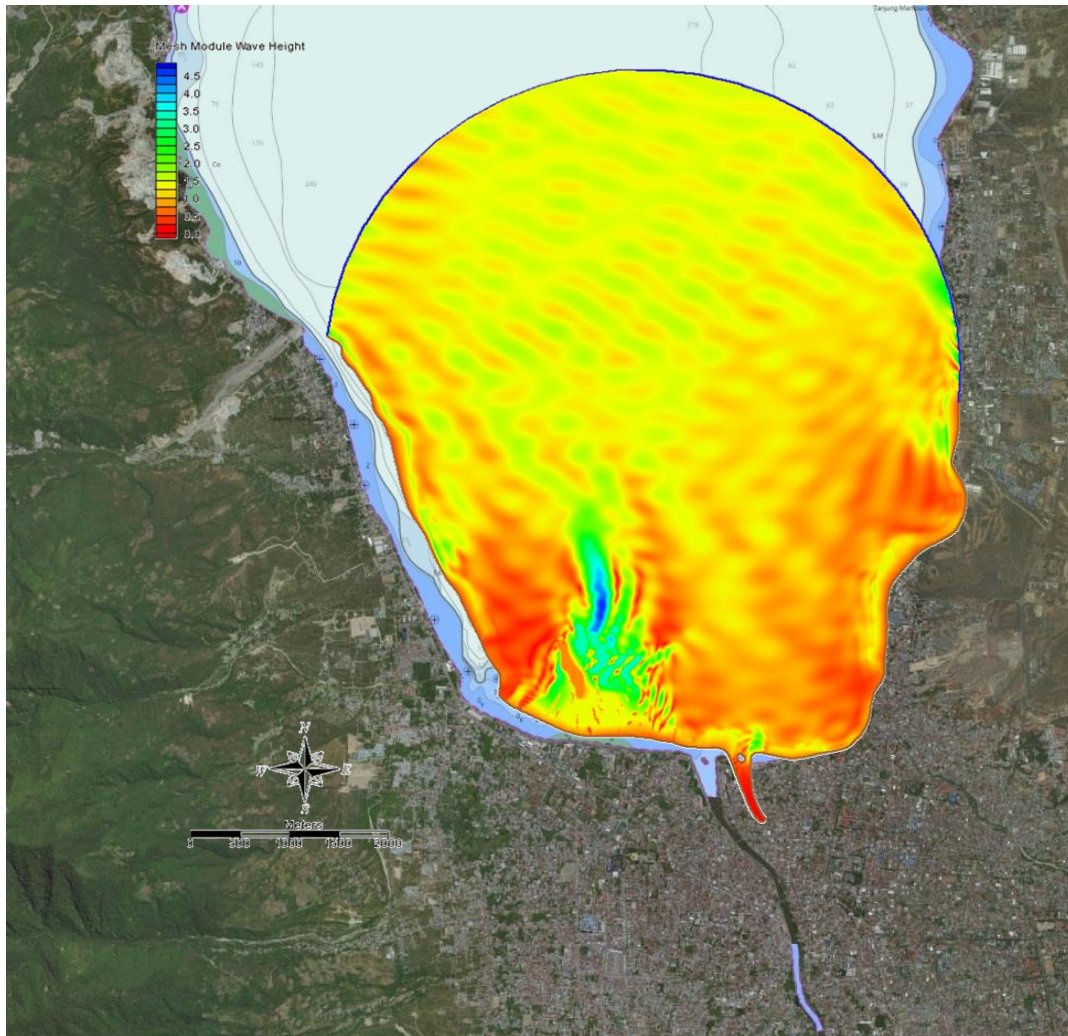
- Water Depth Contour (Bathymetry)
- Wave Characteristics ( $H_s = 1.245$  m,  $T_s = 4.116$  seconds)
- Wave Origin Direction = North (Dominant)



#### Modeling results:

The modeling results include the depth and wave phase contours towards the coast. From the data modeling wave heights and underwater contours, shows that the western coast is shallower and the wave height is relatively low.

**Figure 12: Wave Height Contour**

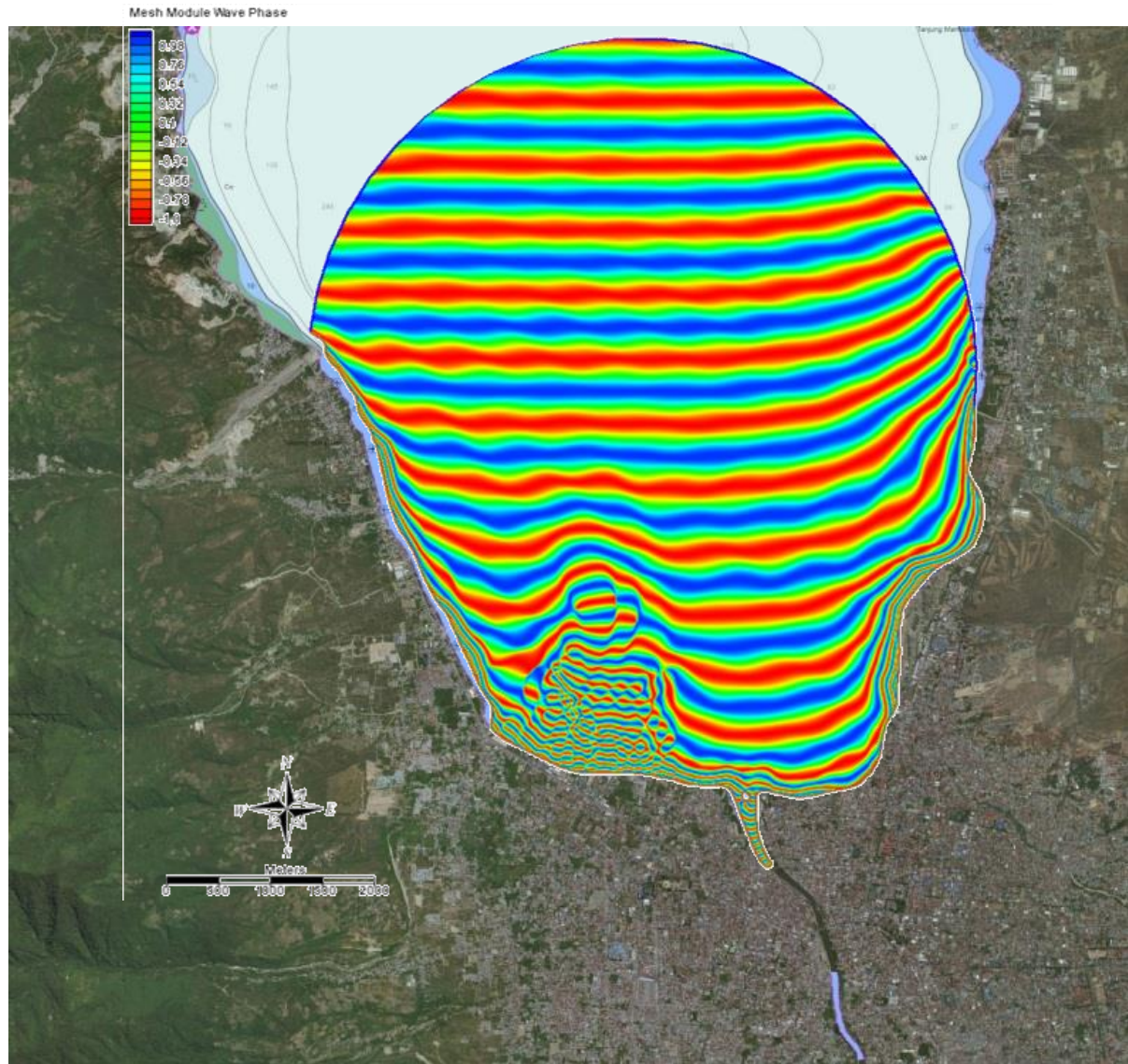


( $H_s = 1.245$  meter,  $T_s = 4.116$  second, wave from the North)

- In the modeling image above the red color indicates a wave height close to 0 m and the blue color 3.5-5.0 m
- The wave height at the Palu beach ranges from 1.00 - 2.00 meters.
- When waves enter more shallow waters (30-50 meters) there is a wave refraction which causes the wave height to rise.
- Waves that experience refraction will be deflected with smaller wave energy. (See Wave Phase Images).
- The wave height after experiencing refraction ranges from 1.50 - 3.00 meters which occurs in the waters of the bay of Palu at a depth of 30-50 meters.
- The wave height will decrease again when entering the coastal area, so that the wave height around the coast ranges from 0.50 - 1.00 meters.



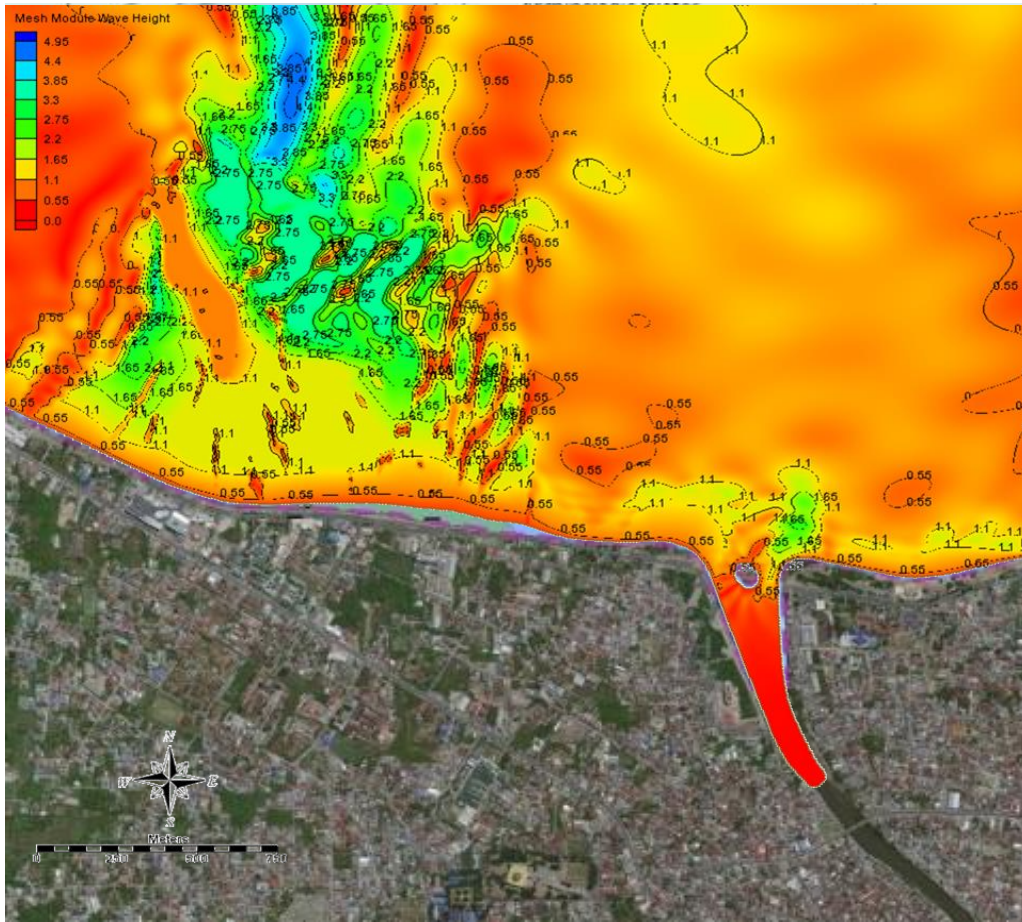
**Figure 13: Wave Phase Towards the Beach**



(Hs= 1.245 meter, Ts= 4.116 second, wave to the North)

Waves coming from the North, with shorter wavelengths heading towards the coast. On the west coast the shortwave frequency is quite high, due to the relatively shallow underwater contours.

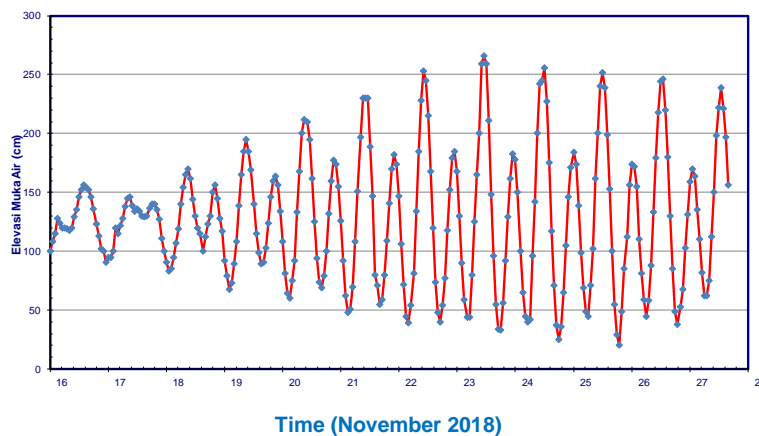
**Figure 14: Wave Height Contour on Palu Beach**



From Figure 14 above, it can be seen that the waves that occur along the Palu coast range from 0.55 to 1.10 meters. But for the western coast because of the influence of the refraction of the wave height varied at a distance of 300 meters from the coast, the wave height reaches 2.00 m. Whereas at a distance of 500 meters from the coast the waves reach 3.00 m.

The sea level used as the reference datum is MSL (Mean Sea Level) obtained from tidal observations for 15 days (Figure 15).

**Figure 15: Tidal graph of field observations**

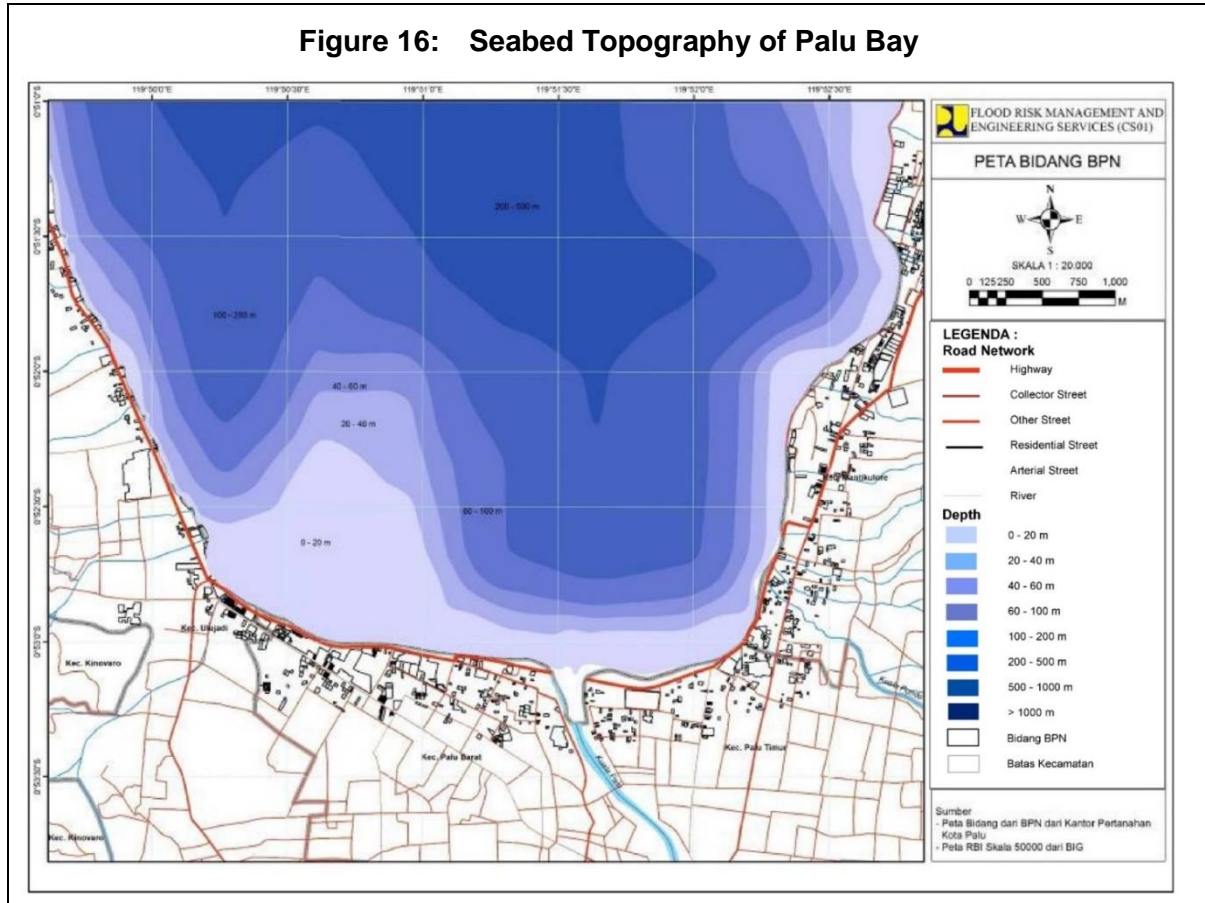




### 3.1.3. Topography

With regards to the condition of sea wave, seabed of Palu Bay is shown in Figure 18, sea water depth is consistent with the wind study, as presented in Figure 19. Compare these two figures, west coast has higher seabed so that the water depth is shallower, it can be seen the wave pattern is a little bit complicated as shown in Figure 20; and Figure 21 shows the wave height of Palu Bay, higher wave is accordingly observed

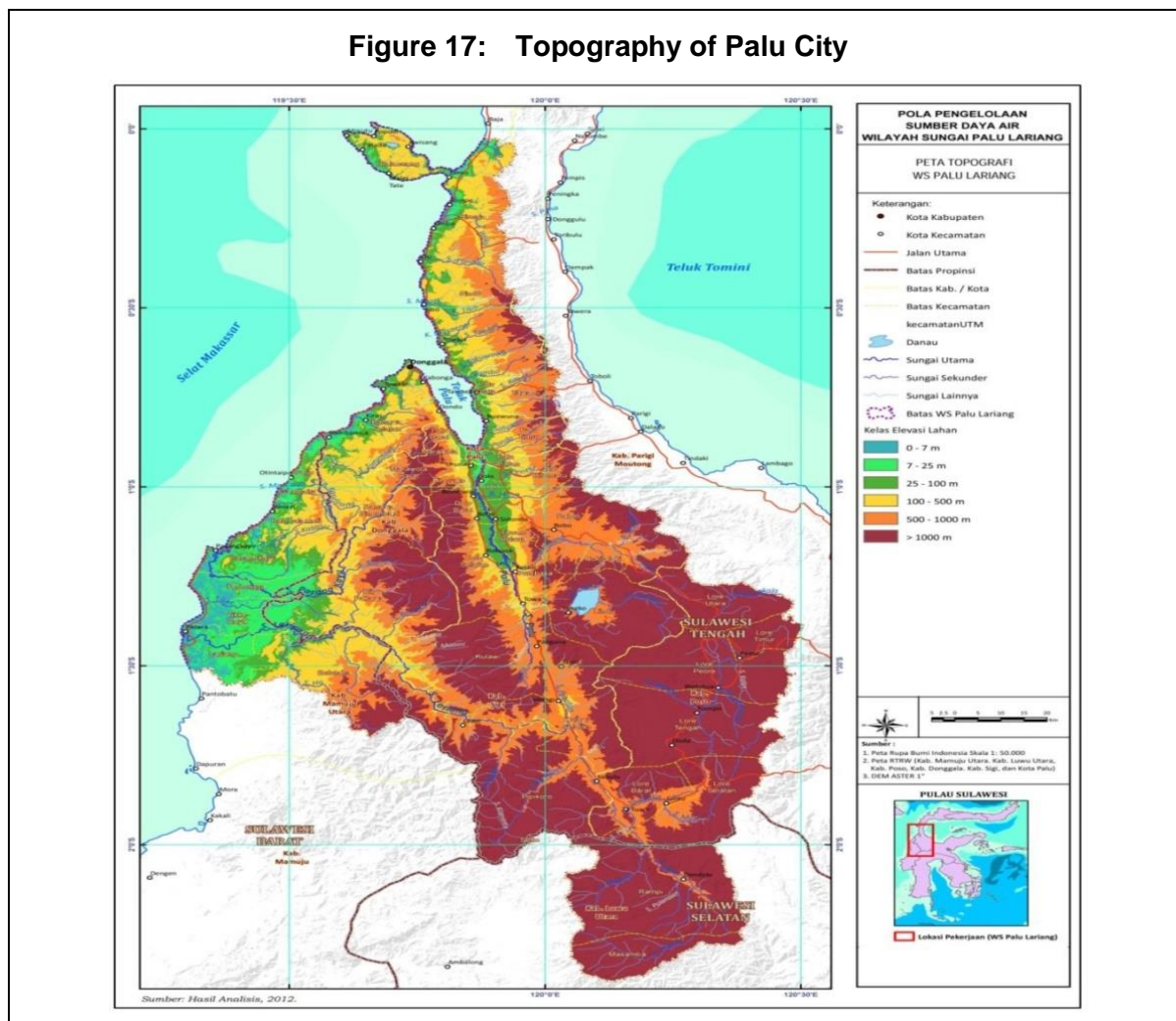
It is quite obvious that under water topography along west coast potentially create higher wave, due to the wave energy transformed to potential energy so that water level is higher along the west coast.



On the topographic map above shows the depth distribution of the coast from 0 m to 300 meters. The darker blue indicates the depth of the sea deeper. At the planned location of activities from West to East in the range of 0-20 meters. The proportion of depth of 0-20 meters is dominated on the coast of Palu on the west side of the mouth of the Palu River. On the west coast the coast is relatively sloping compared to the east Palu coast.

On the topographic map of the land shown in the figure below, shows the contour of the land with gradations of elevation from 0 to more than 1000 meters. The blue color indicates the 0-7 m elevation contour, the light green color indicates the height contour of 7-25 m. The city of Palu is seen as being in a valley with gradations of 25 to 1000 meters in height.

**Figure 17: Topography of Palu City**



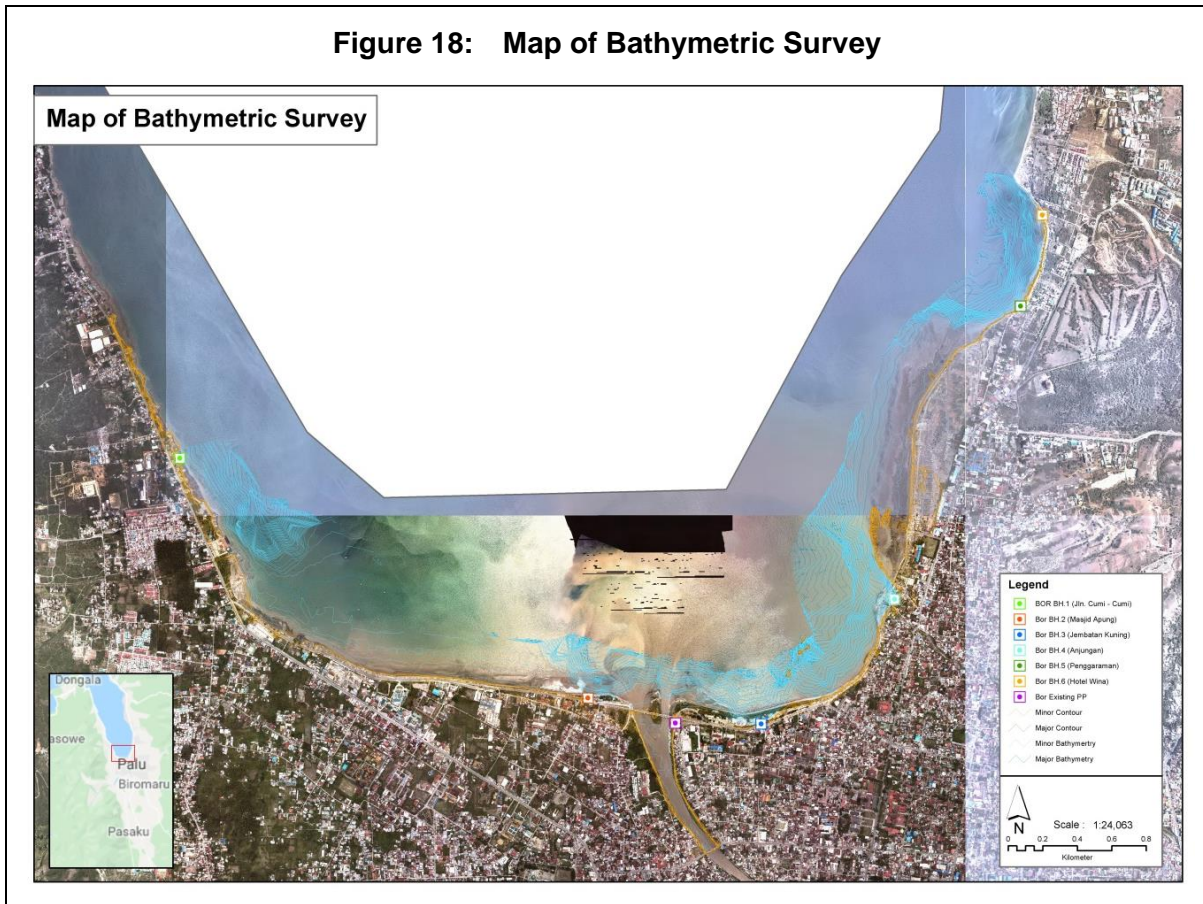
### 3.1.4. Bathymetric Survey

Bathymetric survey has been conducted by the Government of Palu City, under water topography along coast of Palu is presented in Figure 20. Results of the survey will be used for the design of coastal protection, the actual situation along the coast is the basis to set up the alignment of coastal protection.

**Table 7: Summary of critical zone for bathymetry measurement**

No	Location area point	Contour value from shore line (distance 50 m)	Critical zone
1	Cumi cumi	- 4.00 m	flat
2	Masjid Apung	- 11.25 m	steep
3	Anjungan	- 15.50 m	steep
4	Penggaraman	- 15.80 m	steep
5	Wina Hotel	- 17.00 m	steep

**Figure 18: Map of Bathymetric Survey**



### 3.1.5. Morphology and Geology

Palu River passes through Palu City, major part of the city is generally developed over the river basin. Morphology of Palu-Lariang RBT is divided into three parts, namely: lowlands, hills and mountains. The Palu-Lariang RBT was passed by an active fault of the Palu Koro as a manifestation of the ongoing process of deformation of the earth's crust which was the hotspots of the collision process between the three main plates (Subduction Zone) namely the Pacific, Eurasia, and Australia which were directed.

North Northwest - South Southeast along 300 km from Palu in the North to Bay of Bone in the South (Tjia & Zakaria, 1974). Therefore, Palu-Lariang RBT is an active tectonic area that earthquakes occur frequently, either of small or large scale along the Palu-Koro Fault.

Regarding the Palu River Basin, flow pattern of the river in Palu-Lariang RBT generally meanders over the area of Palu City; for the upstream and middle river reach, however, because of steep slope the flow tends to cut riverbed downward to create V-shaped valley. This indicates that the area has a young geological cycle.

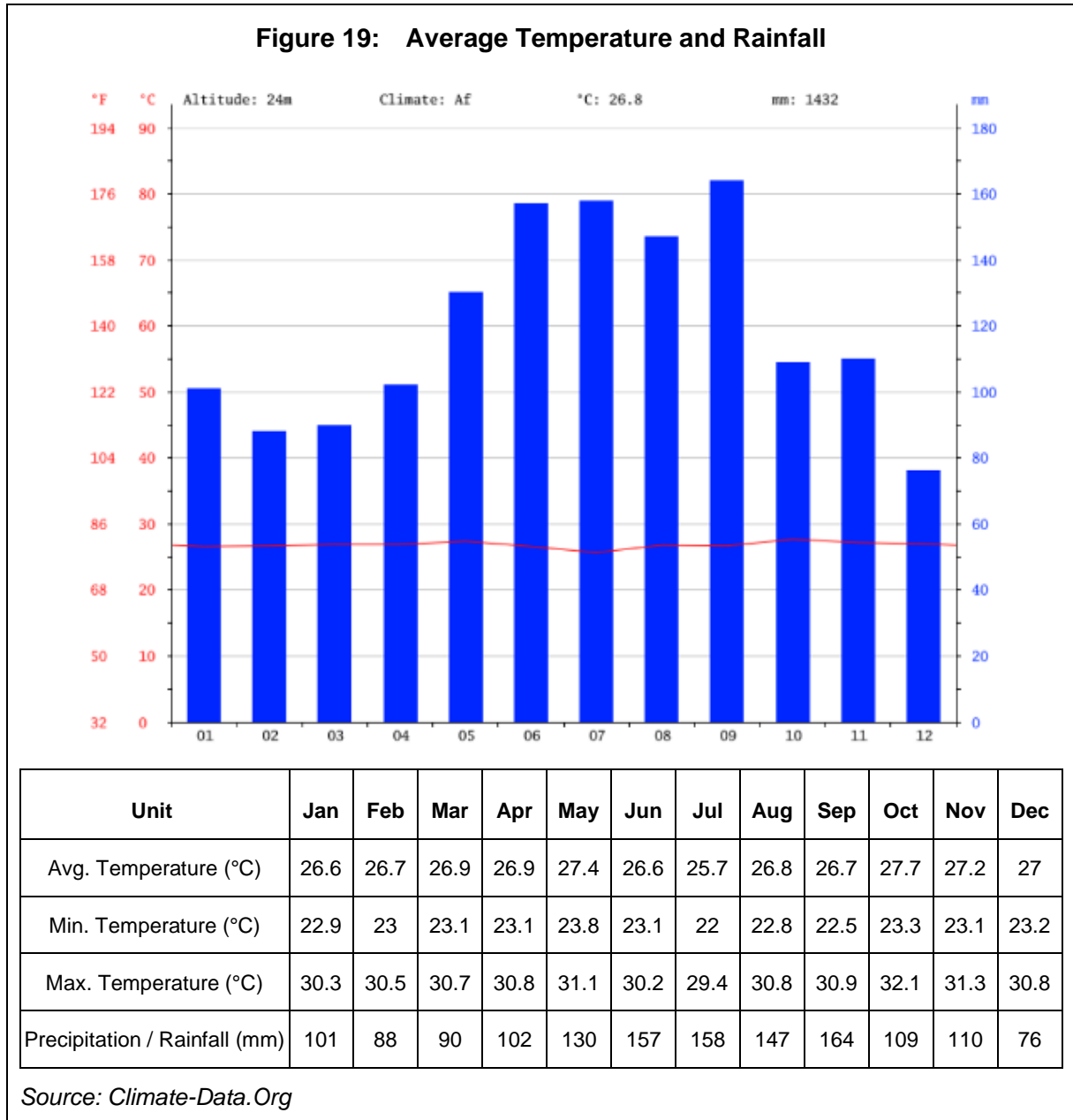
Most of the soil conditions are porous, river flow is not continuous occasionally due to dominant infiltration action, and sometimes even makes base flow disappeared. Under such condition, when heavy rain happens on upstream area, flash floods occur. A map of geologic condition of Palu-Lariang RBT.



### 3.1.6. Climate

The monthly average temperature and precipitation is shown in figure below. The rainfall varies 88 mm/month between the driest month and the wettest month, annual rainfall is 1,432 mm; through the year, temperature varies by 2.0 °C.

From the figure below the rainfall distribution shows that the city of Palu and its surrounding areas peaked highest rainfall in the range of June to September. While the temperature distribution is relatively stable throughout the year, in the range of 25-27 degrees Celsius.



### 3.2. Ecological Resources

#### 3.2.1. Flora

From the observations on the project location, the existing plants have very low densities. The tree species found are generally green plants and shrubs.

**Table 8: Identified Plant Types**

Common Name of the Plant	Latin Name	Information
Trembesi	<i>Samanea saman</i>	Tree
Ketapang	<i>Terminalia catapa</i>	Tree
Pulai	<i>Alstonia scholaris</i>	Tree
Cemara laut	<i>Casuarina sp</i>	Tree
Johar	<i>Cassia siamea</i>	Tree
Kayu jawa, jaran	<i>Lannea coromandelica</i>	Shrub
Kelapa	<i>Cocos nucifera</i>	Tree
Jarak	<i>Ricinus communis</i>	Shrub
Petai cina	<i>Leucaena glauca</i>	Tree
Cemara kipas	<i>Casuarina equisetifolia</i>	Tree
Mimosa	<i>Mimosa sp</i>	Herb
Pisang	<i>Musa paradisiaca</i>	Shrub
Flamboyan	<i>Delonix regia</i>	Tree
Teki besar	<i>Killingia sp</i>	Herb
Kangkung laut	<i>Ipomoea pescapre</i>	Herb
Kersen	<i>Muntingia calabura</i>	Tree

Source: Observation result

Plant species found in the project location are generally plant species that are adaptive to the terrestrial environment. There were no types of mangroves that were adaptive to tidal environments such as *Avecennia sp* and *Rhizophora sp*.

**Figure 20: Types of beach plants that are found**



### 3.2.2. Fauna

Several types of terrestrial fauna observed are:

**Table 9: The species of fauna found along Palu Beach**

Common Name of the Plant	Latin Name	Information	IUCN Status*)
<b>AVES</b>			
Burung gereja	<i>Passer Montanus</i>	Wild	LC
Bondol pucat, pale headed munia	<i>Sterna Bergii</i>	Wild	LC
Bondol taru, black-faced munia	<i>Colocalia Esculenta</i>	Wild	LC
Ketilang	<i>Pycnonotus Aurigaster</i>	Wild	LC
Elang laut perut putih	<i>Haliaetus Leucogaster</i>	Wild	LC
Trinil, common sandpiper	<i>Actitis Hypoleucos</i>	Wild	LC
Perkutut	<i>Geopelia Sp</i>	Wild	LC
Tekukur	<i>Streptopelia Chinensis</i>	Wild	LC
Walet sapi	<i>Collocalia Esculenta</i>	Wild	LC
Layang-layang laut	<i>Apus Sp</i>	Wild	LC
<b>REPTILIA</b>			
Buaya	<i>Crocodylus Porosus</i>	Wild	LC

Remarks: IUCN Status LC: Least Concern, NT: Near Threatened, VU: Vulnerable, EN: Endangered, CR: Critically Endangered, EX: Extinct

In the area around the mouth of the Palu River, an individual crocodile was detected during field observation on the banks of the river. This species is not listed as species of concern in IUCN Red List. This species has extensive distribution, including: Bangladesh, Cambodia, Thailand, Malaysia, Myanmar, Philippines, Viet Nam and Sri Lanka. However, the existence of this animal in urban areas should receive special attention.

**Figure 21: Crocodiles found on the banks of the mouth of the Palu River**



Of all the fauna identified at the Coastal Protection project site, no endemic species were found, both from the Tokalekaju KBA Mountains and KBA Lore Lindu areas (According to EARR 2019 list, appendix 2)

The type of fauna on the coast of Palu can be described from the catch of the fishermen. Paying attention to the catches during the study shows that fish resources in coastal areas are quite diverse, both the type and size of fish caught. The diversity of fish resources can be caused by the fact that in shallow water areas there is a lot of food for demersal fish and even pelagic fish species. According to Nybakken (1992), the occurrence of ups and downs and wave movements on the beach can lift food substances so that various types of fish can take advantage of this condition well.

The abundance of phytoplankton which was collected at each station ranged from 1,870-6,378 cells / m<sup>3</sup>, with diversity indices ranging from 0.54 to 1.71. While zooplankton abundance ranged from 1.103 - 16.710 Individual / m<sup>3</sup> with a diversity index ranging from 0.29 - 0.92. Benthos density in the study area ranged from 23-31 individuals / m<sup>3</sup> with diversity values ranging from 1.32 - 1.73<sup>1</sup>

The dominant types of fish and non-fish caught by fishermen are beach trawlers, including fish, bijinangka fish, peperek, mullet fish, baronang, cendro fish, stingrays, layur, tembang fish, buntel, tongue fish, sea milkfish, lencam, pestle, shellfish, kepting, shrimp and squid (*Loligo sp.*). The dominant catch (by-catch) caught during the study was only the type of tembang fish, baronang fish, bijinangka fish and barebuku species.

**Table 10: The by-catch composition of trawl nets is a type of krakat**

Local Name	Indonesian Name	Scientific name	Fish Size (cm)
Bosuka	Tembang	<i>Sardinella fimbriata</i>	5-7
Lamotu	Bijinangka	<i>Upeneus sulphureus</i>	6-10
Baronang	Baronang	<i>Siganus guttatus</i>	8-12
Baebuku	-	-	3-6

Source: Mardjudo, A, 2011.<sup>2</sup>

From other references, the types of fish that can be caught by fishermen include: *Decapterus russelli*, *Katsuwonus pelamis*, *Rastrelliger braccysoma*, *Rastrelliger kanagurta*, and *Clupea fimbriata* (Dokumen AMDAL Reklamasi Pantai Talise 2013).

Of all the flora and fauna species found at the project location, no species protected under the IUCN Red List were found nor based on Permen LHK No. 106/2018.

<sup>1</sup> Analisis Dampak Lingkungan (ANDAL) Reklamasi Pantai Talise Teluk Palu, Kecamatan Mantikulore, Kota Palu, Provinsi Sulawesi Tengah, oleh PT Yauri Properti Investama Tahun 2013

<sup>2</sup> Ahsan Mardjudo, 2011, " Analisis Hasil Tangkapan Sampingan (By-Catch) Dalam Perikanan Pukat Pantai Jenis Krakat Di Teluk Kota Palu Sulawesi Tengah', Jurnal Kiat, Universitas Alkairaat

### 3.3. Social Economic Resources

Population in Palu City as the capital of Central Sulawesi for 2017 were 379,783 people consisting of 190,880 (50.3%) male and 188,903 (49.7%) female, the average population growth of 2010 - 2017 is 1.8%. Distribution and population growth can be seen in Table 11.

**Table 11: Distribution and Population Growth in Palu City (2010 - 2017)**

Sub-district	Land Area (km <sup>2</sup> )	Population			Population Growth 2016-2017 (%)
		2010	2016	2017	
Palu Barat	8,26	98.739	61.424	62.293	1,4
Tatanga	14,95	-	39.369	39.997	1,6
Ulujadi	40,25	-	27.319	27.763	1,6
Palu Selatan	27,38	122.752	69.492	70.571	1,6
Palu Timur	7,71	75.967	70.36	71.452	1,5
Mantikulore	206,80	-	62.622	63.604	1,6
Palu Utara	29,94	39.074	22.634	23.196	1,6
Tawaeli	59,75	-	20.362	20.706	1,6
<b>Total Palu City</b>	<b>395,06</b>	<b>336.532</b>	<b>374.020</b>	<b>379.783</b>	<b>1,6</b>

Palu City with an area of 395.06 km<sup>2</sup>, is divided into 8 sub-districts and 46 villages with a density of 961 people per km<sup>2</sup>. The status of some major villages is described as follows:

- Mantikulore Village almost has half area of the city, the area is 206.80 km<sup>2</sup> (52.35%) with population of 63,803 people (16.80%) which is also the lowest density as 309 people per km<sup>2</sup>;
- Palu Timur is the smallest village with area of 7.71 km<sup>2</sup> (1.95%), population is 71,452 people (18.81%) and is the most densely populated village with a density of 9,268 people per km<sup>2</sup>.

The number of households in Palu City is 89,783, average household member is 4 people; the distribution of village, population, household and density in Palu 2017 is presented in Table 12.

**Table 12: Distribution of Village, Population, Household and Density in Palu 2017**

Sub-district	% of Land Area	No. of Village	Population	% of Population	No of Household	Population Density per km <sup>2</sup>
Palu Barat	2,10	6	62.293	16,40	14.378	7.523
Tatanga	3,78	6	39.997	10,53	10.544	2.675
Ulujadi	19,19	6	27.763	7,31	6.905	690
Palu Selatan	6,93	5	70.571	18,58	18.378	2.577
Palu Timur	1,95	5	71.452	18,81	15.646	9.266
Mantikulore	52,35	8	73.804	16,80	14.597	309
Palu Utara	7,58	5	23.196	6,11	4.782	775
Tawaeli	15,12	5	20.706	5,45	4.553	346
<b>PALU</b>	<b>100,00</b>	<b>46</b>	<b>379.782</b>	<b>100</b>	<b>89,783</b>	<b>961</b>



The number of poverty in Palu City for the past 5 years has decreased 7.34% in average per year from the population, while the poverty line is increased 40.67% since 2012. In 2017 the poverty line is Rp. 473,355 per capita per month with a total number of poor people 25,500 as can be seen in Table 13.

**Table 13: Number of Poverty in Palu Municipality (2012 - 2017)**

Year	Poverty Line (Rp/Capita/Month))	Poor People	% of Total Population
2012	336,509	30,140	8,58
2013	378,455	25,900	7,24
2014	405,195	25,670	7,05
2015	419,596	27,190	7,42
2016	451,437	26,240	7,06
2017	473,355	25,500	6,74

Source: Palu City in Figures 2018, BPS Palu

### 3.4. Transportation

#### Land Transportation

In general, the condition of the road network to the beach safety construction site is in good condition, i.e. the road used is Jalan Pahlawan and which is the main road with hotmatic pavement (asphalt) has a road width of 7 m not separated by a median (2/2 UD), allowing an average speed of 31 km/h to 42 km/h, based on observations. Side barriers are still classified as very low. This condition is expected to be disrupted and road damage occurs when passed by material transport vehicles as well as equipment and land transport vehicles during the construction stages of the Palu City Coastal Protection construction.

#### Road Level Service

The level of road service is a measure to determine the state of road services to that traffic. The assessment of road service level can be seen from 2 (two) aspects, namely the average speed of the vehicle and the comparison between volume and road capacity. Based on the results of observations while the type of private car is the type of vehicle most used, then motorcycles and followed by other types of transportation vehicles. Traffic conditions are relatively moderate, however during holidays there is a congestion that is congested and it is estimated that if the transport of materials and materials through this road will greatly disrupt existing traffic activities and it is possible for congestion and accidents when crossed

#### Sea Transportation

Sea transportation is a vital and strategic means of transportation for the people of Palu City as a Gulf area, so that development in the field of shipping and sea transportation facilities continue to be improved. This is the same as in the location of the most widely used access planning activities is sea access so that many transportation facilities are used such as small boats, 'pompong' boats and others.

### 3.5. Public Health

The highest number of cases of disease found in Palu City until 2018 were Respiratory tract infections.

**Table 14: Ten (10) Diseases in Palu City**

No	Type of disease	Number of cases
1	Respiratory tract infections	43.507
2	Gastritis	18.206
3	Other diseases of the respiratory tract	17.953
4	Diseases of the muscular system / binding organs	14.986
5	Allergic skin disease	10.540
6	High blood pressure (hypertension)	9.408
7	Nerves	10.253
8	Pulp and periapical tissue disease	7.382
9	Diarrhea	6.451
10	Tonsillitis	6.204
<b>Total</b>		<b>144.890</b>

Source: Palu City in Figures (BPS), 2018

The dominance of respiratory infections is one indication of poor air sanitation in the city of Palu. Dry and dusty conditions facilitate upper respiratory tract infections. Indications of poor water sanitation are also shown by the high cases of gastritis, which ranks second most in the city of Palu.

## **IV. Anticipated Environmental Impacts And Mitigation Measures**

### **4.1. Environmental Impact and Mitigation Measures**

Considering actual condition of Palu beach, the potential impacts of Coastal Protection Project as follows:

During the preparation of the initial environmental examination (IEE) in early 2019, a comprehensive screening for environmental impacts was made through a review of the parameters associated with coastal dike development project against the components of the project and the environment where the facilities will be located.

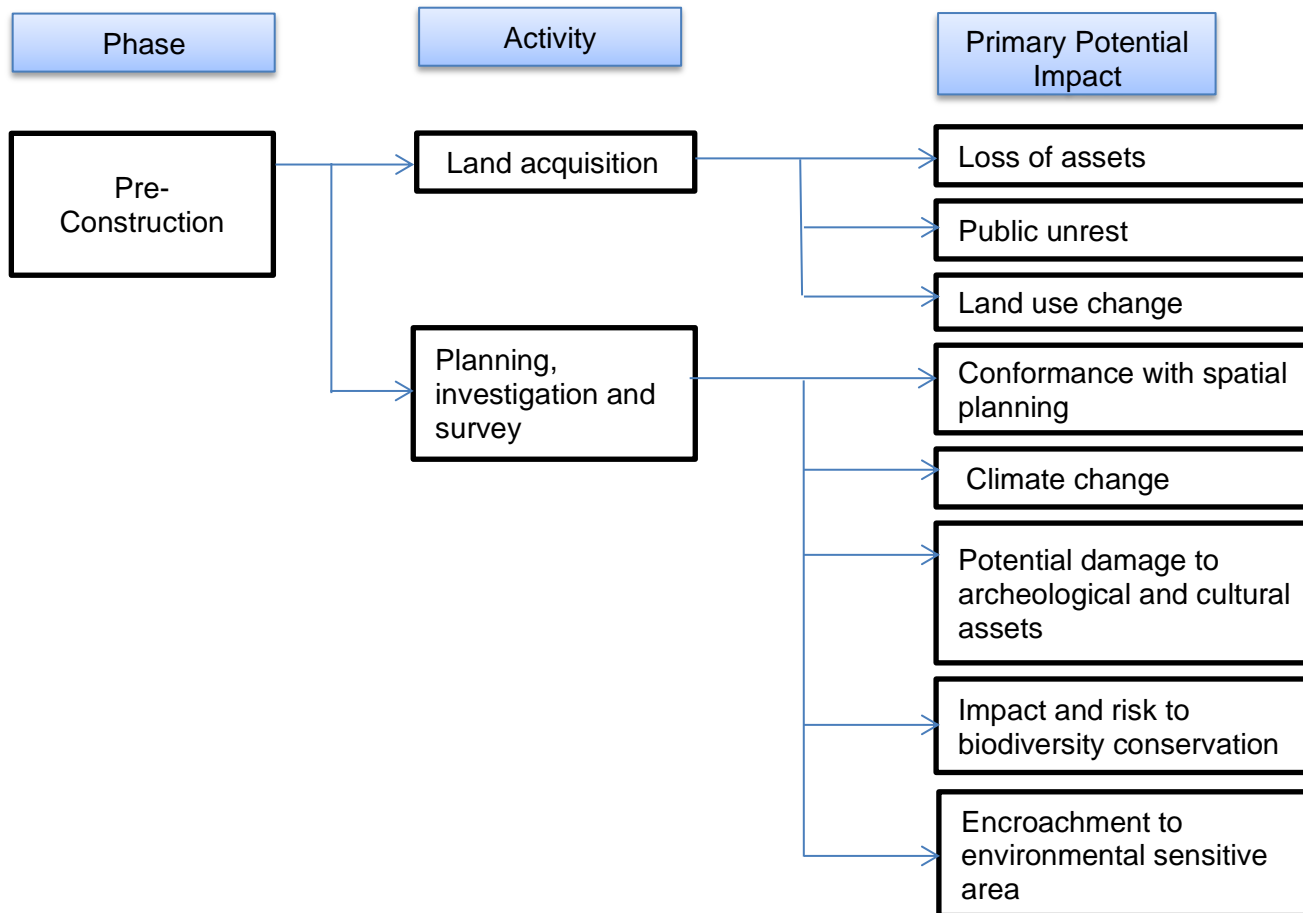
The assessment was made on the following phases of the subproject: (i) preconstruction; (ii) construction; and (iii) operation and maintenance. Results of the environmental impacts screening were then summarized in Table 15, while the discussions of each issues were presented in the succeeding sections. In Table 15 impact types and magnitudes were indicated

Besides, Impact flowchart was also prepared (Figure 22 - Figure 24) showing interrelationships between project activities and possible environmental impacts. It also shows the levels of primary and secondary impacts that arising from each activity.

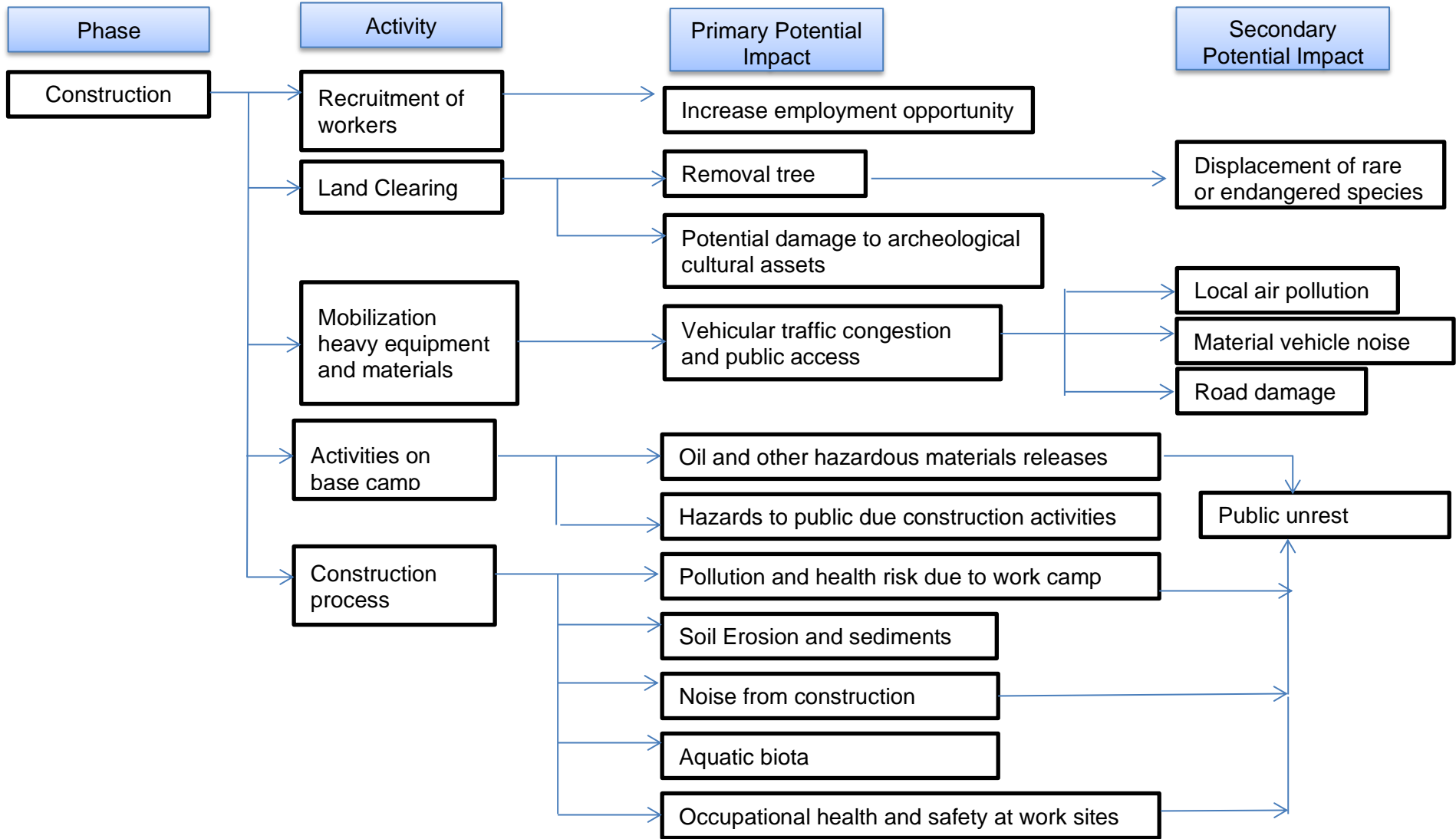
For budgetary purposes a general mitigation cost estimate of 2% of the total direct project cost is used, amounting to Rp 6.56 billion (2% x Rp 328 billion). This budget should be anticipated by the contractor in his proposal, and be available during implementation.

The total cost of monitoring activities is estimated at Rp 300 million for the whole construction period (14 months), covering air quality, water quality, aquatic biota, transportation, social-economic, reporting and development consultant.

**Figure 22: Flow Diagram Potential Impact Pre-Construction Phase**

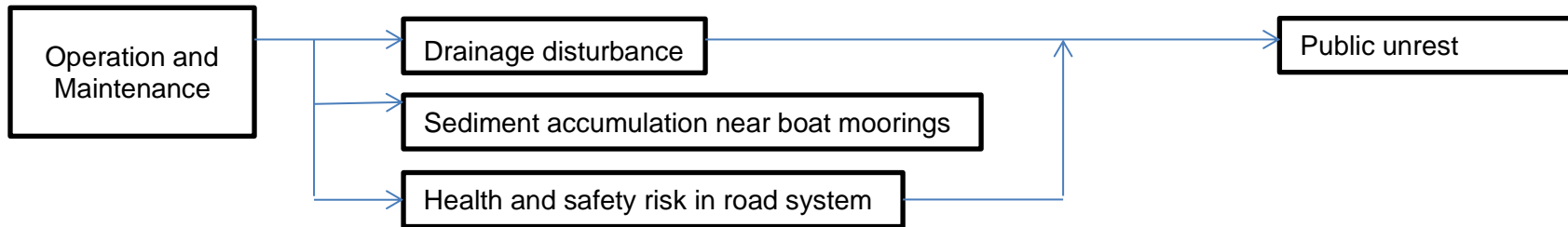


**Figure 23: Flow Diagram Potential Impact Construction Phase**





**Figure 24: Flow Diagram Potential Impact Operation Phase**



Impacts related to social aspects (such as resettlement, employment, etc.) are studied in a separate of this PPTA, and represent an integral of this IEE.

**Table 15: Potential Environmental Impacts**

Project Activity	Potential Environmental Impacts	Environmental Impacts Significance *)
<b>1) Pre Construction</b>		
Land acquisition	<p><u>Public unrest.</u></p> <p>Land acquisition activities, especially as a result of activities to prepare land, will potentially cause unrest in the community. Community unrest occurred because of the public's concern about the value of compensation that was not satisfactory. But the number of houses and land being acquired is very small in number</p>	<p>-3 Significant</p>
	<p><u>Climate change vulnerability (design aspect)</u></p> <p>There are no activities that contribute negatively to climate change, activities that contribute negatively to climate change are activities to clean plants on the beach. But from the results of field observations the number of plants found is very small.</p>	<p>-1 Not Significant</p>
	<p><u>Land use change</u></p> <p>There is no change in land use, because the coastal protection project is located on the existing coastal protection.</p>	<p>0 Not Significant</p>
	<p><u>Conformance to spatial planning</u></p> <p>Coastal protection project is a project that is in the existing location of the old coast guard. The existence of a coastal protection project is not in conflict with the existing urban spatial plan.</p>	<p>0 Not Significant</p>
	<p><u>Encroachment to environmentally sensitive areas conservation</u></p> <p>There are no ecologically sensitive areas in the project site and its surroundings, no mangroves, no special and protected animal habitats are found..</p>	<p>0 Not Significant</p>
	<p><u>Impacts and risks to biodiversity</u></p> <p>The disruption of coastal protection development activities both in the mainland and coastal waters did not significantly reduce the level of diversity of both flora and fauna</p>	<p>-1 Not Significant</p>

<b>Project Activity</b>	<b>Potential Environmental Impacts</b>	<b>Environmental Impacts Significance *)</b>
	<u>Potential nuisance and problems to the public</u> Land acquisition activities for coastal protection construction activities will disturb the community, especially related to land compensation issues	-3 Significant
	<u>Potential damage to archaeological and cultural assets</u> There is a Floating Mosque (Bab Al Rahman) which will be affected by Coastal Protection.	-3 Significant
	<u>Loss of assets (IR concerns)</u> There are no public assets that will be disturbed by this coastal protection activity, because this coastal protection project is located on the existing beach embankment location.	0 Not Significant
<b>2) Construction</b>		
Recruitment of workers	<u>Employment opportunity</u> Coastal construction activities are activities that require a lot of unskilled labor, with a low level of education, so they can recruit a lot of workers around the project.	+5 Significant
Land preparation	<u>Aquatic biota</u> Land preparation activities for the construction of coastline, by carrying out coastal excavation, will potentially cause sediment mixtures. Stirring coastal land will lead to increased levels of fine sediments in coastal waters, which will have an impact on the life of marine biota. Turbidity of coastal waters will reduce the abundance and diversity of aquatic biota.	-3 Significant
	<u>Tree removal</u> Land preparation activities will clean up trees and shrubs that are available at the project site. No mangroves were found and the number of trees at the project site was very low in density. Existing plants are mostly bush plants.	0 Not Significant
	<u>Displacement of Rare or Endangered Species</u> From observations at the location of the planned activity there were no endangered or rare species flora and fauna	0 Not Significant

Project Activity	Potential Environmental Impacts	Environmental Impacts Significance *)
	<p><u>Potential damage to archaeological and cultural assets</u></p> <p>Along the coast of Palu, no archeological assets will be found which will be affected by coastal safeguard development activities. The existence of the Bab Al Rahman floating mosque was not affected by the construction of the Coast Protection .</p>	<p>0</p> <p>Not Significant</p>
	<p><u>Soil erosion and sediments of construction sites</u></p> <p>Coastal Protection and Boat mooring construction activities will potentially increase sedimentation in coastal waters.</p>	<p>-3</p> <p>Significant</p>
	<p><u>Noise and vibration from construction equipment</u></p> <p>The transportation of materials and equipment for subproject construction of coastal protection, and fishing boat mooring construction has the potential to increase noise pollution and vibration.</p>	<p>-5</p> <p>Significant</p>
	<p><u>Air Pollution due to construction activities</u></p> <p>The transportation of materials and equipment for project construction of coastal safety and fishing boat mooring construction has the potential to increase air pollution. Air pollution occurs as a result of exhaust emissions of material transport vehicles and equipment.</p>	<p>-5</p> <p>Significant</p>
	<p><u>Water Pollution due to Oil and other hazardous materials releases</u></p> <p>Workshop for heavy equipment and material transportation vehicles at the directors shack will potentially cause contamination of used oil and diesel residue.</p>	<p>-3</p> <p>Significant</p>
	<p><u>Increase traffic density and public access</u></p> <p>The transportation of materials from quarry, materials and sediments from the excavation will increase traffic density on existing roads.</p>	<p>-5</p> <p>Significant</p>
	<p><u>Road damage</u></p> <p>For all sub project, the activity of transporting material with heavy vehicles has the potential to increase road damage.</p>	<p>-5</p> <p>Significant</p>

Project Activity	Potential Environmental Impacts	Environmental Impacts Significance *)
	<u>Occupational health and safety</u> Risk of accidents and safety due to narrow roads and encroachment of people near construction areas	-3 Significant
<b>3) Operation Phase</b>		
Operation and Maintenance activity	<u>Drainage Disturbance</u> With the presence of coastal, it has the potential to disrupt the drainage flow and can cause inundation	-3 Significant
	<u>Sediment accumulation</u> The existence of coastal protection projects, and boat mooring buildings will potentially cause sediment deposits	-5 Significant
	<u>Health and safety risk in road system operation</u> When operating coastal protection there is no transport or traffic activity.	0 Not Significant

Note: +/- 0-2 Not Significant impact, +/- 3-5 Significant impact  
Valuation based on expert judgement

Potential environmental impacts associated with the proposed project are classified as: (i) impacts during (i) pre construction, (ii) construction phase and (iii) impacts during operation phase. The impacts and mitigation measures are described below.

## 1. Pre-Construction Phase

### Land acquisition

The initial process of construction activities begins with land acquisition activities. Land acquisition activities, especially as a result of activities to prepare land for project elevated roads, will potentially cause unrest in the community. Community unrest occurred because of the public's concern about the value of compensation that was not satisfactory.

The impact of land acquisition activities can be minimized through the findings and recommendation of the LARP study (Land Acquisition and Resettlement Plan) and public consultation meetings that will provide opportunities for the community to convey their concerns so that the Project can find better resolution in addressing public concern related to land acquisition process, both in the form of the process as well as in finding more acceptable prices and replacement of land.



## **Climate Change Vulnerability.**

Climate change adaptation considerations have been included in the design regarding wave height, but not yet including sea-level rise, because of the urgent nature of the implementation. . Sea-level rise will be anticipated in the design of the elevated road. Changes in the intensity of extreme weather events as well as gradual changes in climate parameters such as precipitation can be damaging for coastal protection. Therefore, the project is considered will be able to withstand extreme weather events without affecting the structural integrity of the proposed coastal dyke.

## **Mitigation**

In planning the development of the area around the Coastal Protection project the planned planting of mangrove on the West side of the Palu IV Bridge, is an effort to reduce impacts of tsunami when happened, but planting mangrove may also have benefit as reduction of greenhouse gas emissions (which is potential contribution to climate change). Mangroves will increase the absorption of greenhouse gases, particularly CO<sub>2</sub>.

## **Land use change**

Palu Bay has been originally used for settlement, trade/shops, fishing activities and various social and economic activities. It was the place for people to spend the day or used as recreation areas. The tsunami with high wave hit the coastal area which make the coastal area along the Palu Bay has been devastated. The local government consider the area as tsunami hazard area, therefore during spatial planning this has been subsequently allocated as tsunami hazard zone and hence no building construction will be allowed. New spatial plan has change the area to become non-settlement area. New infrastructure will be developed which will protect the hinterland and the city from possible tsunami, if it happened in future. Changes in land use occur in part of the land affected by coastal protection projects. From environment point of view, construction of infrastructure (dike, elevated road, Palu Bridge IV) will not cause significant impact on land use because according to the new spatial plan, this area has been allocated for this purpose.

## **Conformance to Spatial Plan.**

Coastal safety projects do not conflict with spatial plans. In accordance with the Decree of the Governor of Central Sulawesi Province No. 650/374 / DBMPPR-G.ST / 2019, which states that the Palu coastal security project is included in the spatial revision plan.

## **Encroachments to Environmentally Sensitive Areas.**

An **environmentally sensitive area** is a type of designation for an area which needs special attention or protection because of its landscape, wildlife or historical value. In most cases, the areas are not under legal protection, but it harbors unique ecosystem and/or wildlife species. Based on observation around the project area, there are no such sensitive ecosystem or possible existence of protected species in the area, since the area has been urbanized containing buildings, settlements, and infrastructure.

The existence of crocodiles in estuarine areas was detected (one crocodile was observed). The types of crocodiles encountered is not protected species. Most likely, the existence of the crocodile population tends to decrease, because of damage of the coastal habitat around the estuary due to the tsunami. The existence of crocodiles can threaten the safety of workers both for Coastal Protection construction work, Palu IV Bridge and mangrove planting. Information received from local people that there was crocodile farm in the past, so it is not clear whether the crocodile is wild or feral species (escape from the farm).

## **Mitigation**

If crocodiles are found in the project area, capture and transfer of crocodile habitat in the upstream area, or submitted to the Natural Resources Conservation Agency (BKSDA) of Central Sulawesi Province

### **Impacts and risks to biodiversity conservation**

The issue on impacts and risks to biodiversity conservation is unlikely since the project will not be located in an area that has concerns on biodiversity conservation. The dyke, the road, and the bridge will be located in built-up areas. The areas surrounding the proposed project site are previously as settlement and urban areas with roads and various infrastructures. Therefore, impacts and risks to biodiversity conservation is considered unlikely and not a serious concern.

### **Nuisance and Problems to the Public**

Disturbances and problems that arise that cause a sense of community dislike can be sourced from the problem of increasing traffic density, air and dust pollution, noise, decreasing traffic safety. Mitigation of the emergence of people's dislike is to deal with environmental problems as in the chapter on the discussion of each potential impact, such as in the discussion of air pollution, water, erosion, traffic density etc.

### **Potential Damage to Archaeological and Cultural Assets**

One of the cultural assets in the location of the project plan is the Floating Mosque (Bab Al Rahman). The mosque is located at the coastal area, off the coastal line, where the coastal dike will be constructed, It looks like a floating mosque. It was connected with the land with small bridge. The bridge collapsed and the floating mosque was damaged by the Tsunami wave. Presently the mosque cannot be used to worship by Muslims.

#### **Mitigation**

Mitigation of impacts due to coastal dike construction on Masjid Apung will include preserving it as Cultural Assets. The mosque has the potential to be one of tourism attraction in memory of the Tsunami in Palu.

## **2. Construction Phase**

### **Employment**

Coastal safety projects at the construction stage require labor, whose specifications are dominated by unskilled labor. Recruitment of manual labor will be able to reduce unemployment in the community around the project site..

#### **Mitigation.**

Contractors are expected to recruit unskilled labor by prioritizing coming from the community around the location of the activity. For trained personnel if not obtained from the surrounding community, can be obtained from outside the project area..

### **Potential Damage to Archaeological and Cultural Assets**

One of the cultural assets in the location of the project plan is the Floating Mosque (Bab Al Rahman). The base of the floating mosque was damaged by the Tsunami, so it cannot be used to worship Muslims.

#### **Mitigation.**

Mitigation of the existence of the floating mosque will be preserved as Cultural Assets, and also has the potential to be developed as a tourism object in memory of the Tsunami in Palu.

So far, no information of any archaeological and cultural assets that may be affected.

### **Impact on Aquatic Biota**

The construction of a coastal dike will need excavation of coastal land and then building of embankment foundations which may cause coastal land erosion and increase turbidity of coastal waters. Increased turbidity will reduce the quality of sea water. Decreasing the quality of sea water will disrupt marine aquatic biota such as plankton, benthos and nekton. However, coastal safety construction activities will take place in a limited time (only 14 month) so that the influence of disturbances in the coastal waters of Palu can be restored.

Activities that disrupt the life of aquatic biota are excavation of basic embankment, but this activity only takes place during coastal protection construction and only during preparation of embankment base.

#### **Mitigation.**

To minimize the impact of deterioration in water quality due to sedimentation, excavated land is not buried in coastal areas.

### **Soil erosion and sediment from project construction**

During construction activities, excavation of land or demolition of old dykes will have an impact on erosion of coastal land by sea waves. Erosion will increase levels of dissolved sediment in coastal waters and will have an impact on the life of aquatic biota

#### **Mitigation.**

To reduce the erosion of coastal land into the sea, after the excavation process geotextile layers are installed. Geotextile layer will reduce the erosion of coastal land into sea waters

### **Noise and vibration Impacts**

During construction phase, noise will be generated from various activities such as site clearing, excavation, material mobilization, etc. The general noise levels during construction phase such as due to working of heavy earth moving equipment and heavy equipment machine can potentially go up to 100 dB(A) at the work sites. It is also to be noted that significant amount of manual labor will be involved during construction of embankments.

However, the increase in noise levels will be localized, temporary in nature and mostly will be during working hours only.

#### **Mitigation.**

A variety of noise control measures can be adopted such as:

- Site Controls: Where possibly placing equipment away from sensitive receptors and where not possible using temporary noise barriers.
- Scheduling of Project Activities: Operations will be scheduled to when people would be least likely to be affected. Construction activities shall be restricted between 10 A.M and 4 P.M near residential areas.
- Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.
- Construction equipment and machinery shall be fitted with silencers and maintained properly.
- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance
- Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines.
- Avoiding or minimizing project transportation through community areas.

In line with contracting practice for this project, the Contractor will be responsible for “performance” to meet acceptable noise levels rather than the Contract specifying what actual methods the Contractor must adopt. The Contractor will be required to produce Contractor’s Environmental Management Plans (CEMP) including methods to control noise to accompany normal Work Plans for approval by the Supervising Engineer. The Supervising Engineer will be responsible for immediate monitoring of compliance of environmental conditions and under Contract Conditions will be able to enforce immediate remedial action.

### **Air pollution Impact**

During the construction phase for all sub-projects, there will be two main sources of air emissions, i.e., mobile sources and stationary sources. Mobile sources are mostly vehicles involved in construction activities, whereas emissions from stationary sources include construction equipment & machinery, diesel generator sets, excavation/ grading activities, etc. It would not be possible to distinguish between the emissions from project construction vehicles and equipment and emissions from non-project vehicles.

However, construction-related airborne dust can arise from both vehicular traffic generating fugitive dust on paved and unpaved roads (and especially from construction vehicles and from material handling and processing). As with noise impact, bidding and contract documents will require the Contractor to identify, via the Contractor’s EMP/Work Plan, methods to control dust and compliance monitoring will be under the responsibility of the Supervising Engineer.

#### **Mitigation.**

- Feasibility test of vehicles used for construction activities
- Washing vehicle tires coming out of the project site
- Cover sediment transport trucks and material carriers with tarpaulin covers
- Periodic inspection of transport vehicles
- Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content.

### **Water pollution Impact**

Sea water pollution occurs when construction of a Coastal Protection Embankment, namely during excavation and construction of building structures. Sea water pollution occurs because of the process of stirring the soil, which increases turbidity of sea water. Turbidity of sea water decreases the quality of sea water. However, the occurrence of fine sediment pollution in coastal waters only lasts for a limited time, so it does not have the potential to affect the community structure of aquatic biota

#### **Mitigation.**

- To minimize the impact of deterioration in water quality due to sedimentation, excavated land is not buried in coastal areas. Dump piles on the beach will be eroded by the waves and potentially erosion will pollute marine waters with dissolved sediment.
- To reduce the erosion of coastal land into the sea, after the excavation process geotextile layers are installed. Geotextile layer will reduce the erosion of coastal land into sea waters.

### **Impact of Traffic Density (during construction)**

The construction of the coastal dike will need to carry material from the quarry site to the project location. The activity of transporting materials will go through the streets of Palu. Dump truck transportation activities will increase the traffic density of the road being traversed. The process of transporting this material has the potential to cause traffic congestion.

From the transportation of cobble stone material and armor stone: 396,084 m<sup>3</sup> and excavation of earth and unloading of the existing embankment: 299,914 m<sup>3</sup>, then by transporting a truck volume of 10 tons, trips of 190 trucks / day is needed for 1 year

#### Mitigation

- The impact of traffic congestion due to the material mobilization process can be reduced by carrying out transportation not at rush hour traffic
- The contractor will maintain the security of the intensive material entry and exit lane by placing guard posts. Arrangements in and out of vehicles by guard posts are needed to avoid accidents by public vehicles that cross the road that intersects with the project road
- Feasibility test of vehicles used for construction activities
- Washing vehicle tires coming out of the project site
- Cover the trucks during transportation of materials (cobble stone, soils, gravels, etc) with tarpaulin covers
- Periodic inspection of vehicles used for material transportation to ensure in good condition.
- To prevent congestion of transporting trucks through the city, it is divided into 2 locations for material collection quarry. The location of material collection is on the West side in Silae District and on the East side is the quarry location in Mantikulore District. Material transportation from quarry to the west side of Mantikulore District is done by barging across the Palu Bay
- For more detailed traffic management, a Traffic Impact Analysis study will be made. a Traffic Impact Analysis study will be conducted by BWS Sulawesi III
- The contractors should carry out compensation for road repairs, periodically during the construction period and thereafter. This should be included in the bidding document and subsequently in the contractor's contract.

#### Road Damage

The transportation of materials and equipment during construction with a total of 190 trucks per day, will have an impact on damage to road conditions. Road damage will affect the smooth flow of public traffic and will increase the incidence of traffic accidents. In addition, road damage will cause public unrest both the surrounding community and road users.

#### Mitigation.

- The contractor carries out periodic road repairs and monitors at all times the condition of the road through which material transportation passes from the quarry to the project site
- Include road repair compensation clauses in the contractor contract, both during the construction period and after the construction period is finished
- Use material transport vehicles in accordance with the class of road being traversed, and transport material according to the vehicle capacity.

#### Occupational health and safety

Construction hazards may occur in the implementation of the proposed project. Hazards may exist in all construction sites in many different forms such as sharp edges, falling objects, flying sparks, chemicals, noise and various potentially dangerous situations. Good practices in construction occupational health and safety requires that employers protect their employees from workplace hazards that can cause injury.

#### Mitigation

- Although the risks associated with the proposed project are low. However, since roads are narrow, efforts shall be made that no hazardous traffic conditions are created due to construction vehicle movement. Local people may encroach to construction area and get hurt. Mitigation will include provide adequate lighting and fluorescent signage



shall be provided at the construction sites. Signage shall be made in language understandable to the community (when deemed necessary, it may use local language). The workers shall be provided with necessary Personal Protective Equipment and a First Aid kit. In case of emergency the victims will be referred to the nearest hospitals or clinics. Detail guidance refers to the World Bank Occupation Health and Safety<sup>3</sup>.

- The construction site safety management plan will provide guidance to the Contractors' staff on how good work practices can be carried out on every activity in the construction site to prevent accidents to the workers and the general public. This shall include, among others, emergency procedures and the required resources, clear description of responsibilities and management, specific requirements of occupational health and safety policies and regulations, training requirements, and site safety rules.

### **3. Operation Phase**

#### **Drainage Disturbance**

During the construction of the coastal protection and elevated road, during the rainy season will occur disruption of drainage will potentially cause inundation and even flooding..

#### **Mitigation:**

- To minimize the occurrence of inundation, maintain the smooth flow of water in the drainage channel and keep from blocking the drainage
- Keep the function of the floodgates still functioning

#### **Sediment Accumulation**

During the operational phase of the coastal protection building, and Boat Moorings sediment accumulation will occur along the coast and river estuary. The accumulation of sediments at the river mouth will potentially result in narrowing of the river mouth, which can hamper the smooth flow of the Palu River. Silting will also occur around fishing boat moorings, as a result of sediment transport from rivers that spread to coastal areas. Silting around the fishing boat mooring area will make it difficult for fishermen to access the mooring location.

#### **Mitigation:**

- The impact of sediment generation can be overcome by periodic sediment dredging activities. Sediment dredging near the boat moorings can be routinely carried out with a period of 6 months.
- When the mangrove rehabilitation program is implemented, sediment can be 'channeled' to the west coast, to support the mangrove development.

#### **Cumulative Impact**

As described earlier, beside the Coastal Protection project activities there are other projects located close to the Coastal Dike Project, i.e. the Elevated Road, Palu IV Bridge, Boat Mooring and Mangrove Area Development. Since they are located close to each other, and may be constructed at the same time, environmental impacts caused by these projects may accumulate and may have incremental impact. This counts especially for transport activities: i.e. if coble stone transport takes place while the elevated road is constructed, traffic congestion and dust production will occur.

Mitigation: Coordination among Coastal Dike Project, Elevated Road, Palu IV Bridge and Mangrove sub-projects.

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<sup>3</sup> <http://www.ifc.org>

## V. Information Disclosure, Consultation, and Participation

Meaningful stakeholders' consultation and participation would be necessary for ensuring subproject acceptability by all stakeholders, including government, local people, non-governmental organization, and other related social and community groups. Activities for information disclosure, public consultation, and public participation are part of the overall planning, design process, and construction of the proposed project.

During preparation of the coastal dyke/road/bridge/Boat Mooring, information regarding the proposed project was disclosed to the public during the stakeholder consultation. Subproject information was also disclosed in focus group discussions (FGDs) conducted as part of the activities.

### Public Consultation

Public consultation and FGD (Focus Group Discussion) were held with stakeholders in Palu on 24 May 2019 as part of the environmental assessment process. At the initial phase where the project has not been specified in term of site location, design, technology, and material the discussion cover general hints to people that the project will generate both positive and negative impacts. In this case it is emphasized that the project will avoid, reduce, and mitigate the impacts. At the same time the project will enhance the positive impacts for community welfare. Once the actual environmental (AMDAL) study will be conducted, the discussion will focus on the environmental impacts and its mitigation measures.

The public consultation was carried out in advance prior to the commencement of the Coastal Protection project construction. The announcement was made in the local newspaper Radar Sulteng on April 12, 2019. Through reporting in the newspaper the public was widely able to find out about the project plan, so they could provide input through the address listed. The public consultation was held by inviting the people affected by the Coastal Protection project, community leaders, Non-Governmental Organizations (list of attendees at Appendix 8). Some of the issues raised by the public consultation participants include:

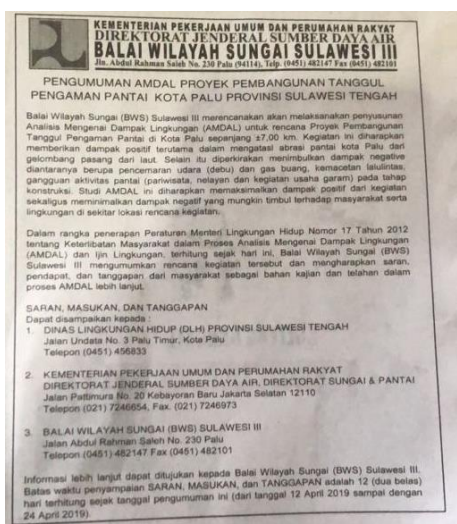
1. Concerns about the problem of fishing activity barriers
2. Proposed addition of description of Tsunami embankment activities
3. Description of the origin of the stone used for construction of embankments
4. Do not agree with the retention pool
5. Problems of land acquisition

(Public consultation notes on Appendix 6)

**Table 16: Review public consultation input and responses provided**

Person or Group Represent	Issue/Concerns raised	Project Response
Village leader/public figure	Concerns about the problem of fishing activity barriers	The problem of mooring a fishing boat will be accommodated with plans to add a fishing Boat Mooring building
	Do not agree with the retention pool	The retention pool will be converted to long storage
People affected	Problems of land acquisition	Before the project plan is implemented, a LARP study will be conducted
Non-government organization	Description of the origin of the stone used for construction of embankments	The location of the stone material will be taken from the stone provider who has an official mining permit

**Figure 25: Project Plan Publication with 'Radar Sulteng' Local Newspaper**



**Figure 26: Public consultation documentation**



## VI. Grievance Redress Mechanism

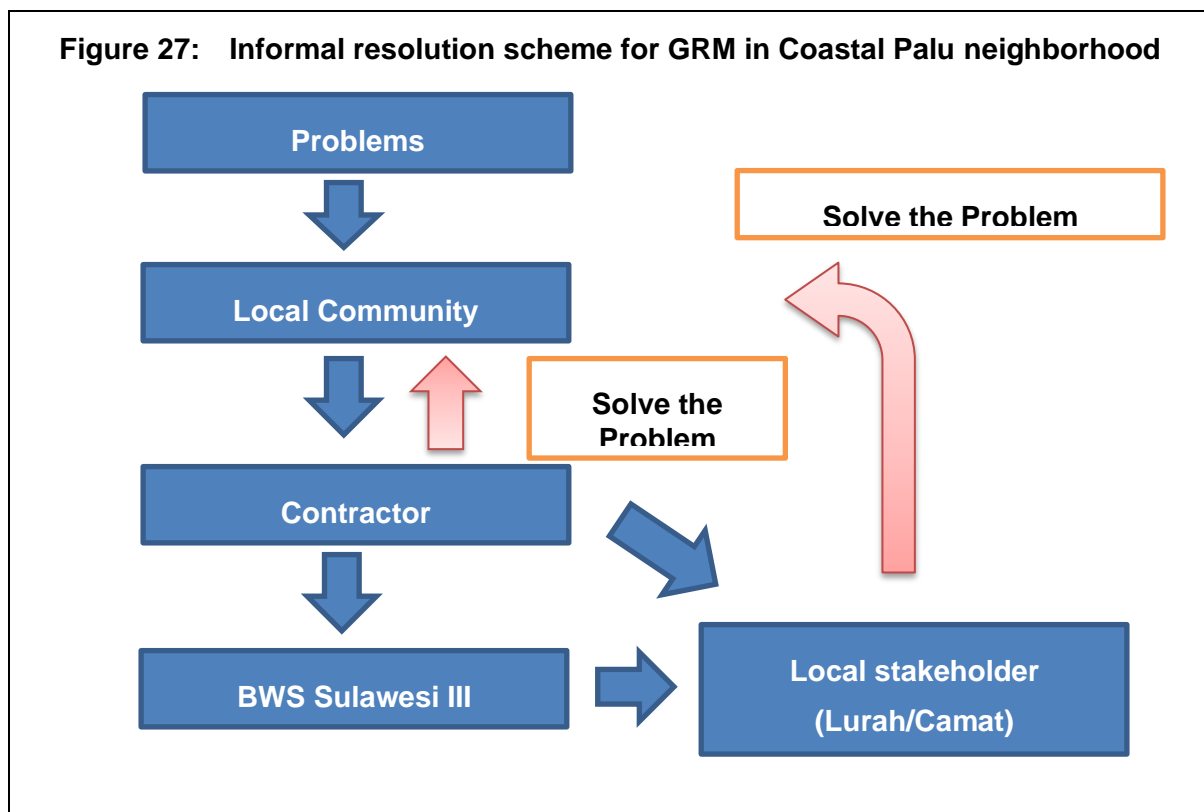
The Grievance Redress Mechanism (GRM) process in accordance with EARF 2019 consists of the following stages:

- Stage 1: Submission of Complaint & Informal Resolution
- Stage 2: Formal Sub-mission of Complaint
- Stage 3: Multi-stakeholder Meeting
- Stage 4: ADB Special Mission
- Stage 5: Judicial Proceedings
- Stage 6: Reporting

Handling the problem of complaints from the community for Coastal Protection project, information was obtained from the community directly, local non-government organizations, local government, contractors and environmental departments. Complaint handling from the community related to the implementation of project activities in general is only in the Informal Resolution stage.

When a problem occurs during project implementation, the community will complain to the project implementation contractor. The project implementing contractor will solve the problem if it is felt capable of resolving the problem. If the problem cannot be resolved by the contractor, he will report to the project supervisor or to BWS Sulawesi III. To solve the problem reported to the BWS Sulawesi III, the contractor together with BWS Sulawesi III will coordinate with the Sub-district or village where the problem originated.

### Stage 1: Submission of Complaint & Informal Resolution



A resolution during construction can be handled by the Contractors' representatives at the construction site and other parties. At this first level, the grievance should be resolved within maximum 2 days. If the complaint is not resolved at this level, they may elevate his grievances to the second level GRM.

### **Stage 2: Formal Submission of Complaint**

In the event of environmental problems related to the implementation of coastal protection projects, the community through its representatives can submit complaints to the City or Provincial Environment Agency (DLH: Dinas Lingkungan Hidup), bringing required evidences.

### **Stage 3: Multi Stake-holder Meeting**

At village level, where a construction activity is implemented, an ad-hoc committee will be established at village level.

At this stage through mediation by the District or Provincial Environmental Office, an "*environmental communication forum*" will be formed, which will accommodate community complaints related to problems arising from Coastal Protection project activities and other related projects. Through this forum, ways of solving environmental problems that arise will be sought. The forum also involved the BWS Sulawesi III, the implementing contractor, community leaders, representatives of NGOs and local governments.

### **Stage 4: ADB Special Mission**

Environmental problems due to the implementation of the Coastal Protection project have still not been resolved either formally or informally, so can ask for assistance from ADB Mission. ADB Mission will examine the implementation of projects that cause these problems in more depth to be able to provide advice .

### **Stage 5: Judicial Proceedings**

When solution of problem cannot be met and resolved, the community can submit a case of environmental problems to the court. Communities can submit claims against BWS Sulawesi III to the court through designated lawyer accompanied by relevant evidence.



## VII. Environmental Management Plan

### 7.1. Environmental Mitigation

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Location	Mitigation Cost	Responsibility Supervision	Implementation Schedule
<b>Pre-Construction Phase</b>						
Land acquisition	Public unrest	<ul style="list-style-type: none"> <li>Preparation of resettlement plan for residents affected by the project based on LARP data, which shows the people affected by the Coastal Safeguard development plan</li> <li>Hold a public meeting to socialize the objectives and activities of the project, so that the community can understand the conditions of the project and the impacts that will occur</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore	Mitigation cost are estimated at 2% of the total project cost	Mayor of Palu City BWS Sulawesi III	4 month
	Encroachment to environmental sensitive area	<ul style="list-style-type: none"> <li>There is no sensitive area</li> <li>Coordinate handling of crocodile existence with the Natural Resources Conservation Agency (BKSDA) of Central Sulawesi Province</li> <li>Installing a warning sign of a crocodile, at the project site adjacent to the estuary</li> </ul>	On Palu river estuarine and Palu Coastal		BKSDA Palu BWS Sulawesi III	4 month
	Potential nuisance and problems to the public	<ul style="list-style-type: none"> <li>Preparation of resettlement plan for residents affected by the project based on LARP data, which shows the people affected by the Coastal Safeguard development plan</li> <li>Hold a public meeting to socialize the objectives and activities of the project, so that the community can understand the conditions of the project and the impacts that will occur</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		Walikota Palu BWS Sulawesi III	4 month

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Location	Mitigation Cost	Responsibility Supervision	Implementation Schedule
<b>Construction Phase</b>						
Recruitment of workers	Employment opportunity	<ul style="list-style-type: none"> <li>Work contractor performs the recruitment of workers from the community around the project site in coordination with the village / sub-district</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		Walikota Palu BWS Sulawesi III	2 month
Land Preparation	Aquatic biota	<ul style="list-style-type: none"> <li>During the land clearing process, building waste and rubbish may not be disposed of into marine waters.</li> <li>Collect building waste and rubbish in a container to be disposed of to a waste disposal site</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		Walikota Palu BWS Sulawesi III	2 month
Mobilization heavy equipment and materials	Increase traffic density and public access	<ul style="list-style-type: none"> <li>The impact of traffic congestion due to the mobilization of heavy equipment and materials can be reduced by carrying out transportation not at rush hour traffic</li> <li>The contractor will maintain the safety and security of the intensive material entry and exit lane by placing guard posts.</li> <li>Performance test of vehicles used for construction activities</li> <li>Cover sediment transport trucks and material carriers with tarpaulin covers</li> <li>Periodic inspection of transport vehicles</li> <li>To prevent traffic congestion by transporting trucks through the city, 2 locations for collection of quarry material will be provided. The of west quarry site will be located in Silae Village and the east quarry site will be located in Mantikulore Sub-district.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province Dinas Perhubungan BWS Sulawesi III	2 month
	Road damage	<ul style="list-style-type: none"> <li>The contractor will periodically repair road damage due to transport activities of material transport vehicles, in accordance with the class of the damaged road.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province Dinas Bina Marga	14 month

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Location	Mitigation Cost	Responsibility Supervision	Implementation Schedule
		<ul style="list-style-type: none"> <li>Transport vehicles will be used in accordance with the class of the road</li> <li>Cargo load will be limited in accordance with the loading capacity of the transport vehicle</li> </ul>				
	Air Pollution from transportation activities	<ul style="list-style-type: none"> <li>Performance test of vehicles used for construction activities</li> <li>Vehicle tires coming out of the project site will be washed. Truck tires need to be washed to prevent the spread of the remaining soil from the tires to public roads, which will make the road slippery and be a source of dust pollution</li> <li>Cover material transport trucks and material carriers with tarpaulin covers</li> <li>Periodic inspection of transport vehicles</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	2 month
	Noise and vibration Impacts	<ul style="list-style-type: none"> <li>Site Controls: Where possible place equipment away from sensitive receptors and where not possible use temporary noise barriers.</li> <li>Scheduling of Project Activities: Operations will be scheduled to when people would be least likely to be affected. Construction activities shall be restricted between 10 A.M and 4 P.M near residential areas.</li> <li>Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.</li> <li>Construction equipment and machinery shall be fitted with silencers and maintained properly.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	2 month
Activities on base camp	Water pollution due to oil and other hazardous materials releases	<ul style="list-style-type: none"> <li>Waste oil will be collected in a safe place, and handed over to parties who have official permission to transport and treat hazardous waste.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	12 month

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Location	Mitigation Cost	Responsibility Supervision	Implementation Schedule
Construction process	Air pollution and health risk due to work place	<ul style="list-style-type: none"> <li>Implement a system of Occupational Safety and Health and Environment (K3 LH)</li> <li>To reduce health risk of construction workers, coaching of workers is carried out to discipline the use of occupational safety and health tools (i.e. helmets, ear plugs, masks, safety shoes, gloves, etc.)</li> <li>Check the exhaust emissions of heavy equipment engines used with a vehicle performance test</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	12 month
	Soil erosion and sedimentation at construction sites	<ul style="list-style-type: none"> <li>To minimize soil erosion at the beach location during excavation, excavation tracks will be kept short, and coastal protection (cobble stones) directly.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	12 month
	Noise and vibration from construction equipment	<ul style="list-style-type: none"> <li>Implement a system of Occupational Safety and Health and Environment (K3 LH)</li> <li>To reduce the impact of noise and vibration on construction workers, coaching of workers is carried out to discipline the use of occupational safety and health tools (i.e. ear plugs, maskers, etc.)</li> <li>Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.</li> <li>Check the performance of heavy equipment engines used by the vehicle performance test</li> <li>Construction equipment and machinery shall be fitted with silencers and maintained properly.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	12 month
	Water pollution	<ul style="list-style-type: none"> <li>To minimize water pollution due to sedimentation, excavated land is not disposed in coastal areas and open waters</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		BWS Sulawesi III	14 month

Project Activity	Potential Environmental Impact	Proposed Mitigation Measure or Enhancement Measure	Location	Mitigation Cost	Responsibility Supervision	Implementation Schedule
	Aquatic biota	<ul style="list-style-type: none"> <li>To avoid aquatic biota habitat disturbance due to sedimentation, excavated land is not disposed in coastal areas and open waters</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	12 month
	Occupational Health & Safety (OHS)	<ul style="list-style-type: none"> <li>To reduce work accidents and health problems due to work, the contractor will hold regular training on Occupational Safety such as training in the use of personal protective equipment, work equipment usage and vehicle speed monitoring.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		BWS Sulawesi III	14 month
<b>Operation Phase</b>						
Maintenance	Drainage disturbance	<ul style="list-style-type: none"> <li>To minimize the occurrence of inundation, drainage inlets and drainage channels will be kept clean</li> <li>The floodgates will be kept in functioning condition at all times</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	During operational activities
	Sediment accumulation	<ul style="list-style-type: none"> <li>The impact of sediment accumulation can be overcome by periodic sediment dredging activities.</li> </ul>	Sub-district: Palu Barat, Ulujadi, Palu Timur and Mantikulore		DLH Province BWS Sulawesi III	During operational activities



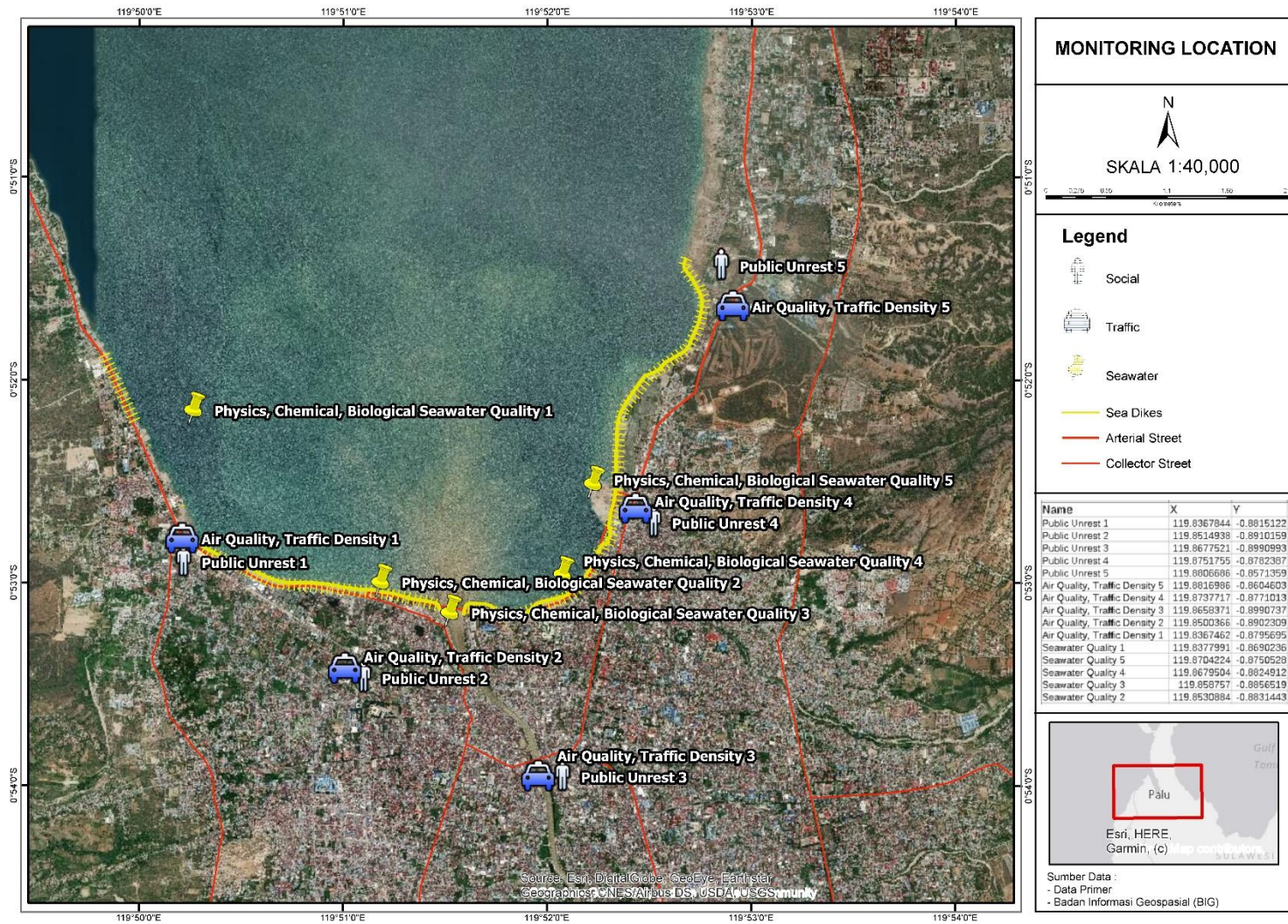
## 7.2. Environmental Monitoring

Aspects/ Parameters to be monitored	Location	Means of Monitoring (undertaken by the Contractor)	Monitoring Frequency	Monitoring Responsibility	Compliance Monitoring Supervision	Monitoring Cost
Public unrest	Throughout the project site	<ul style="list-style-type: none"> <li>Register the community members affected by the activity, which do not approve the resettlement plan</li> <li>Monitor whether the community does not approve the resettlement plan</li> </ul>	Once a month	DPIU (BWS Sulawesi III)	DLH Kota DLH Province	Total monitoring cost is estimated at Rp. 300 million.
Encroachment to environmental sensitive area	Throughout the project site	<ul style="list-style-type: none"> <li>Note and report the location and number of individual crocodiles when observed or encountered, and report to concerned agency (BKSDA) to take necessary precautionary action.</li> </ul>	When the concerned species are encountered	DPIU (BWS Sulawesi III)	DLH Kota DLH Province	
Potential nuisance and problems to the public	Throughout the project site	<ul style="list-style-type: none"> <li>Register the community affected by the activity, which does not approve the resettlement plan</li> <li>Monitor whether the community does not approve of a resettlement plan</li> <li>Monitor whether there are people who do not understand the planned coastal protection project, and show a sense of disapproval</li> </ul>	Once a month	DPIU (BWS Sulawesi III)	DLH Kota DLH Province	
Employment	Throughout the project site	Register the people around the project site, capable to work on coastal protection construction projects and others	Before the implementation of activities	DPIU (BWS Sulawesi III)	Dinas Tenaga Kerja Provinsi Sulawesi Tengah DLH Province	
Potential damage to archaeological	Throughout the project site	The Masjid Apung remained undisturbed by project activities. The study did not find any other archaeological and cultural asset that may be affected. Precautions will be taken to avoid potential damage to	During the construction period	DPIU (BWS Sulawesi III)	DLH Province	

Aspects/ Parameters to be monitored	Location	Means of Monitoring (undertaken by the Contractor)	Monitoring Frequency	Monitoring Responsibility	Compliance Monitoring Supervision	Monitoring Cost
and cultural assets		any archaeological and cultural assets when found, and inform the local authorities and the Local Balai Arkeologi, if archaeological and cultural assets are discovered.				
<b>Activities on base camp</b>						
Traffic density	From quarry to project location	Monitoring the level of traffic density in accordance with Law No. 22 of 2009 concerning Road Traffic and Transportation	Once a month	DPIU (BWS Sulawesi III)	Dinas Perhubungan Provinsi Sulawesi Tengah DLH Province	
Road damage	Roads from quarry to project location	Inventory and document damaged roads on the hauling road	Once a month	DPIU (BWS Sulawesi III)	Dinas Perhubungan Provinsi Sulawesi Tengah DLH Province	
Air pollution impact	From quarry to project location	Monitoring if parameters of air pollution (NOx, SOx, CO, PM10, dust, Pb) do not exceed air quality standards in accordance with PP No. 41 of 1999 concerning Air Pollution Control	Once a month	DPIU (BWS Sulawesi III)	DLH Kota DLH Province	
Noise and vibration impact	From quarry to project location	Noise level does not exceed the quality standard of Kep Men LH No. 48 of 1996 concerning Noise Level Quality Standards	Once a month	DPIU (BWS Sulawesi III)	DLH Kota DLH Province	
<b>Activities on base camp</b>						
Water pollution due to oil and other hazardous materials releases	At the base camp	Monitor how to handle used oil and diesel fuel spills	Once a month	PIU (BWS Sulawesi III)	DLH Kota DLH Province	

Aspects/ Parameters to be monitored	Location	Means of Monitoring (undertaken by the Contractor)	Monitoring Frequency	Monitoring Responsibility	Compliance Monitoring Supervision	Monitoring Cost
Water pollution Impact	Throughout the project site	Monitoring the level of pollution of sea and river water, if pollutant parameters do not exceed the quality standards in accordance with PP No. 82 of 2001 concerning Management of Water Quality and Water Pollution Control	Once a month	PIU (BWS Sulawesi III)	DLH Kota DLH Province	
Noise and vibration Impacts	Throughout the project site	Monitoring if the noise level does not exceed the quality standard of Kep Men LH No. 48 of 1996 concerning Noise Level Quality Standards	Once a month	PIU (BWS Sulawesi III)	DLH Kota DLH Province	
Impact on aquatic biota	Throughout the project site	Monitoring if the level of diversity and abundance of plankton, benthos and nekton are at a stable level according to the Shanon and Weiner diversity index	Once a month	PIU (BWS Sulawesi III)	DLH Kota DLH Province	
Occupational health and safety	Throughout the project site	Monitor if efforts to implement the safety and health of project workers are in accordance with Law RI No. 05 of 2014 concerning occupational safety and health in construction activities	Once a month	PIU (BWS Sulawesi III)	DLH Kota DLH Province	
Drainage disturbance	Throughout the project site	Monitor the condition of drainage channels that lead to coastal protection locations and receive complaints from communities about inundation around coastal protection locations	Once a month in the rainy season	BWS Sulawesi III	DLH Kota DLH Province	
Sediment accumulation	Throughout the project site	Monitor at the site of the project being built, the height of the sediment on the beach, river mouth and in the river.	Each 6 months	BWS Sulawesi III	DLH Kota DLH Province	

Figure 28: Proposed Monitoring Locations

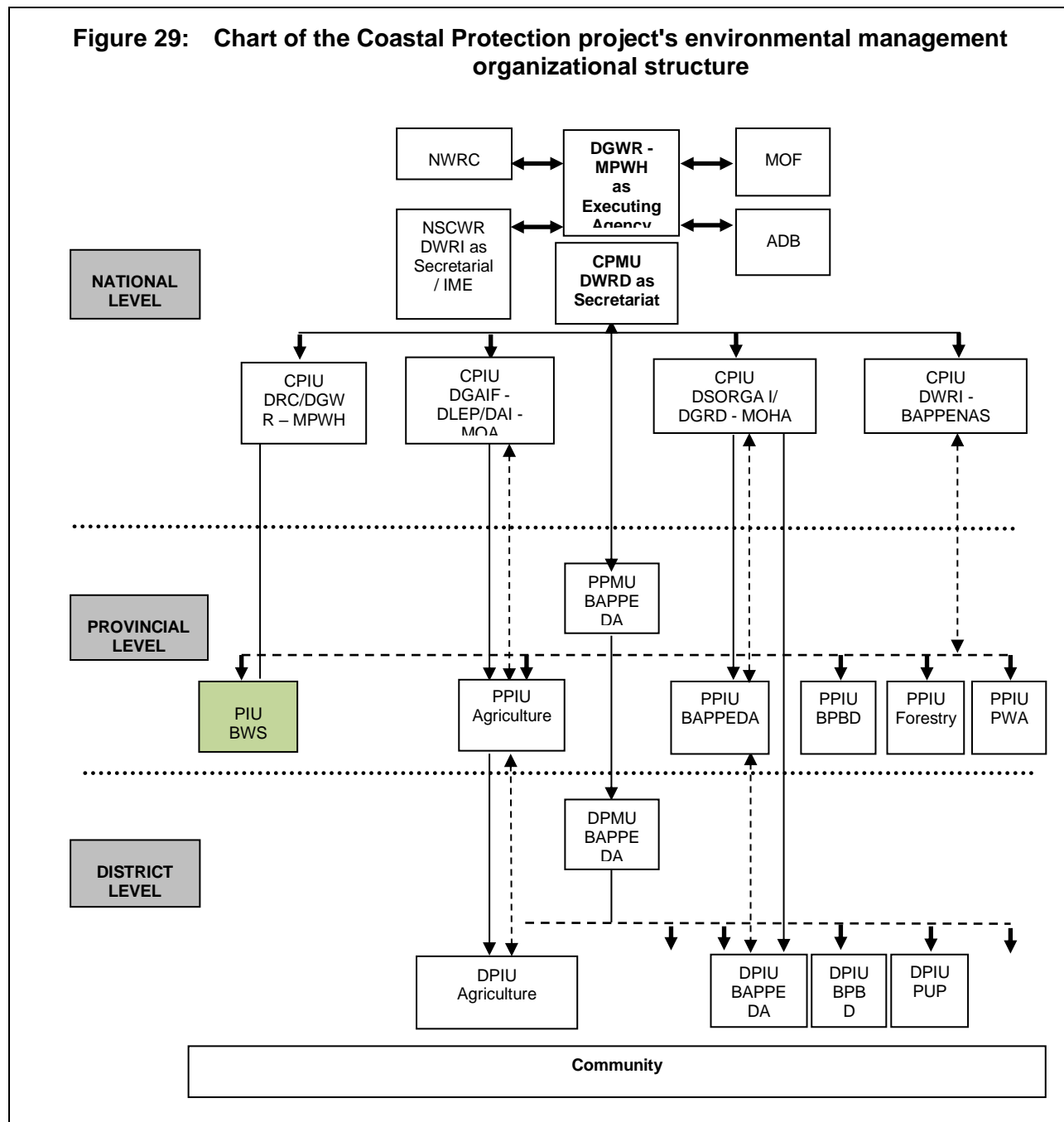


### 7.3. Implementation Arrangement

This subsection presents the: (i) Institutional set-up, (ii) Implementation Schedule, (iii) GOI Permits and (iv) Capacity Building

#### 7.3.1. Institutional set-up

Environmental management and monitoring for the Coastal Protection project is the responsibility of BWS Sulawesi III as a PIU.



In addition to recording information to track performance, the PIU will undertake inspections to verify compliance with the EMP and progress toward the expected outcomes. The PIU will document monitoring results, identify necessary corrective action, and reflect



them in corrective action plan, and will implement these corrective actions and follow up on these action to ensure their effectiveness. PIU will prepare periodic monitoring reports that describe progress with implementation of the EMP and any compliance issues and corrective actions. The PIU will submit at least semi-annual report to ADB on environmental safeguard monitoring report (ESMR), where the result of environmental monitoring of project implementation will be reported. Such periodic reports will be submitted to ADB for review, and when approved it will be posted in ADB website. The ESMR will be made available in a location accessible to the public.

### 7.3.2. GOI Permits

The process of preparing the Palu Coastal Protection AMDAL is still at the stage of preparing the Terms of Reference (ANDAL KA), thus no Environmental Permit has been issued.

### 7.3.3. Capacity Building

To support the implementation of management and environmental monitoring of the Palu Coastal Protection project, institutional strengthening needs to be undertaken in PIU, which includes:

- Strengthen environmental management capability
- Technical assistance program
- Training program
- Procurement of equipment and supplies related to environmental management and monitoring

### 7.3.4. Environmental Monitoring Cost

Monitoring activities are carried out every 6 months in accordance with AMDAL Environmental Permit demands. Based on three times reporting needed during the construction period, the total monitoring cost is estimated at Rp. 300 million. These monitoring cost may be adjusted as required.

**Table 17: Estimate environmental monitoring cost (each 6 months)**

No	MONITORING	NUMBER OF SAMPLES	UNIT PRICE (IDR)	COST (IDR)
1	Air quality	5	2,000,000	10,000,000
2	Water quality	5	2,000,000	10,000,000
3	Aquatic biota	5	500,000	2,500,000
4	Transportation	5	1,500,000	7,500,000
5	Social-Economic	100	300,000	30,000,000
6	Reporting	Ls	20,000,000	20,000,000
7	Development consultant	Ls	20,000,000	20,000,000
			<b>Total</b>	<b>100,000,000</b>

### 7.3.5. Implementation Schedule

**Table 18: Implementation Schedule**

No	Activity Plan	2019								2020												2021	Total (month)		
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan			
<b>A</b>	<b>Pre-Construction Phase</b>																								
	Survey, Investigation	■	■																						2
	Land Acquisition			■	■	■	■																		7
<b>B</b>	<b>Construction Phase</b>																								7
	Mobilization of Labor						■																		2
	Mobilization Material							■																	14
	Base Camp Construction							■																	
	Coastal Construction							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	14
<b>C</b>	<b>Operation Phase</b>																								
	Operation & Maintenance																						■		

Remark: The activity schedule above is only for Coastal Protection activities, while the Associated Projects has not been planned, because the project design is not final.

## VIII. Conclusion and Recommendations

### 8.1. Conclusions

The IEE Palu Coastal Protection report has been prepared based on field data as well as secondary data collection. The following conclusions can be drawn:

~~From the IEE Palu Coastal Protection report study along with the Associated Activity, after going through several studies the following conclusions can be drawn:~~

1. The Palu Coastal Project Reconstruction and Rehabilitation activities are in line with the regional spatial plan, in accordance with the Letter Number from the Spatial Planning Office Province: 660/216 / BID.PR / 2019 dated April 11, 2019 concerning Recommendations on Spatial Conformity in Sulawesi Central Province.
2. Screening of environmental impact found that all potential impacts that arise can be mitigated to acceptable levels, so that negative impacts that occur can be mitigated, while positive impacts can be enhanced.
3. From the results of public consultations, the community wants a Boat Mooring facility, expressed concern over the process of land acquisition, does not want a retention pool, proposes planting mangroves to reduce the Tsunami wave, asking for clarification of project plans including project associated.
4. The Environmental Management Plan will be implemented under the responsibility of PIU (BWS Sulawesi III) assisted by the implementing contractor. Supervision of environmental management from the Palu Coastal Protection activities is carried out by the Provincial DLH together with the Kota DLH.

### 8.2. Recommendations

Based on the IEE of the proposed Palu Coastal Protection Embankment subproject, there are no significant adverse impacts that cannot be mitigated. With proper mitigation measures, the subproject can be implemented in an environmentally acceptable manner. There is no need for further environmental assessment study. A full EIA is not warranted and the subproject's environmental classification as Category B is considered appropriate. The IEE shall therefore be considered as the final environmental assessment document of the proposed Palu Coastal Protection Embankment subproject.

Mitigation measures and recommendation presented in this IEE should be implemented to minimize environmental impacts caused by the Project. The Project will conduct regular monitoring on project implementation supervised by DPIU (BWS Sulawesi III). The Project will prepare environmental monitoring report every 6 months to be submitted to ADB. The contents of the monitoring report (Environmental Safeguard Monitoring Report - ESMR) should follow the ESMR format as presented in the Appendix of Environmental Assessment Review Framework (EARF) of the "Emergency Assistance for Rehabilitation and Reconstruction" which should be prepared and submitted to ADB every 6 month (See Appendix 6).

## Appendixes

### Appendix 1: Rapid Environmental Assessment (REA)

Subproject Name	Reconstruction and Rehabilitation Palu Coastal Protection
Location	Palu City
Date	15 September 2019
Person Preparing the Checklist	Drs Iwan Stefanus M. MT
Signature	

#### Environmental Category

<input type="checkbox"/>	ADB Category A
<input checked="" type="checkbox"/>	ADB Category B
<input type="checkbox"/>	ADB Category C

#### PART 1. SCREENING BASED INDONESIA PROCEDURE

<input checked="" type="checkbox"/>	AMDAL TYPE PROJECT
<input type="checkbox"/>	UKL/UPL TYPE PROJECT
<input type="checkbox"/>	SPPL TYPE PROJECT

Is categorization confirmed by provincial or district DLH

No

Yes

PART 2: SCREENING BASED ON ENVIRONMENTAL FACTORS – Environmental Checklists

- Embankment and other project activities do involve land acquisition
- Potential for sediment pollution
- Potential for Water pollution
- Potential for Air and Noise pollution
- Potential for dust pollution due to transportation
- Potential for traffic congestion and road damage
- Potential for reduce public health and safety

## Rapid Environmental Assessment (REA) for Coastal Protection Construction

### Port Activity

Country/Project Title : Indonesian

Sub Project : Coastal Protection Construction

Sector Division : PUPR Sulawesi III River Basin Organization (Balai Wilayah Sungai Sulawesi III)

Project Location : Palu, Sulawesi Tengah

SCREEN QUESTIONS	YES	NO	REMARKS
<b>a. Project Sitting</b> Is the Project area adjacent to or within any of the following environmentally sensitive areas ?			
Cultural heritage site	V		Masjid Apung will be spiritual heritage site
Protected Area		V	
Wetland	V		Location is a tidal area
Mangrove		V	
Estuarine	V		There is the estuary of the Palu River
Buffer zone of protected area		V	
Special area for protecting biodiversity		V	The density and diversity of plants at the project plan location is very low
<b>B. Potential Environmental Impacts Will the Project cause</b>			
Encroachment on precious ecology resulting in loss or damage to fisheries an fragile coastal habitats such as coral reefs, mangrove and sea grass beds		V	
Short term increase in turbidity an sunlight penetration as well as change in sediment pattern and flows at dredging site?	V		
Removal and disturbance of aquatic flora and fauna at dredging site	V		
Alteration of bottom surface and modification to bathymetry, causing change in tidal bore, river circulation, species diversity and salinity?		V	
Change in sediment pattern and littoral drift that may cause beach erosion on neighboring areas?	V		
Modification of terrestrial habitat by upland disposal of dredged material or covering of potential archeological site with dredge spoil		V	



SCREEN QUESTIONS	YES	NO	REMARKS
Short-term air quality degradation due to dredging-related operations?		V	
Noise and vibration due to blasting and other civil works?	V		Noise impacts arise from the transportation of materials
Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	V		
Dislocation or involuntary resettlement of people?	V		
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		V	
Other social concerns relating to inconveniences in living conditions in the project areas?		V	
Social conflicts if construction depletes local fishery resources on which communities depend for subsistence?		V	
Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations (such as STI's and HIV/AIDS)?	V		
Social concerns relating to local inconveniences associated with port operation (e.g. increased volume of port traffic, greater risk of accidents, communicable disease transmission)?		V	
Deterioration of water quality due to ship (e.g. ballast water, oil waste, lubricant and fuel spills, sewage) and waterfront industry discharges?		V	
Increased noise and air pollution resulting from airborne emissions (e.g. gas, smoke, fumes) from maneuvering and berthing ships and the waterfront industry?		V	

SCREEN QUESTIONS	YES	NO	REMARKS
Large population increase during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		V	
Social conflicts especially when workers from other areas are hired?		V	
Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		V	
Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		V	

Table 2: Preliminary Climate Risk Screening

Screening Questions		Score	Remarks
<b>Location and Design of project</b>	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	2	
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	2	
<b>Materials and Maintenance</b>	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	0	
<b>Performance of project outputs</b>	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

**Result of Initial Screening (Low, Medium, High): 4**

Project Reconstruction and Rehabilitation Palu Coastal is included **MEDIUM RISK**

## Appendix 2: Minutes of Meeting Urgent Plan Design and Comprehensive Plan Design for Palu

	<p>Satker Direktorat Sungai dan Pantai Direktorat Jenderal Sumber Daya Air Kementerian Pekerjaan Umum dan Perumahan Rakyat</p>	<p><b>MEETING</b> <b>Urgent Plan Design and Comprehensive Plan Design for Palu</b></p>	<p><b>18 Dec 2018</b></p>
<p><b>MINUTES OF MEETING</b></p>			
<p>Project : Consulting Services for Flood Risk Management and Engineering Services Flood Management in Selected River Basins Sector Project</p> <p>Day/date : 18 December 2018</p> <p>Time : 09.00 AM – 10.30 AM</p> <p>Venue : Batu Tegi Meeting Room, 7<sup>th</sup> Floor, Gedung SDA, Jl. Pattimura No. 20 – Jakarta Selatan</p>			
<p>Participants:</p> <ol style="list-style-type: none"> <li>1. Director River and Coastal, DGWR MPWH (Pak Jarot Widyoko)</li> <li>2. Balai Wilayah Sungai Sulawesi III, DGWR MPWH (Pak Donny Syahputra)</li> <li>3. Balai Pantai Puslitbang MPWH (Pak Leo)</li> <li>4. PPK Sungai dan Pantai</li> <li>5. Team Direksi FMSRB (pak Hendra Yuldi)</li> <li>6. Team Consultant CS01</li> <li>7. Team Consultant CS02</li> <li>8. ADB IRM</li> <li>9. JICA Indonesia Team</li> </ol> <p>(List of Participants attached)</p>			
<p>Agenda:</p> <ol style="list-style-type: none"> <li>1. Presentation of Urgent Plan Palu by CS01 FMSRB</li> <li>2. Presentation of Comprehensive Plan Design Palu by JICA Team</li> </ol>			
<p>Consultant,</p>	<p>Asian Development Bank</p>	<p>Director River &amp; Coastal,</p>	
<p><u>Yandi Hermawan</u> Team leader of CS01 FMSRB</p>	<p><u>Suharyani</u></p>	<p><u>Ir. Jarot Widyoko, Sp.1</u> Planning Officer</p>	

## MINUTES OF MEETING

No	Discussion	Action by																								
1.	<p><b>OPENING</b></p> <p>Meeting was opened by Pak Agus Rudiyanto as Chief of Coastal at Directorate of River and Coastal, DGWR. The agenda is to follow-up the meeting on 11 December 2018 and the final design plan will be report to Director General of WR and will bring to Ka. Satgas Palu in next 1-2 days.</p>																									
2	<p>1. The Team Leader of Consultant CS01, Mr. Yandi presented the progress of the Design of dyke;</p> <ul style="list-style-type: none"> <li>- A typical cross section of the dyke of emergency works of Palu Bay with a length of 7000 m</li> <li>- Consultant need advice from ADB for No. 6 (no objection letter) and No. 7 (procurement method) as mentioned in the schedule of design.</li> <li>- The total area which passed by the alignment:</li> </ul> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th></th> <th style="text-align: center;">Name of Village</th> <th style="text-align: center;">Area</th> <th style="text-align: center;">Number of Building</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Silae</td> <td style="text-align: center;">22.000 m<sup>2</sup></td> <td style="text-align: center;">66</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Lere Village</td> <td style="text-align: center;">32.000 m<sup>2</sup></td> <td style="text-align: center;">66</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Besusu Barat Village</td> <td style="text-align: center;">26.000 m<sup>2</sup></td> <td style="text-align: center;">No</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Talise Village</td> <td style="text-align: center;">60.000 m<sup>2</sup></td> <td style="text-align: center;">23</td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>Total</b></td> <td style="text-align: center;"><b>140.000 m<sup>2</sup></b></td> <td style="text-align: center;"><b>155</b></td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>- The documents has prepared for tendering process:               <ol style="list-style-type: none"> <li>(1) Detail Emergency Design Sea Dike</li> <li>(2) Bidding Document</li> <li>(3) General and Technical Specifications</li> <li>(4) Summary of Sub Project Report</li> <li>(5) Engineering Cost Estimate</li> </ol>               (The presentation material as attached)             </li> </ul> <p>2. <u>Pak Djarot:</u></p> <ul style="list-style-type: none"> <li>- How many housing should be acquisition, housing ownership should be checked more clearly, who is the owner, and the compensation will be the responsibility of provincial government (PEMDA)</li> <li>- There is only 1 alternative of design, the design focus for short term program and based on the design agreed on the First meeting (Rapat Awal)</li> <li>- The process UKL/UPL can be parallel with the design</li> <li>- Pak Hedrayuldi please prepared one page of summary today meeting for reporting to Pak DG by today and get ready before 3 p.m.</li> </ul> <p>3. <u>Ibu Yani, ADB:</u></p> <ul style="list-style-type: none"> <li>- No Objection letter will be taken in a week, if we working closely</li> <li>- Procurement method 1S1E Post-qualification will be speed up from normally in 2-3 month</li> <li>- immediately form a working unit of procurement (Pokja) whether it has been established</li> <li>- For LARAP and UKL/UPL Pak Edy will support with the Environment document</li> <li>- Mr. Sangyoung will advise on the <b>resilient</b> design</li> </ul>		Name of Village	Area	Number of Building	1	Silae	22.000 m <sup>2</sup>	66	2	Lere Village	32.000 m <sup>2</sup>	66	3	Besusu Barat Village	26.000 m <sup>2</sup>	No	4	Talise Village	60.000 m <sup>2</sup>	23	<b>Total</b>		<b>140.000 m<sup>2</sup></b>	<b>155</b>	
	Name of Village	Area	Number of Building																							
1	Silae	22.000 m <sup>2</sup>	66																							
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4	Talise Village	60.000 m <sup>2</sup>	23																							
<b>Total</b>		<b>140.000 m<sup>2</sup></b>	<b>155</b>																							



No	Discussion	Action by
	<p><u>Bp. Edy, ADB</u></p> <ul style="list-style-type: none"> <li>- Environment requirement based on GOI (Pelpres No. 5/2012) and ADB (Criteria B), document of EIA/Amdal or UKL/UPL are necessary to prepare or not, the implementation need to check in the site, and need to coordination and discussion with Dinas KLH Palu.</li> </ul> <p>4. <u>Bp. Donny, PJSA Palu</u></p> <ul style="list-style-type: none"> <li>- Based on information from Pak Yoyo, Balai Bina Marga in Palu, the existing road will not be used and the road will move to other location, according to Pak Ari Setiadi the road will design by Bina Marga.</li> <li>- The design is plan based on the survey and data of wave, wind, how's the earthquake? safe for how many richter?</li> <li>- In Bina Marga there is no project based on Direct Appointment/PL procurement method anymore, they use beauty contest/Limited Competitive Bidding method, and procurement training will be necessary in Palu</li> </ul> <p>5. <u>JICA Team</u></p> <ul style="list-style-type: none"> <li>- For Design, JICA and Consultant CS01 is agreed to provide the detailed design</li> <li>- Design is comprehensive covered all facilities and infrastructure including road, garden etc.</li> <li>- The cost is divided for Short and Next Step, Short Term will financed by ADB and Next step for Tsunami Dyke will financed by JICA</li> <li>- JICA fund will ready on March 2018</li> <li>- Mr. Fukushima as JICA Team presented the design of Tsunami Dyke, the material as attached</li> </ul>	
<b>3</b>	<p><b>CONCLUSION</b></p> <ol style="list-style-type: none"> <li>1. Alignment and design of dyke has agreed between Directorate of River and Coastal, Balai Litbang Pantai, Consultant CS01 and JICA (Yachiyo Consultant).</li> <li>2. As promise the output of design be submitted to Ka.Satgas and Provincial Government at Palu during 2-3 days</li> <li>3. Summary of the report should be ready before 3.p.m: the ownership of land, design, Cost Estimate/RAB, Map, Procurement, etc.</li> </ol>	
<b>4.</b>	<p><b>CLOSING</b> Meeting closed at 10.30 AM.</p>	

## Appendix 3: Indonesia AMDAL Screening Criteria (Selected Sectors)

### 4.1. Public Works (Permen PU No.10/2008)

Nr.	Type of Activities	Scale / Magnitude		Scientific Reasons	Special Reasons
		UKL / UPL	AMDAL		
<b>1</b>	<b>Dam / reservoir development</b>				
a.	Development of dam/reservoir or other water storages: - Height - Inundation area - Storage volume	6 to < 15 m 50 to < 200 ha 300,000 - 500,000 m <sup>3</sup>	> 15 m > 200 ha > 500,000	Change of natural landscape and topography, change of environment and aquatic ecosystem, and exploitation of natural resource, river morphology, effect to social, economic and cultural setting and technology application	Rehabilitation that affect environment in term of river morphology, aquatic ecosystem, change of groundwater head, land conversion, social and culture change.
b.	Rehabilitation of dam/reservoir or other water storages: - Height - Inundation area - Storage volume	6 to < 15 m 50 to < 200 ha 300,000 - 500,000 m <sup>3</sup>	> 15 m > 200 ha > 500,000		
<b>2</b>	<b>Irrigation Scheme</b>				
a.	New development with size	500 ha to < 2,000 ha	> 2,000 ha	Change of natural landscape and topography, increased commercialization and use of water resources that affect to decreased availability of water resource, affect social, economic and culture of local people.	Change of regional ecosystem, water balance, pesticide pollution, potential erosion and sedimentation, utilization of water resource, change of social, economic and culture.
b.	Improvement with size	500 ha to < 1,000 ha	> 1,000 ha	Change of natural landscape and topography, increased commercialization and use of water resources, affect social, economic and culture of local people.	Change of water balance, pesticide pollution, potential erosion and sedimentation, utilization of water resource, change of social, economic and culture.
c.	Construction of new rice fields with size (per cluster)	100 ha to < 500 ha	> 500 ha	Change of natural landscape and topography, increased commercialization and use of water resources, affect social, economic and culture of local	Change of regional ecosystem, water balance, change of social, economic and culture.

Nr.	Type of Activities	Scale / Magnitude		Scientific Reasons	Special Reasons
		UKL / UPL	AMDAL		
<b>3</b>	<b>Swamp Development</b>				
	Swamp reclamation for agriculture cultivation	500 ha to < 1000 ha	> 1,000 ha	Change of natural landscape, affect regional natural resource conservation, protection of cultural sanctuary and social, economic and culture of local people.	Change of regional ecosystem, change of water system, change of social and culture of local people.
<b>4</b>	<b>Development of coastal defense and improvement of estuary</b>				
a.	Parallel with coast (sea wall/revetment)	< 1 km	> 1 km	Change of sediment transport rate along the coast that affect to landscape and land topography, affect to aquatic organism, change of social and culture.	Change of coastal line, aesthetics, and change of cultural asset value.
b.	Perpendicular with coast (groin, breakwater)	10 to < 500 m	> 500 m		
<b>5</b>	<b>River flood management (including diversion) and construction of flood canal</b>				
a.	In metropolitan / large city - OR length - Dredging volume	1 - 5 km 50,000 - 500,000 m <sup>3</sup>	> 5 km > 500,000m <sup>3</sup>	Change of natural landscape, topography, change of river ecosystem, change of river morphology, and effect to social, economic and culture of local people.	Change of river path, bed, and wall in achieving new balance, increased water pollution, traffic disturbance, and nuisance to aesthetics.
b.	In medium city - OR length - Dredging volume	3 - 5 km 100,000 - 500,000 m <sup>3</sup>	> 5 km > 500,000m <sup>3</sup>		
c.	In rural areas - OR length - Dredging volume	5 - 15 km 150,000 - 500,000 m <sup>3</sup>	> 15 km > 500,000m <sup>3</sup>		

#### 4.2. Other Related Multi Sectors (Permen LH No. 5/2012)

Below provided AMDAL criteria for other sectors (multi-sector) that may be involved in FMSRB

No.	Type of Activities	Scale/Magnitude	Special Scientific Reasons
<b>1</b>	<b>Reclamation of Coastal Areas and Isles</b>		
a.	Width of the reclamation area	≥ 25 ha	Potentially to generate impacts, among others: - Hydro-oceanography, covering tidal, current, wave and sea bed sediment - Hydrology, covering rainfall, groundwater, river or stream flow, and run-off - Bathymetry, covering depth contour of water bottom - Topography, covering contour of terrestrial surface - Geomorphology, covering shape and typology of coast - Geotechnical, covering physical and mechanical features of soil surface - Social impact
b.	Volume of fill material	≥ 500,000 m <sup>3</sup>	
c.	Length of the reclamation	50 m (perpendicular toward sea from coastline)	
<b>2</b>	<b>Cutting hill and fill of land, with volume</b>	> 500.000 m <sup>3</sup>	- Change of natural landscape - Landslide and increasing run-off and flood
<b>3</b>	<b>Aquaculture</b>		
a.	Advanced and medium technology aquaculture for shrimp/fish with or without processing unit  - Width	2.5 ha	- Damaged mangrove ecosystem that becomes breeding site and nursery areas will affect productivity in the area. - Several environmental components that will be affected are: organic contents, BOD, COD, DO, turbidity, number of phytoplankton and increase of virus and bacteria. - The higher technology application, the waste generation that indicated will lead to negative impact to surrounding water/ecosystem
	Floating fish cage (floating net and pen system): In fresh water (lake) - Width, or - Number	> 500 unit	- Change of water quality - Effect of current change and use of water space - Effect to water aesthetic - Disturb navigation pathway

## Appendix 4: Field Visits, Meetings and Institutional/Public Consultation

The Consultants made site visits to core subprojects during the assignment. The purpose of the visits was to discuss the subprojects with government authorities at central, provincial and local level, collect data and see flood prone areas first hand (including from non-formal sources such as residents fishermen, and others):



Announcement of the Palu Coast Safety Plan for the community around the planned activities



Announcement of the Palu Coastal Protection Plan for the community around the planned activities (24 May 2019)



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## Appendix 5: Minutes of Meeting Public Consultation AMDAL

**RISALAH PERTEMUAN**  
**KONSULTASI PUBLIK/SOSIALISASI UNTUK STUDI AMDAL DAN**  
**PENYUSUNAN LARAP**  
**RENCANA PEMBANGUNAN TANGGUL PENGAMAN PANTAI (COASTAL**  
**PROTECTION) DAN TANGGUL TSUNAMI/PENINGGIAN BADAN JALAN**  
**(TSUNAMI DIKE/HEIGHTEN ROAD)**  
**DI KOTA PALU**

Pada hari Jumat, tanggal 24 Mei 2019, bertempat di Ruang Pertemuan Vardas Hotel Jazz, Jalan Zebra II No. 11 Kota Palu Provinsi Sulawesi Tengah, waktu 09:00 WITA sampai 11:45 WITA telah dilakukan Pertemuan Konsultasi Publik/Sosialisasi untuk Studi *Analisa Mengenai Dampak Lingkungan (AMDAL)* kegiatan rencana Pembangunan Tanggu Pengaman Pantai dan Tanggul Tsunami/Peninggian Badan Jalan di Kota Palu.

### **I. Pembukaan dan Paparan**

Acara dibuka oleh BWS Sulawesi III, diwakili oleh PPK Perencanaan

### **II. Isi**

1. Pemrakarsa menyampaikan tentang kegiatan Rencana Pembangunan Tanggul Pengaman Pantai Kota Palu.
2. Tim Penyusun AMDAL memaparkan tentang AMDAL, diantaranya latar belakang rencana kegiatan, dasar pemikiran kegiatan wajib dokumen AMDAL, lokasi rencana kegiatan, peruntukan lahan, serta tahapan-tahapan kegiatan yang akan dilaksanakan dalam penyusunan dokumen AMDAL.

### **III. Saran, Pendapat, dan Tanggapan Peserta Undangan**

1. Zonasi pembangunan Tanggul Pengaman Pantai dan Tanggul Tsunami/Peninggian Badan Jalan ? (BWSS III)
2. Mengingat sebagian besar masyarakat Lere berprofesi sebagai nelayan Dampak pembuatan tanggul ini akan berpengaruh pada kebutuhan nelayan, harus dibuatkan Tambatan Perahu. Dan untuk masalah kolam yang akan dibuat tolong dikoordinasikan dahulu karenamemakai sebagian dari tanah warga. (Lurah Lere)
3. Setiap Air Laut pasang mengakibatkan sebagian warga Lere melarikan diri mengungsi di masjid agung, yang ditanyakan kapan waktu pelaksanaan pembuatan tanggul pengaman pantai ? (Camat Lere)
4. Kami belum melihat adanya desain dari Tanggul Pengaman Pantai maupun Tanggul Tsunami/Peninggian Badan Jalan, diwilayah Besusu Barat juga ada kelompok nelayan, mohon dibuatkan juga tambatan perahu di area patung kuda (Lurah Besusu Barat)
5. Jika dibuatkan tambatan perahu di sekitar area komodo, bagaimana dengan sebagian warga sekitar yang sebagian besar mata pencariannya Pedagang kaki lima di kawasan Komodo ? (Masyarakat Jl. Komodo)

- 
6. Berapa kubik batu yang dibutuhkan dalam pembuatan tanggul? Dan asal batu yang digunakan? Jangan sampai menyelesaikan masalah di pantai tetapi membuat masalah baru, dan bagaimana penyesuaian elevasinya? (WALHI)
  7. Pada saat penyusunan AMDAL Desain teknis harusnya sudah ada, sehingga untuk penempatan tambatan perahu dapat diketahui, gambar yang ada ini adalah prototype (standar) tetapi apakah seperti itu yang akan diterapkan dilapangan? Desain tersebut diperlihatkan agar dapat diketahui lahan yang digunakan. Diperlihatkan eksistingnya dan rencananya! (PEMDA)
  8. Kolam retensi harap dipindahkan kelokasi lain. (Lurah Silae)
  9. Lahan yang dilalui tanggul tsunami/peninggian jalan, bagaimana pembebasan lahannya? (Masyarakat Talise)
  10. Untuk tanggul tsunami akan banyak hak masyarakat yang akan diambil, karena perencanaannya jalanakan berada diatas tanggul. Mohon diatur sedemikian rupa untuk menghindari resiko yang tidak diinginkan, mengingat ada PKL disekitar area. Mohon disampaikan untuk teknis pelaksanaan tanggul pengaman pantai, apakah ada masyrakat yang terdampak?
  11. Mengapa tidak menggunakan lahan eksisting saja? Agar tidak ada lahan warga yang terkena? (Masyarakat)
  12. Mengingat waktu yang sangat mepet, tolong dijadwalkan kembali pertemuan ini, karena banyaknya masukan-masukan dari masyarakat, terlebih masalah Tanggul/Peninggian Jalan !
  13. Harus ada persetujuan dari semua masyarakat, Seharusnya dijelaskan dulu perihal pembebasan warga yang terdampak, kemudian lanjut kemasalah teknis pekerjaan (Masyarakat Talise)
  14. Pertemuan ini belum bisa dikatakan konsultasi public, karena tidak ada presentasi desain yang menjelaskan bagaimana pembangunan itu dilakukan. (WALHI)
  15. Untuk masyarakat awam penjelasan yang disajikan kurang dimengerti.
  16. Ketika merencanakan desain apakah sudah diadakan konsultasi dengan masyarakat? (BWSS III)
  17. Jelaskan dahulu detail desainnya, untuk masalah lahan warga yang tekena agar jelas.

#### **IV. Jawaban dan Tanggapan Pemrakarsa dan Tim Penyusun AMDAL**

1. Tanggul Pengaman dimulai dari STA 0 berada di pertigaan jalan Diponegoro dan berakhir di Hotel Wina, sedangkan untuk Tanggul Tsunami/Peninggian Badan Jalan STA 0 masih dimulai dipertigaan Diponegoro dan berakhir di jalan Komodo.
2. Untuk penggunaan Batu Armour (Gajah) ini sudah dilakukan survey di beberapa lokasi, dan bagi yang melaksanakan ini harus wajib dan sudah mempunyai izin lingkungan, dan masalah dasar ketinggian tanggul itu bervariasi, akan tetapi sudah dilakukan bathymetri dari Balai Pantai dan sudah ada data kedalamannya, modeling pantai dan geotekniknya.
3. Mengenai tambatan perahu sudah ada beberapa masukan yang ada, dan akan kami tindaklanjuti dan pedagang kaki lima akan koordinasi pada pemerintah kota Palu. Dan yang pasti desain ini sudah memperhatikan social ekonomi dan budayanya.

- 
4. Untuk pelaksanaan perencanaan Tanggul Tsunami/Peninggian Badan Jalan masih On Process, tetapi untuk Tanggul Pengaman Pantai dilaksanakan 2019 setelah penyusunan Amdal dan Larap.
  5. Terkait dalam penyusunan AMDAL, konsultasi public ini adalah bagian dari proses penyusunan Amdal, untuk waktu pelaksanaannya didasarkan dari UU No. 32 th 2009, setelah mendapatkan Izin Lingkungan (Dinas LH Sulteng)
  6. Mengingat keterbatasan waktu desain tidak dapat lebih jelas ditampilkan.
  7. Pengerjaan Kolam Retensi direncanakan akan di alihkan menjadi Long Storage sesuai arahan/masukkan Kepala BWSS III.
  8. LARAP masih untuk Tanggul Pengaman Pantai, sedangkan untuk AMDAL untuk Tanggul Pengaman Pantai dan Tanggul Tsunami.
  9. Tanggul Tsunami diubah namanya menjadi Heightening Road (Jalan yang Ditinggikan) itu berfungsi untuk melindungi dari gelombang laut besar, jadi ada 2 fungsi : untuk Jalan dan Pelindung Tsunami. Untuk desain masih ON PROSES dan desainnya memakai kondisi eksisting, untuk lahan kita maksimalkan untuk menggunakan eksisting dan harus mempertimbangkan kondisi tanah dilakukan survey tanah, ada beberapa opsi desain, tergantung dari masukan sesuai kebutuhan masyarakat, untuk tinggi tanggul diambil standar ketinggian tsunami yang terjadi yaitu +6.00 Meter, dan dilakukan pula survey elevasi juga, untuk Tambatan Perahu dan Pedagang Kaki Lima juga sudah dipertimbangkan (JICA).

#### **V. Penutup**

BWS Sulawesi III menutup acara Konsultasi Publik / Sosialisasi AMDAL Kegiatan Rencana Pembangunan Tanggul Pengaman Pantai dan Tanggul Tsunami/Peninggian Badan Jalan di Kota Palu.

## List of Attendees

**DAFTAR HADIR RAPAT**  
**PERTEMUAN KONSULTASI MASYARAKAT (PKM) AMDAL & LARAP**  
**PEKERJAAN TANGGUL PENGAMAN PANTAI & TANGGUL TSUNAMI KOTA PALU**

HARI / TANGGAL : JUMAT, 24 MEI 2019  
 JAM :  
 TEMPAT : HOTEL JAZZ PALU

NO	NAMA	INSTANSI	JABATAN	NO. TELP	TANDA TANGAN
1.	Sawiah Ambawa S.Pd.M.Pd (Septin Dwi Nita)	Kel Talise RT 01 Raos		085397855254	
2.	SAHRIR	Kel. Talise.		0853 0441 6191	
3	LIJANALUCENTE/HORA	Kel. TALISE		085396780574	
4	FACHRUL	Kel. Talise		0822414112316	
5	MARSONI	Kel. Dere	Lurah	081557008112	
6	RADEN HARJONO	BWS 14	GTAF	082348208940	

NO	NAMA	INSTANSI	JABATAN	NO. TELP	TANDA TANGAN
7	ARWIN	BWS III	STAF	082193697777	
8	ARLESTO K	BWS SUL III	PPE PBP		
9.	Yekiana W	BWS Sul III	staf		
10	Finta Eprida	BWS Sul III	staf		
11	Anastasia	BWS Sul III	Opit		
12.	Jant. fontaine	Purmanawani	-	0812427660	
				<del>0812427660</del>	
13	Astroni DARS.	WIRABANAR.	-	0812 4524 3306	
14	Chairil An	Lutung	-	0811755792	
15	YUNAN BAWINAN	Masyarakat	-	085241007060	
16	SAPWAN ARI TOPI	masyarakat mi	-	0812 42010457	

NO	NAMA	INSTANSI	JABATAN	NO. TELP	TANDA TANGAN
17	DHUKA	JICA PROJECT TEAM	Project Manager Sp.	0877 1571 6162	
18	GOLDMAN	JICA PROJECT TEAM	Project technical sp	081327774714	
19	Mohamad Rizal	DPIAP kota Batu	Koalisi	0811655376	
20	Lucky ARIE	Genetoci		0813 9947580	
21	Schik	Masyarakat	-	0813 54908967	
22	MARSINSIA	Masyarakat	-	082377791178	
23	Sitti Buhafiah	Byroad for. kltg	Koalisi		
24	MIRANI WICAYA	BAREKAT PAU	STAF TERKUS	08116882125	
25	fathurrahman	JICA study team	JICA OP2	085255282599	
26	Golong Longi Persada	JICA Study team	JICA OP2	08534093316	
27	Abd Haris	Din walhi st	Dirakta	082191520215	

NO	NAMA	INSTANSI	JABATAN	NO. TELP	TANDA TANGAN
28	Khairul Syahputra	Walhi - st	-	0813 43195257	
29	Rinaldi gaya	Dinas Perhubungan PAU	staf program	082370669486	
30	Satrio/muhammad	Masyarakat	-	085398086615	
31	Rusbang	DIT - PROV. Sulawesi Tengah	Koalisi Pemukiman dan KDL	08124118114	
32	Assanta	Masyarakat	-	08219473167	
33	PERY TAULA	KAMPUS NEWAYAN	-	0811453595	
34	ARIZIAH. HANZALAH.	Masyarakat	Koalisi RT 01		
35	KAHARUDIN AS	Masyarakat	-	0811 462231	
36	Moh. Irfahat	Masyarakat	-		
37	MARINA PERMANA S	PISN Sukung BSNAN		08199804411	
38	ABD HALIM	Perk. BSNAN BSNAN	LURAH	082188770000	





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## Appendix 6: Environmental Safeguard Monitoring Report (ESMR) Outline

(Annotated Format)

### I. INTRODUCTION

- a. Report Purpose and Rationale
- b. Project Objective and Components

### II. PROJECT IMPLEMENTATION PROGRESS

*Using most recent project progress report, describe status of project implementation, including full list of contracts, status of contract implementation, name of contractors, availability of site-EMPs.*

### III. INSTITUTIONAL SETUP AND RESPONSIBILITIES FOR EMP IMPLEMENTATION AND SUPERVISION

- a. Institutional responsibilities for environmental management

*Describe institutional arrangements and responsibilities for EMP implementation, monitoring, and reporting, defining roles and capacities of PIU, Implementation Consultant, Contractors. (Table format appropriate)*

- b. Incorporation of Environmental Requirements into Project Contractual Arrangements

- *Define manner by which EMP requirements are incorporated into contractual arrangements, such as with contractors or other parties.*
- *Indicate when CEMPs were submitted by Contractors, and when these were approved by Engineer/Supervision Consultant (Table format appropriate).*

### IV. COMPLIANCE WITH ENVIRONMENT RELATED PROJECT COVENANTS

*List all environment related loan covenants, and assess projectse were approved by Engineer/Supervision Consultant (Table format appropriate).PIU, Implementation Consultant, Contracte, and corrective actions as needed)*

### V. ENVIRONMENTAL MITIGATIONS MEASURES IMPLEMENTED IN THE REPORTING PERIOD

- *Summarize main mitigation/protection measures implemented in the reporting period (narrative section). Structure in accordance to phases (detailed design, construction preparation, construction, and operation).*
- *Include EMP table or updated EMP table if applicable. Assess compliance of environmental management activities with the original or updated EMP. For that purpose, include an additional column in the EMP entitled "Implementation status and compliance". E.g. is provided below:*

<b>Impact Factor/ Stage</b>	<b>Potential Impacts and/or Issues</b>	<b>Mitigation Measures defined in the EMP</b>	<b>NEW COLUMN Implementation status and compliance with EMP</b>
<b>Pre-construction Phase</b>			
1. Design Stage	Establishing CPIU	<ul style="list-style-type: none"> <li>An environmental management unit (EMU) will be established within CPIU</li> </ul>	<p><i>EMU established in CPIU, consisting of xxx persons.</i></p> <p>→ <i>Complied with</i></p>
	...	• ...	...
3. Biding and Construction Preparation	Bidding documents and contractors' qualifications	<ul style="list-style-type: none"> <li>Environmental section will be included in the TOR for bidders.</li> <li>Environmental clauses for contractors in reference to the EMP and monitoring plan will be included in the construction and supply contracts.</li> </ul>	<p><i>Environmental section was included in TOR for bidders, environmental clauses were included in contracts (see chapter xxx).</i></p> <p>→ <i>Complied with</i></p>
	Environment al operation and supervision manual	<ul style="list-style-type: none"> <li>Contractors will be required to prepare an environmental operation and supervision manual, for approval by PIC.</li> </ul>	<p><i>6 out of 7 contractors have prepared manuals, submitted to the respective IA. Contractor xxx was requested to prepare a manual, to be submitted by end of xxx 2016.</i></p> <p>→ <i>Partly complied with</i></p>
	...	...	...
<b>Construction Phase</b>			
1. Soil Erosion	Excavation	<ul style="list-style-type: none"> <li>Strip and stockpile topsoil, build retaining walls where necessary before dumping.</li> <li>Provide temporary detention ponds or containment to control silt runoff.</li> <li>Construct intercepting ditches and chutes to prevent outside runoff entering disposal sites, and divert runoff from sites to existing drainage or ponds.</li> </ul>	<p><i>Soil erosion protection measures are implemented at each site, fully complying with the measures defined in this EMP.</i></p> <p>→ <i>Complied with</i></p>
	...	...	<p>...</p> <p>→ <i>Not complied with. Corrective action plan developed.</i></p>
<b>Commissioning Phase</b>			
...	...	...	...

<b>Impact Factor/ Stage</b>	<b>Potential Impacts and/or Issues</b>	<b>Mitigation Measures defined in the EMP</b>	<b>NEW COLUMN Implementation status and compliance with EMP</b>
Operation Phase			
...	...	...	... → Not yet due

## VI. ENVIRONMENTAL MONITORING

### a. Monitoring plan and responsibilities

*Present the monitoring plan as defined in the EMP or adjusted monitoring plan. Describe monitoring responsibilities. Differentiate between internal and external/compliance monitoring responsibilities.*

### b. Environmental quality targets, sampling and analytical methods

*Describe environmental quality targets for the different sites and environmental media (e.g. effluent quality standards, ambient air, noise, water quality standards etc). Define analytical methods applied for monitoring.*

### c. Monitoring Results

#### i. Emission Discharge (Source) Monitoring Results (if relevant)

##### 1. Results

*Table format is appropriate. Discharge levels should be compared to the relevant discharge standards and/or performance indicators noted in the EMP. Any non-compliance should be highlighted for attention and follow-up.*

##### 2. Assessment

*Discharge levels should be compared to baseline conditions (if baseline data is available) and described in qualitative terms. Additional explanatory comments should be provided as necessary. Possible reasons for non-compliance should be identified.*

#### ii. Ambient Monitoring Program

##### 1. Results

*Table format is appropriate. Ambient environmental conditions should be compared to the relevant ambient standards and/or performance indicators noted in the EMP. Any non-compliance should be highlighted for attention and follow-up.*

---

## **2. Assessment**

*Ambient environmental conditions should be compared to the baseline conditions (if baseline data is available) and described in qualitative terms. Additional explanatory comments should be provided as necessary. Possible reasons for non-compliance should be identified.*

### **VII. PUBLIC CONSULTATION, GRIEVANCE REDRESS MECHANISM**

*Describe mechanisms established to address and redress public complaints and grievances. Summarize grievances received, if any, and measures implemented to redress them. Describe public consultation activities during the reporting period. Present planned consultation activities in next reporting period.*

### **VIII. HEALTH AND SAFETY**

*Describe health and safety management arrangements at project and contract level, including safety supervision and reporting procedures, people assigned (table format appropriate), training provided (table format appropriate), full list of fatal and serious occupational accidents including reference to minutes of investigation report meetings.*

### **IX. INSTITUTIONAL STRENGTHENING AND TRAINING**

*Present training activities conducted in the reporting period (Table format appropriate). Compare training activities with approved training plan defined in EMP/PAM, if any. Present planned training and institutional strengthening activities in next reporting period.*

### **X. KEY ENVIRONMENTAL ISSUES**

#### **a. Key Issues Identified, Actions Taken, Additional Actions Required**

*Include a concise and clearly articulated table that lists (i) all observed non-compliances with the approved EMP or SEMP (both at project and contract level), (ii) corrective actions taken; (iii) implementation responsibility and timeframe.*

### **XI. CONCLUSION**

#### **a. Overall Progress of Implementation of Environmental Management Measures**

#### **b. Problems Identified and Actions Recommended**

### **XII. APPENDICES**

1. Site Inspection / Monitoring Reports
2. Monitoring Results
3. Accidents/Incident investigation meeting minutes
4. Photographs
5. Others

## Appendix 7: Related Sub-projects

### 7.1 Elevated Road

The Elevated Road will restore the coastal road destroyed by the 2018 tsunami, and will form a second line of coastal protection. The crest of the elevated road is planned at an elevation of 6.5 m MSL, meant to protect on the long term against sea-level rise, and withstand or at least significantly reduce a possible future tsunami. The elevated road will start from Jalan Cumi-Cumi in Silae village, cross the Palu River at the also to be build Palu IV Bridge, and end at Cut Meutia road in Talise village (total 4.1 km). On the sea-side, where sufficient space is available between the coastal protection and the elevated road, a green zone will be developed (see **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.**). Some typical dimensions are:

- Width of Elevated Road at base : 24 m
- Width of Road at crest : 14 m
- Length of Elevated Road West side : 2,5 km
- Length of Elevated Road East side : 1,6 km
- Height of Elevated Road : 6.5 m

Figure 1: Mitigation system for waves, high tide and Tsunami

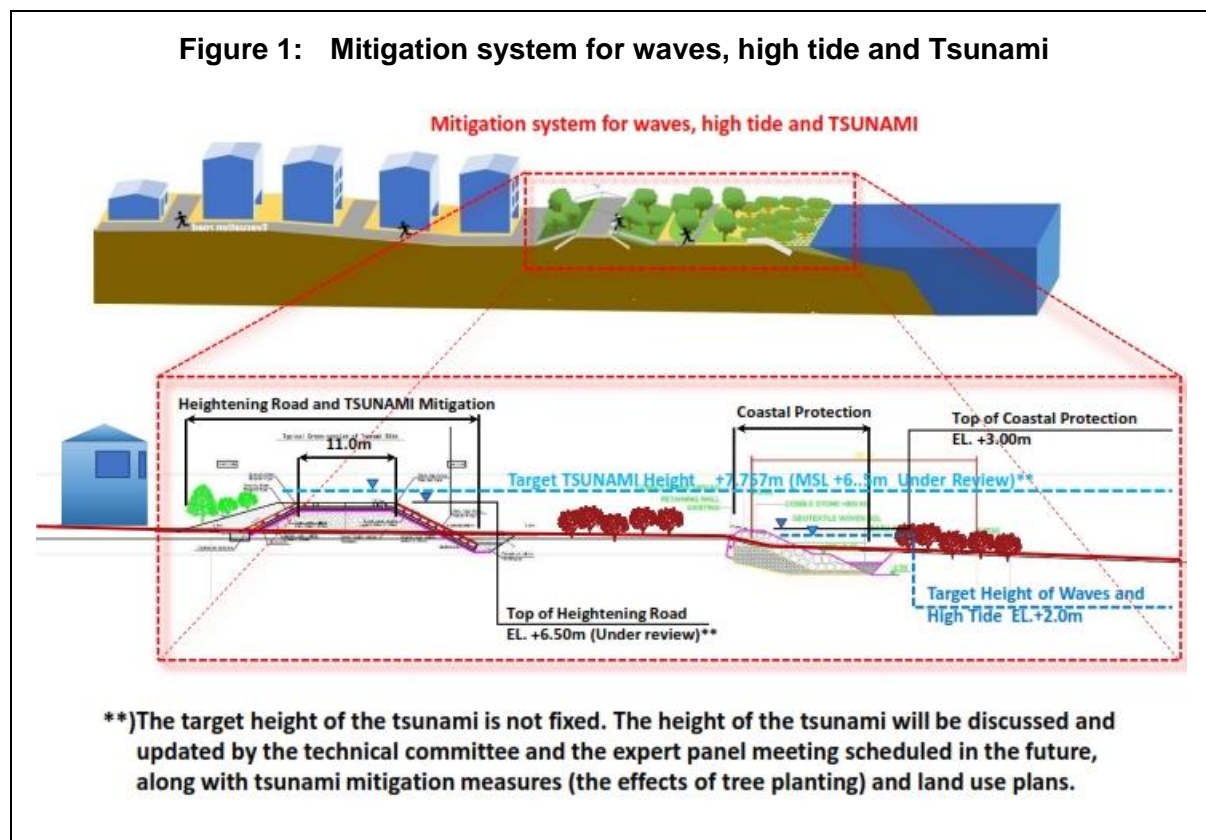


Figure 2: General Plan of Mitigation system (1/5)

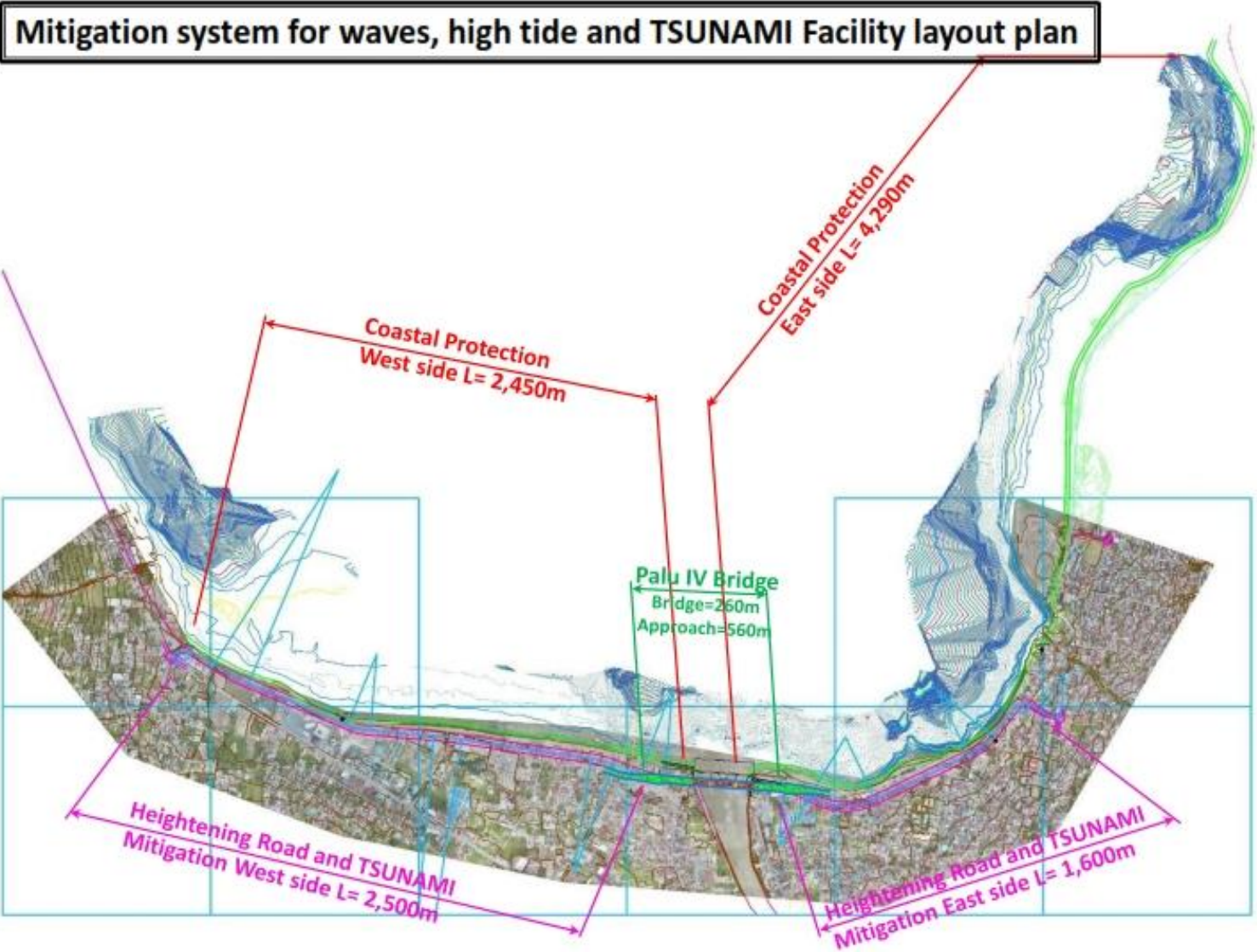
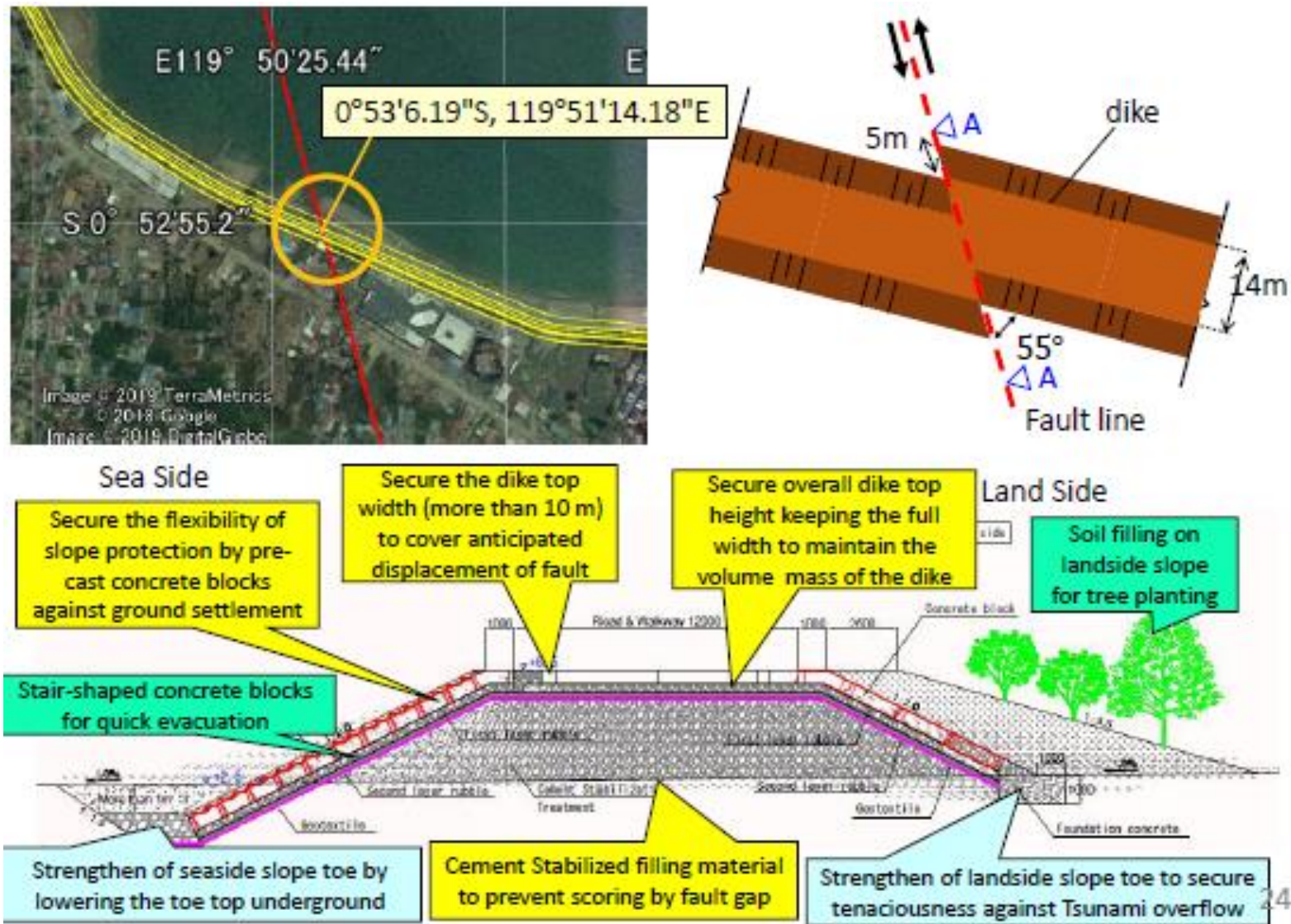




Figure 3: Design Cross Section Elevated Roads



## Palu IV Bridge

Some typical dimensions of Palu IV Bridge are (**Error! Reference source not found.**):

- Length of Retaining Wall Section (2 sides) : 140 m
- Length of Bridge Section : 260 m
- Target Tsunami Height : MSL +6,5 m
- Retaining wall (2 Sections) : 140 m
- Main bridge : 260 m
- Bridge ramp : both sides

### 7.3 Mangrove Development

Noting the field conditions in Palu Bay, there is an estuary area with brackish water from the Palu River flow which can be developed as a coastal security and protection area through mangrove plant revitalization activities. Mangrove planting cannot be done at all locations on the Palu coast, because only certain locations have flat slopes. At a distance of 50 m from the seashore the shallowest location on the location of the Cumi-cumi Road, the depth has reached 4 m.

**Table 1: Contour value from shore line**

No	Location area point	Gradient from shore line (distance 50 m)	Critical zone
1	Cumi cumi	- 4.00 m	flat
2	Masjid Apung	- 11.25 m	steep
3	Anjungan	- 15.50 m	steep
4	Penggaraman	- 15.80 m	steep
5	Wina Hotel	- 17.00 m	steep

The extent of protection with mangroves is an area of 62.5 ha from Jalan Cumi-cumi to near the mouth of the Palu River. Mangrove planting is planned to be on land between Elevated Road and Coastal Protection and in flat shallow water along the coast. To support sedimentation and protect the mangrove seedlings against waves, impermeable barriers will be constructed along the coast, at a depth of 2 meters (building with nature / hybrid system).

**Figure 4: Sediment collection system for mangrove growth**



Source: *Building with Nature Indonesia, Case study factsheet*



